Supplemental Guide: Clinical Neurophysiology

ACGME

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Milestones Supplemental Guide

This document provides additional guidance and examples for the Clinical Neurophysiology 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 **Overall Intent:** To obtain a focused history to guide neurophysiologic testing and management	
Milestones	**Examples**
Level 1 *Obtains a basic neurologic history*	● Presents a 45-year-old patient with hand numbness for two years
Level 2 *Obtains, communicates, and documents a focused and relevant history, including collateral information as appropriate*	● Presents to attending and then summarizes in note: 45-year-old with numbness in her digits 1-3 on the ventral surface only
Level 3 *Obtains a focused history sufficient to guide subsequent neurophysiologic investigation*	● Presents to attending and then summarizes in note: 45-year-old with numbness in her digits 1-3 on the ventral surface only, shakes her hands out at night, no weakness
Level 4 *Consistently obtains a focused history to guide hypothesis-driven neurophysiologic investigation*	● Obtains history of fatigueable weakness along with ptosis and dysarthria efficiently
Level 5 *Serves as a role model in obtaining histories that guide a hypothesis-driven neurophysiologic investigation*	● Teaches learners the art of the focused and efficient EMG history
Assessment Models or Tools	● Direct observation ● Multisource feedback ● Simulation
Curriculum Mapping	●
Notes or Resources	● Preston DC, Shapiro BE. *Electromyography and Neuromuscular Disroders: Clinical-Electrophysiologic-Ultrasound Correlations*. 4th ed. Philadelphia, PA: Elsevier; 2020. ISBN:978-0323661805.

Patient Care 2: Neurological Exam **Overall Intent:** To perform a focused physical examination to guide neurophysiologic testing and management	
Milestones	**Examples**
Level 1 *Performs a basic neurological exam*	● Documents areas “waiter’s tip” position of arm but fails to check intrinsic finger strength
Level 2 *Performs, communicates, and documents a neurological exam incorporating additional relevant maneuvers*	● Documents medial rotation of arm at shoulder, extension at elbow, pronation, and preserved grip strength
Level 3 *Performs, communicates, and documents a focused neurological examination sufficient to guide subsequent neurophysiologic investigation*	● Discussed patient with likely upper trunk brachial plexus injury with some possible preserved pronation and plans for appropriate needle examination
Level 4 *Consistently obtains a focused neurological examination to guide hypothesis-driven neurophysiologic investigation*	● Efficiently examines patients with several different complaints and uses this to guide the appropriate neurophysiologic investigation
Level 5 *Serves as a role model in performing a focused neurological examination to guide hypothesis-driven neurophysiologic investigation*	● In a patient with reported right upper extremity weakness, teaches others to focus on the affected extremity with comparison only as needed on the left and minimal examination of the lower extremities unless a more generalized process is suspected
Assessment Models or Tools	● Direct observation ● Multisource feedback ● Simulation
Curriculum Mapping	●
Notes or Resources	● Møller A. *Intraoperative Neurophysiological Monitoring*. 2nd ed. Humana Press: 2006. ISBN:978-1-59745-018-8. ● Preston DC, Shapiro BE. *Electromyography and Neuromuscular Disroders: Clinical-Electrophysiologic-Ultrasound Correlations*. 4th ed. Philadelphia, PA: Elsevier; 2020. ISBN:978-0323661805. ● Rubin D, Daube J. *Clinical Neurophysiology*. 4th ed. New York, NY: Oxford University Press; 2016. ISBN:978-0190259631.

Patient Care 3: Electroencephalogram (EEG) **Overall Intent:** To interpret and report EEG findings	
Milestones	**Examples**
Level 1 *Describes normal EEG features of awake and sleep states and common EEG artifacts* *Identifies the elements of a routine EEG report*	● Describes the posterior dominant rhythm and sleep/wake states ● Describes eye blink, movement, and muscle artifacts ● Uses terminology such as montages, amplitudes, frequencies, and epileptiform abnormalities
Level 2 *Interprets common EEG abnormalities* *Generates a routine normal EEG report*	● Describes generalized slowing ● Describes generalized spike-wave discharges ● Uses terminology to generate a normal report including technical description, background, activations, and abnormalities
Level 3 *Interprets common normal variants and abnormal EEG patterns* *Generates an abnormal EEG report*	● Describes positive occipital sharp transients of sleep (POSTS) ● Describes lambda waves and lateral rectus spikes ● Describes focal slowing, focal spikes, and focal status epilepticus ● Uses the above to generate an abnormal EEG report with detailed description of the location, frequency, and clinical significance of the abnormalities
Level 4 *Efficiently interprets EEG findings, including uncommon normal variants and abnormal EEG patterns* *Efficiently generates normal and complex reports of continuous video EEG*	● Describes 14 and 6 Hz positive bursts, wicket spikes, and rhythmic midtemporal theta ● Describes paroxysmal fast activity, eye closure sensitivity, and notched delta ● Uses Salzberg criteria to describe non-convulsive status epilepticus ● Writes multiple complete continuous EEG reports describing background features, abnormalities, seizures, and communicate the clinical relevance of those findings ● Uses American Clinical Neurophysiology Society's guideline for the EEG determination of suspected cerebral death
Level 5 *Mentors others in interpreting EEG findings in children and adults* *Utilizes advanced analytic techniques to efficiently and accurately generate reports on continuous video EEG studies*	● Uses quantitative EEG and computer assisted analysis of EEG to review trends and patterns in ICU EEG studies ● Uses computer assisted analysis of EEG to assess seizure burden
Assessment Models or Tools	● Direct observation ● Report review

Curriculum Mapping	●
Notes or Resources	● American Clinical Neurophysiology Society (ACNS). Guidelines and Consensus Statement. https://www.acns.org/practice/guidelines. 2021. ● Schomer DL, Lopes da Silva F. *Niedermeyer's Electroencephalography: Basic Principles, Clinical Applications, and Related Fields*. 6th ed. Philadelphia. PA: Lippincott, Williams, & Wolters; 2011. ISBN:978-0781789424.

Patient Care 4: Nerve Conduction Studies (NCS) **Overall Intent:** To perform and interpret NCS	
Milestones	**Examples**
Level 1 *Applies principles of electrical safety to the performance of NCS* *Identifies the elements of a routine NCS report*	● Places the ground electrode ● Identifies sensory and motor conduction studies
Level 2 *Performs common motor and sensory NCS and late responses* *Interprets common motor and sensory abnormalities and generates a report*	● Independently perform routine peroneal, tibial motor, and sural sensory nerves. ● Identifies moderate carpal tunnel syndrome.
Level 3 *Performs neuromuscular junction testing* *Interprets uncommon motor and sensory abnormalities, as well as common anatomical variants in the interpretation of NCS and generates a report*	● Performs a repetitive stimulation study ● Identifies a normal variant such as a Martin Gruber anastomosis of the ulnar nerve.
Level 4 *Performs cranial nerve testing uncommon motor and sensory NCS* *Efficiently interprets and generates a detailed report of complex nerve conduction study findings*	● Performs blink reflex testing ● Identifies and reports an ALS case
Level 5 *Performs special NCS procedures (e.g., autonomic testing)* *Mentor others in the interpretation and documentation of NCS*	● Performs single fiber EMG ● Teaches session on NCS and documentation
Assessment Models or Tools	● Direct observation ● Report review ● Written test
Curriculum Mapping	●

Notes or Resources	● Kumbhare D, Robinson L, Buschbacher R. Buschbacher's Manual of Nerve Conduction Studies. 3rd ed. New York, NY: Demos Medical Publishing LLC; 2015. ISBN:978-1620700877. ● Preston DC, Shapiro BE. *Electromyography and Neuromuscular Disroders: Clinical-Electrophysiologic-Ultrasound Correlations*. 4th ed. Philadelphia, PA: Elsevier; 2020. ISBN:978-0323661805. ● Rubin D, Daube J. *Clinical Neurophysiology*. 4th ed. New York, NY: Oxford University Press; 2016. ISBN:978-0190259631.

Patient Care 5: Needle EMG **Overall Intent:** To plan, perform, and interpret a needle EMG	
Milestones	**Examples**
Level 1 *Identifies technical artifacts in the interpretation of EMG* *Applies knowledge of nerve and muscle anatomy in the performance of EMG and applies principles of electrical safety to the performance of EMG* *Identifies the elements of an EMG report*	● Identifies 60 Hz abnormality ● Places ground electrode ● Identifies the APB is a median innervated muscle from C8/T1 ● Identifies needle exam portion of the report
Level 2 *Formulates basic EMG plan for common clinical presentations* *Performs and interprets EMG of commonly sampled muscles, recognizing common EMG findings* *Generates a normal report for an EMG/NCS study*	● Identifies that numbness and tingling into the first three digits into the hand will require sensory and motor testing of the median and ulnar nerve with obvious attention to the median nerve along with needle examination of intrinsic hand muscles (APB) ● APB denervation would show fibrillations or positive sharp waves ● Completes a report with sensory, motor, EMG, interpretation, and conclusion that the patient has normal findings
Level 3 *Formulates EMG plan for uncommon/atypical clinical presentations* *Performs and interprets EMG of uncommonly sampled muscles, including cranial nerve innervated muscles* *Generates a report for common normal and abnormal findings of an EMG/NCS study*	● Forms a plan for the muscles to be testing in a patient with pain in his shoulder and proximal arm; needle testing needs to be performed for a brachial plexopathy versus a torn rotator cuff ● Performs tongue EMG for ALS ● Completes a report with sensory, motor, EMG, interpretation, and conclusion that the patient has a median neuropathy ● Completes a report with sensory, motor, EMG, interpretation, and conclusion that the patient has a median neuropathy
Level 4 *Actively interprets EMG findings "in real time" and adjusts EMG plan in accordance*	● Identifies additional muscles to be tested in a complex case with a patient that is diabetic with evidence of a peripheral neuropathy and possible radiculopathy with evidence of

	decreased innervation into the vastus medialis on the right who requires testing of multiple proximal muscles in order to assess for femoral neuropathy
Interprets uncommon EMG findings *Generates a report for uncommon normal and abnormal findings of an EMG/NCS study*	● Performs needle EMG for plexus screen including serratus anterior ● Completes a report with sensory, motor, EMG, interpretation, and conclusion that the patient has peripheral polyneuropathy and L5 radiculopathy
Level 5 *Serves as a mentor in the planning of EMG studies* *Performs and interprets special EMG procedures* *Serves as a mentor in generation of EMG reports*	● Assists a resident who presents a patient with neuromuscular disorder needs advanced needle testing ● Performs single fiber EMG ● Assists others in generation of a detailed EMG report.
Assessment Models or Tools	● Direct observation ● Report Review ● Written examination
Curriculum Mapping	●
Notes or Resources	● Preston DC, Shapiro BE. *Electromyography and Neuromuscular Disroders: Clinical-Electrophysiologic-Ultrasound Correlations*. 4th ed. Philadelphia, PA: Elsevier; 2020. ISBN:978-0323661805. ● Rubin D, Daube J. *Clinical Neurophysiology*. 4th ed. New York, NY: Oxford University Press; 2016. ISBN:978-0190259631.

Patient Care 6: Intra-operative Monitoring (IOM) **Overall Intent:** To perform and interpret IOM cases	
Milestones	**Examples**
Level 1 *Describes normal waveforms related to commonly performed IOM studies* *Identifies the basic elements of the IOM report*	● Identifies normal SSEP waveforms ● Identifies normal BAEP waveforms
Level 2 *Correlates normal waveforms with associated anatomic structures and physiologic phenomena* *Generates a basic normal IOM report* *Orders and utilizes appropriate basic procedures in patients undergoing IOM*	● Associates BAEP waves I, III and VI with CN VIII, superior olivary nucleus and MGN, respectively ● Formulates an appropriate monitoring plan for lumbar spinal fusion surgery
Level 3 *Interprets common normal and abnormal findings in IOM, including artifacts* *Provides timely feedback to surgeons with support and generates written report* *Orders appropriate IOM in cases of moderate complexity*	● Associates changes in SSEP amplitudes and latency with anesthesia levels ● Alerts surgeons of unilateral EEG attenuation and decreased faster frequencies associated with carotid clamping during carotid endarterectomy
Level 4 *Interprets uncommon findings in IOM studies* *Provides timely feedback to surgeons independently, and generates written report* *Orders and utilizes appropriate IOM in cases of high complexity*	● Identifies unilateral EEG attenuation and decreased faster frequencies after the unclamping of during carotid endarterectomy, suggesting reperfusion injury ● Formulates an appropriate monitoring plan for critical trauma-related cases
Level 5 *Serves as a mentor in interpretation of IOM studies*	● Gives a lecture on IOMs to rotating students

Serves as a mentor in communication with surgeons during IOM studies and generating a written report *Role models the ordering and utilization of appropriate IOM*	● Creates a guide to reporting IOM for next year's fellows ● Designs a quality improvement project related to IOM
Assessment Models or Tools	● Cases ● Direct observation ● Examination questions ● Report review
Curriculum Mapping	●
Notes or Resources	● Møller A. *Intraoperative Neurophysiological Monitoring*. 2nd ed. Humana Press: 2006. ISBN:978-1-59745-018-8. ● Rubin D, Daube J. *Clinical Neurophysiology*. 4th ed. New York, NY: Oxford University Press; 2016. ISBN:978-0190259631.

Patient Care 7: Evoked Potential (EP) **Overall Intent:** To perform, interpret, and report EP studies	
Milestones	**Examples**
Level 1 *Describes normal waveforms related to commonly performed EP studies* *Identifies the basic elements of the EP study report*	● Describes the meaning of P100 waveform of a visual EP ● Describes the required elements of an EP study: identification, clinical information, technical data, results, description, and interpretation (including impressions and clinical correlation).
Level 2 *Describes normal waveforms related to commonly performed EP studies and correlates normal waveforms with associated anatomic structures and physiologic phenomena* *Generates a basic normal report* *Orders and utilizes appropriate basic procedures in patients undergoing EP studies*	● Identifies the brainstem auditory evoked potential wave V as localizing to the lateral lemniscus in the midbrain ● Identifies the P100 on visual evoked potentials ● Identifies the N20 on somatosensory evoked potentials ● Generates a normal SSEP report ● Generates a normal visual evoked potential report ● In BAEP testing, records the stimulus intensity, polarity (rarefaction, condensation, or both), and if applicable: frequency and duration of tone stimuli, masking and transducer type.
Level 3 *Interprets common findings of clinical significance associated with EP studies* *Generates a report of common abnormal EP studies* *Orders and utilizes appropriate EP studies in cases of moderate complexity*	● Describes prolonged P100 latency and correlates this clinically to optic nerve pathology ● Generates a visual evoked potential report of prolonged P100 latency consistent with optic neuritis ● Discusses with a surgeon to add BAER to monitoring in a patient undergoing removal of cerebellopontine angle tumor
Level 4 *Interprets uncommon findings of clinical significance during EP studies* *Generates a report of uncommon EP studies* *Orders and utilizes appropriate EP studies in cases of high complexity*	● Uses short latency somatosensory evoked potentials in the assessment of suspected cerebral death ● Generates an SSEP report characteristic with brain death ● Decides against using an SSEP to determine brain death in a patient with known critical illness neuropathy. Guides the ordering team on more applicable studies

Level 5 *Serves as a mentor for interpretation of EP studies* *Role models in the creation of EP reports* *Role models the ordering and utilization of appropriate EP studies*	● Gives a lecture on evoked potentials to rotating students ● Creates a guide to reporting evoked potentials for next year's fellows ● Designs a quality improvement project around most useful clinical scenarios for ordering evoked potentials to neurology residents
Assessment Models or Tools	● Cases ● Direct observation ● Examination questions ● Report review, ● Simulation
Curriculum Mapping	●
Notes or Resources	● ACNS. Guideline 10: Guidelines for Writing Evoked Potential Reports. https://www.acns.org/pdf/guidelines/Guideline-10.pdf. 2021. ● Rubin D, Daube J. *Clinical Neurophysiology*. 4th ed. New York, NY: Oxford University Press; 2016. ISBN:978-0190259631.

Patient Care 8: Polysomnography **Overall Intent:** To perform and interpret polysomnography studies	
Milestones	**Examples**
Level 1 *Identifies the technical aspects of polysomnography*	● Describes the 10-20 system in EEG positioning for sleep studies ● Describes channels necessary for complete polysomnogram recording
Level 2 *Describes normal neurophysiologic features of sleep stages*	● Identifies the normal percentages of N1/N2/N3/R sleep in different ages
Level 3 *Interprets and reports polysomnographic features of common sleep disorders*	● Recognition of Cheyne-Stoke respiration ● Identifies obstructive apneas and hypopneas on a home sleep apnea test
Level 4 *Interprets and reports polysomnographic features of uncommon sleep disorders*	● Interprets pathological sleepiness and sleep onset REM periods on an MSLT ● Recognizes CPAP emergent central apnea
Level 5 *Mentors others in the interpretation and reporting of PSG*	● Serves as mentor to residents on signal acquisition and processing
Assessment Models or Tools	● AASM inter-scorer reliability program ● Direct observation ● Review of scored sleep studies ● Simulation ● Written or electronic examinations
Curriculum Mapping	●
Notes or Resources	● American Academy of Sleep Medicine (AASM). The AASM Manual for the Scoring of Sleep and Associated Events. https://aasm.org/clinical-resources/scoring-manual/. 2021. ● AASM. Sleep ISR is Here. https://aasm.org/sleep-isr-is-here/. 2021. ● Sateia MJ. International classification of sleep disorders - third edition. *Chest*. 2014;146(5):1387-1394. https://journal.chestnet.org/article/S0012-3692(15)52407-0/fulltext. 2021.

Patient Care 9: Telemedicine **Overall Intent:** To utilize digital and telehealth technology to monitor and manage patients	
Milestones	**Examples**
Level 1 *Identifies the required components for remote neurophysiologic monitoring* *Identifies the required components of a telehealth visit*	● Identifies required technology and software needed for monitoring ● Identifies the need for permission from the patient to conduct a telehealth visit
Level 2 *Identifies appropriate use settings for remote neurophysiologic monitoring* *Identifies clinical situations that can be managed through a telehealth visit*	● Knows that video EEG monitoring can be read outside of hospital ● Identifies that a patient with stable epilepsy who needs medication refills is appropriate for a telehealth visit.
Level 3 *Demonstrates use of digital or remote monitoring to support patient management in clinical neurophysiology settings* *Initiates and performs a complete telehealth visit*	● Reads a routine EEG remotely ● Initiates and completes a follow-up visit with a patient with stable epilepsy
Level 4 *Utilizes digital and remote monitoring data to optimize the care of patients in clinical neurophysiology settings* *Utilizes telehealth visits for complex patient management*	● Remotely monitors bedside EEG of hospitalized patients with status epilepticus ● Initiates and completes a visit for a patient with ALS in a convalescence setting who is experiencing complications
Level 5 *Innovates and leads in the use of emerging remote monitoring technologies in clinical neurophysiology settings* *Innovates and leads in the use of telehealth technologies in the delivery of patient care*	● Participates in clinical trial to evaluate wireless ambulatory EEG technology ● Develops a template for others to follow to ensure that telehealth requirements are met
Assessment Models or Tools	● Direct observation ● Medical record (chart) review ● Multisource feedback ● Simulation ● Standardized patients
Curriculum Mapping	●

Notes or Resources	● American Academy of Neurology (AAN). Telehealth and Remote Care. https://www.aan.com/tools-and-resources/practicing-neurologists-administrators/telemedicine-and-remote-care. 2021. ● Child Neurology Society (CNS). Toolkit for Telemedicine. https://www.childneurologysociety.org/docs/default-source/2020-cns-/cns-toolkit-for-telemedicine-(apr-5).pdf?sfvrsn=1a5065b8_2. 2021.

Medical Knowledge 1: Localization **Overall Intent:** To demonstrates knowledge of neuroanatomy and neurophysiology to guide neurophysiologic studies.	
Milestones	**Examples**
Level 1 *Accurately localizes lesions to specific regions of the nervous system*	● Recognizes that numbness in the hand below the wrist in digit 1-4 is most likely consistent with carpal tunnel rather than a radiculopathy
Level 2 *Demonstrates knowledge of neuroanatomy and neurophysiology relevant to performing and interpreting common neurophysiologic studies*	● Recognizes length-dependent gradient on needle examination in patient with diabetic sensorimotor axonal neuropathy
Level 3 *Demonstrates knowledge of neuroanatomy and neurophysiology relevant to performing and interpreting uncommon neurophysiologic studies*	● Understands the importance of muscle choice during single-fiber EMG, depending on location of patient's symptoms
Level 4 *Consistently demonstrates sophisticated and detailed knowledge of neuroanatomy and neurophysiology relevant to performing and interpreting complex neurophysiologic studies*	● In patient with brachial plexus injury, able to perform physical examination and localize to appropriate trunk or roots, and then confirm findings with EMG/NCS appropriately
Level 5 *Teaches other learners neuroanatomy relevant to performing and interpreting neurophysiologic studies*	● Develops EMG educational materials or resources ● Gives lectures on EMG cases and neuroanatomy
Assessment Models or Tools	● Direct observation ● Multisource feedback ● Practice cases ● Simulation
Curriculum Mapping	●
Notes or Resources	● Preston DC, Shapiro BE. *Electromyography and Neuromuscular Disroders: Clinical-Electrophysiologic-Ultrasound Correlations*. 4th ed. Philadelphia, PA: Elsevier; 2020. ISBN:978-0323661805.

Medical Knowledge 2: Neuromuscular (NM) Disorders **Overall Intent:** To demonstrate knowledge of neurophysiologic findings in neuromuscular disorders	
Milestones	**Examples**
Level 1 *Explains typical presentations of common NM disorders (based on knowledge of anatomy of the NMJ*	● 76-year-old male presents with new onset diplopia and ptosis in the left eye most consistent with an ocular myasthenia gravis
Level 2 *Explains atypical presentations of commonly encountered NM disorders*	● 63-year-old female with an emergency cholecystectomy who had been complaining of some generalized weakness with exertion prior to surgery who is having issues being weaned from the ventilator
Level 3 *Demonstrates basic knowledge of neurophysiologic findings in common and uncommon neuromuscular disorders*	● 45-year-old patient with weakness is sent for a repetitive stimulation EMG however repetitive stimulation shows a CMAP increment suggestive of LEMS
Level 4 *Demonstrates detailed knowledge of neurophysiologic findings in common and uncommon neuromuscular disorders*	● While performing EMG on a patient with neck pain and cervical dystonia complex repetitive discharges are found in the cervical paraspinal muscles and with further discussion the patient reveals that she gets botox injections into her paraspinals therefore this would be an expected finding
Level 5 *Engages in scholarly activity related to neurophysiologic findings in neuromuscular disorders*	● Presents a case study at a local conference ● Publishes a peer-reviewed paper
Assessment Models or Tools	● Case based discussion ● Direct observation ● Multisource feedback
Curriculum Mapping	●
Notes or Resources	● Preston DC, Shapiro BE. *Electromyography and Neuromuscular Disroders: Clinical-Electrophysiologic-Ultrasound Correlations*. 4th ed. Philadelphia, PA: Elsevier; 2020. ISBN:978-0323661805.

Medical Knowledge 3: Epilepsy **Overall Intent:** To demonstrate knowledge of neurophysiologic findings in patients with epilepsy	
Milestones	**Examples**
Level 1 *Demonstrates basic knowledge of common types of seizures and epilepsy syndromes* *Demonstrates basic knowledge related to the medical management of epilepsy*	● Identifies the child with staring and unresponsive events who has 3-Hz spike-and-wave discharges on EEG as having absence seizures and childhood absence epilepsy ● Also state the treatment for this child would be ethosuximide
Level 2 *Demonstrates basic knowledge of uncommon types of seizures and epilepsy syndromes as well as demonstrates an ability to differentiate epileptic seizures from other paroxysmal disorders* *Demonstrates detailed knowledge of common anti-seizure medications (ASM)*	● Identifies the 2-year-old child with an explosive onset generalized tonic-clonic seizures and myoclonic-atonic seizures as having Doose syndrome ● Correctly distinguishes when a patient is having psychogenic non-epileptic seizures versus epileptic seizures ● Discusses with a patient and family the side effect profile, typical dosing and drug-drug interactions for levetiracetam
Level 3 *Demonstrates detailed knowledge of clinical, findings seen in common and uncommon types of seizures and epilepsy syndromes, as well as the ability to localize and lateralize seizure foci based on reported seizure semiology* *Demonstrates detailed knowledge of uncommon ASMs*	● Recognizes the patient who is having frequent brief seizures out of sleep characterized by abrupt onset and offset of asymmetric posturing with minimal postictal confusion as localizing to the frontal region ● Discusses the mechanism of action, side effect profile and pharmacokinetics for uncommon ASMs such as CBD oil, felbamate, stiripentol
Level 4 *Demonstrates detailed knowledge of clinical findings, and typical EEG findings seen in common and uncommon seizures and epilepsy syndromes* *Demonstrates knowledge of advanced treatment options for medically refractory epilepsy*	● Identifies the seizure described in level 3 as originating from the supplementary sensorimotor cortex ● Recognizes that after the patient with frontal lobe epilepsy with seizures arising from supplementary sensorimotor had failed 2 ASMs, they should be evaluated for epilepsy surgery
Level 5 *Engages in scholarly activity related to epileptic seizures and/or epilepsy syndromes*	● Works on research related to the field of epilepsy ● Participates in the surgical planning for the intractable patient with focal lobe epilepsy

Demonstrates detailed knowledge of advanced treatment options for medically refractory epilepsy	● Mentors residents and medical students
Assessment Models or Tools	● Direct observation ● Simulation
Curriculum Mapping	●
Notes or Resources	● Wyllie E. *Wyllie's Treatment of Epilepsy*: *Principles and Practice*. 7th ed. Philadelphia, PA: Wolters Kluwer; 2020. ISBN:978-1496397690.

Medical Knowledge 4: Sleep Disorders **Overall Intent:** To demonstrate knowledge of neurophysiologic findings in patients with sleep disorders	
Milestones	**Examples**
Level 1 *Recognizes clinical features of common sleep disorders*	● Knows the risk factors for obstructive sleep apnea and those that require testing ● Defines the clinical features of disorders of arousal
Level 2 *Recognizes the indications for use of different sleep study modalities*	● Patient has symptoms of daytime sleepiness despite adequate sleep hours requires both PSG and MSLT to assess night time sleep and for narcolepsy without features of OSA
Level 3 *Describes clinical and neurophysiologic features of common sleep disorders on PSG or HST*	● Identifies obese male with frequent arousals and daytime hypersomnia needs sleep study and can interpret a PSG or HST; identifies normal sleep pattern along with obstructive sleep apnea event
Level 4 *Describes clinical and neurophysiologic features of uncommon sleep disorders*	● Identifies clinical symptoms of an ALS patient with poor unrefreshed sleep and witnessed episodes of breathing need for PSG and can interpret PSG with central sleep apnea or complex sleep apnea events
Level 5 *Engages in scholarly activity related to sleep disorders*	● Gives lecture on advanced positive airway pressure modes to junior residents. ● Lectures on early childhood insomnias to junior residents ● Participates in research related to sleep disorders
Assessment Models or Tools	● Direct observation ● Overscoring or residents PSG/HST interpretation
Curriculum Mapping	●
Notes or Resources	● Foldvary-Schaefer N, Grigg-Damberger M, Mehra R. *Sleep Disorders: A Case a Week from the Cleveland Clinic.* 2nd ed. New York, NY: Oxford University Press; 2019. ISBN:978-0190671099. ● Kryger MH, Roth T, Dement WC. *Principles and Practice of Sleep Medicine*. 6th ed. Philadelphia, PA: Elsevier; 2016. ISBN:978-0323242882. ● Pressman M. *Primer of Polysomnogram Interpretation*. 1st ed. Butterworth-Heinemann; 2002. ISBN:978-0750697828.

Medical Knowledge 5: EP/IOM **Overall Intent:** To demonstrate knowledge of the technical aspects of EP/IOM and findings	
Milestones	**Examples**
Level 1 *Describes basic knowledge of the fundamental neurophysiologic principles of EP and/or IOM*	● Identifies the localization of the waves I-V for brainstem auditory evoked responses
Describes common indications for IOM and/or EP studies	● Recognizes that cranial nerve monitoring would be useful for brainstem tumor procedures
Level 2 *Demonstrates advanced knowledge of the fundamental neurophysiologic principles of EP and/or IOM*	● Identifies that facial EMG and BAER would be useful for brainstem tumor procedures
Describes basic procedures utilized in IOM and/or EP and when studies are clinically appropriate	● Identifies that a reduction in amplitude of 50% on SSEP is clinically significant
Level 3 *Demonstrates basic knowledge of the technical aspects of EP and/or IOM*	● Recognizes that cold temperature can increase all SSEP latencies
Describes normal patterns of EP and/or IOM studies	● Identifies normal BAER waves when given an image
Level 4 *Demonstrates detailed knowledge of the technical aspects of EP and/or IOM studies*	● Recognizes that volatile anesthetics can suppress signals in a dose dependent manner
Describes atypical findings of clinical significance associated with EP and/or IOM studies	● Identifies abnormal BAER (loss of wave 5)
Level 5 *Demonstrates comprehensive knowledge of the fundamental neurophysiologic principles and technical aspects of EP and/or IOM studies*	● Applies medical knowledge to interpret IOM findings in complex cases considering technical artifact and anesthesia effects
Describes uncommon findings of clinical significance during IOM and/or EP studies	● Identifies brain death pattern in BAER
Assessment Models or Tools	● Chart audit ● Direct observation

	● E-modules (test) ● Multisource Feedback ● Simulation
Curriculum Mapping	●
Notes or Resources	● Rubin D, Daube J. *Clinical Neurophysiology*. 4th ed. New York, NY: Oxford University Press; 2016. ISBN:978-0190259631.

Systems-Based Practice 1: Patient Safety **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* *Demonstrates knowledge of how to report patient safety events*	● Has basic knowledge about the definition of patient safety events and reporting pathways
Level 2 *Identifies system factors that lead to patient safety events* *Reports patient safety events through institutional reporting systems*	● Identifies and reports a delayed communications of a critical EEG finding to the primary care team.
Level 3 *Participates in analysis of patient safety events* *Participates in disclosure of patient safety events to patients and families (actual or simulated)*	● Participates in a root cause analysis for a delayed communication of a critical EEG finding and attends a team meeting to disclose
Level 4 *Conducts analysis of patient safety events and offers error prevention strategies* *Discloses patient safety events to patients and families (actual or simulated)*	● Collaborates in the analysis of a delayed communications of a critical EEG finding to improve communications ● Discloses a delayed communication of a critical EEG finding to patients/families.
Level 5 *Actively engages teams and processes to modify systems to prevent patient safety events* *Role models or mentors others in the disclosure of patient safety events*	● Engages appropriate stakeholders to improve timely communication of critical EEG findings and provides education to the team ● Leads a simulation for junior residents in error disclosure
Assessment Models or Tools	● Chart audit ● Direct observation ● E-module multiple choice tests ● Multisource feedback ● Portfolio ● Simulation

Curriculum Mapping	●
Notes or Resources	● These Milestones can be addressed via low fidelity simulation if the opportunity is not available to perform with patients or families. ● Institute of Healthcare Improvement. http://www.ihi.org/Pages/default.aspx. 2021.

Systems-Based Practice 2: Quality Improvement (QI) **Overall Intent:** To conduct a QI project	
Milestones	**Examples**
Level 1 *Demonstrates knowledge of basic quality improvement methodologies and metrics*	● Has basic knowledge about QI strategies
Level 2 *Describes local quality improvement initiatives*	● Describes initiatives to improve access to stat EEGs
Level 3 *Participates in local quality improvement initiatives*	● Participates in a QI project to improve access to stat EEGs, though may not have yet designed a QI project
Level 4 *Demonstrates the skills required to identify, develop, implement, and analyze a quality improvement project*	● Designs a QI project that will allow for to improved access to stat EEGs
Level 5 *Creates, implements, and assesses quality improvement initiatives at the institutional or community level*	● Analyzes, presents, and implements the process to improve access to stat EEGs
Assessment Models or Tools	● Chart audit ● Direct observation ● Documentation of QI ● E-module multiple choice tests ● Multisource feedback ● Portfolio ● 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 **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*	● Identifies that the patient will be need social work or case management prior to discharge
Identifies key elements for safe and effective transitions of care and hand-offs	● Identifies pending EEG findings as key elements for successful hand-offs in the EMU/ICU
Demonstrates knowledge of population and community health needs and disparities	● Identifies access to primary care and insurance status as social determinants of health
Level 2 *Coordinates care of patients in routine clinical situations effectively using the roles of the interprofessional teams*	● Coordinates the follow-up appointment and EEG prior to discharge and works with social worker to ensure patient is able to get to follow-up appointment
Performs safe and effective transitions of care/hand-offs in routine clinical situations	● Completes structured sign-out for a patient with new onset epilepsy and transition from inpatient to outpatient care
Identifies specific population and community health needs and inequities for their local population	● Identifies that the hospital serves a large, low income rural area without good public transportation and because of this, many patients have difficulty with accessing studies
Level 3 *Coordinates care of patients in complex clinical situations effectively using the roles of their interprofessional teams*	● Works with nutrition, respiratory therapy, and physical therapy to optimize care for a patient with a new diagnosis of ALS and severe malnutrition
Performs safe and effective transitions of care/hand-offs in complex clinical situations	● Performs safe and effective transitions of care for a patient with myasthenia gravis with acute respiratory decompensation, and is transferred to the intensive care unit
Uses local resources effectively to meet the needs of a patient population and community	● Provides information about resources for transportation to next EEG/EMG appointment
Level 4 *Role models effective coordination of patient-centered care among different disciplines and specialties*	● Leads the discussion in an interprofessional discharge planning conference for a patient with complex psychosocial issues
Role models and advocates for safe and effective transitions of care/hand-offs within and	● Calls the primary care doctor for a patient newly diagnosed with new onset seizure to discuss seizure precautions

across health care delivery systems, including outpatient settings *Participates in changing and adapting practice to provide for the needs of specific populations*	● Coaches a junior resident on how to communicate with the primary care provider and family to transition a patient with functional impairment or epilepsy to outpatient care ● In the continuity clinic, helps implement a literacy screening tool to identify populations that would benefit from alternative patient education materials
Level 5 *Analyzes the process of care coordination and leads in the design and implementation of improvements* *Improves quality of transitions of care within and across health care delivery systems to optimize patient outcomes* *Leads innovations and advocates for populations and communities with health care inequities*	● Works with clinic nurse manager to analyze clinical schedule and make changes to the appointment structure to minimize no-show rates and improve access to care ● Works with a QI mentor to identify better hand-off tools for on-call services or to improve teaching sessions ● Identifies needs of underserved population in continuity clinic and offers resources to improve access to care.
Assessment Models or Tools	● Direct observation ● Medical record (chart) review ● Multisource feedback ● Quality metrics ● Review of sign-out tools
Curriculum Mapping	●
Notes or Resources	● CDC. Population Health Training. https://www.cdc.gov/pophealthtraining/whatis.html. 2021. ● Skochelak SE, Hawkins RE, Lawson LE, Starr SR, Borkan JM, Gonzalo JD. *AMA Education Consortium: Health Systems Science*. 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 **Overall Intent:** To understand one's own role in the treatment team and 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 *Identifies key components of the complex health care system (e.g., hospital, skilled nursing facility, finance, personnel, technology)*	● Lists hospital, skilled nursing facility, finance, personnel, and technology as components of the health care system
Describes basic health payment systems (e.g., government, private, public, uninsured care) and practice models	● Recognizes there are different payment systems, such as managed care systems, Medicaid, and commercial third-party payers
Identifies basic knowledge domains for effective transition to practice	● Knows that there are different requirements for varying levels of billing for EEG and EMG
Level 2 *Describes how components of a complex health care system are interrelated, and how this impacts patient care*	● Understands that when a 10-year-old child needs an EEG and the hospital is not in the preferred network for this patient, the insurance company also will not allow an EEG to be ordered without a peer-to-peer consultation
Delivers care with consideration of each patient's payment model (e.g., insurance type)	● Arranges to have the EEG performed at an in-network facility so can be covered by insurance
Describes core administrative knowledge needed for transition to practice	● Lists medication and allergy reconciliation and updating the problem list as being required every visit
Level 3 *Discusses how individual practice affects the broader system (e.g., length of stay, readmission rates, clinical efficiency)*	● Knows that a late discharge impacts new patient admissions
Engages with patients in shared decision making, informed by each patient's payment models	● Discusses other options with the patient when their insurance does not cover new epilepsy therapies
Demonstrates use of administrative knowledge required for transition to practice	● Bills an encounter at a Level 4 and elements of their notes supports this level of service
Level 4 *Manages various components of the complex health care system to provide efficient, and effective patient care and transition of care*	● Works collaboratively with the institution to improve patient assistance resources or designs the institution's community health needs assessment

Advocates for patient care needs (e.g., community resources, patient assistance resources) with consideration of the limitations of each patient's payment model *Analyzes individual practice patterns and professional requirements for transition to practice*	● Provides documentation for need of a new epilepsy therapy for a patient with intractable focal epilepsy ● Finds a resource for free gene testing in a child ● Asks social worker to suggest low-cost psychological therapy for patients ● Reviews previous continuity clinic patients with seizures to determine the number with seizure action plans ● Identifies a pattern of prolonged patient visits and level of billing
Level 5 *Advocates for or leads systems change that enhances high-value, efficient, and effective patient care and transition of care* *Participates in health policy advocacy activities* *Educates others to prepare them for transition to practice*	● Develops an institutional protocol regarding the neuroimaging of patients needing a surgical work-up for epilepsy and addresses neuroimaging as it relates to delivering high-value care ● Improves informed consent process for non-English-speaking patients requiring interpreter services ● Coaches residents on preparation and need for fellowship or applying for attending jobs
Assessment Models or Tools	● Direct observation ● Medical record (chart) audit ● Portfolio review
Curriculum Mapping	●
Notes or Resources	● Agency for Healthcare Research and Quality (AHRQ). Major Physician Measurement Sets. https://www.ahrq.gov/talkingquality/measures/setting/physician/measurement-sets.html. 2021. ● AHRQ. Measuring the Quality of Physician Care. https://www.ahrq.gov/talkingquality/measures/setting/physician/challenges.html. 2021. ● The Kaiser Family Foundation. Health Reform. https://www.kff.org/topic/health-reform/. 2021. ● Dzau VJ, McClellan M, Burke S, 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. ● The Commonwealth Fund. Health System Data Center. http://datacenter.commonwealthfund.org/?_ga=2.110888517.1505146611.1495417431-1811932185.1495417431#ind=1/sc=1. 2021. ● AAN. Neurology Career Center. https://careers.aan.com/. 2021.

Practice-Based Learning and Improvement 1: Evidence-Based and Informed Practice **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 in patient care*	● Searches for appropriate evidence-based guidelines for a patient with new onset epilepsy
Level 2 *Articulates clinical questions to guide search for evidence and elicits patient preferences and values in order to guide evidence-based care*	● Asks about patient preferences for nutritional support in advanced neurologic disorders and searches literature for available options
Level 3 *Locates and applies the best available evidence, integrated with patient preferences and values, to the care of patients*	● Applies evidence for alternate rescue therapy in a patient with myasthenia gravis who declines blood products
Level 4 *Critically appraises and applies evidence, even in the face of uncertainty, 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 ● 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 ● Journal club assessment ● 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 **Overall Intent:** To seek clinical performance information with the intent to improve care; to reflect on all domains of practice, personal interactions, and behaviors, and their impact on colleagues and patients (reflective mindfulness); to develop clear objectives and goals for improvement in some form of a learning plan	
Milestones	**Examples**
Level 1 *Accepts responsibility for personal and professional development by establishing goals* *Identifies the factors which contribute to gaps between expectations and actual performance* *Actively seeks opportunities to improve*	● Creates a personal learning goal ● Identifies that too much time is spent on notes ● Asks attending for tips on efficient note writing
Level 2 *Demonstrates openness to performance data (feedback and other input)* *Analyzes and reflects on the factors which contribute to gaps between expectations and actual performance* *Designs and implements a learning plan, with prompting*	● Asks follow-up questions regarding how to improve after receiving feedback ● Identifies that too much time spent on notes impacts other aspects of patient care ● At the suggestion of the attending, creates a note template
Level 3 *Seeks performance data sporadically, with adaptability and humility* *Institutes behavioral changes to narrow the gaps between expectations and actual performance* *Independently creates and implements a learning plan*	● At the end of a particularly difficult rotation, asks for feedback ● Tracks the time spent on notes to recognize improved efficiency ● Independently creates a note template to improve efficiency of documentation
Level 4 *Seeks performance data consistently* *Challenges assumptions and considers alternatives in narrowing the gaps between expectations and actual performance*	● At the end of all rotations, seeks out and uses feedback on performance ● Works with information technology (IT) to improve note template after recognizing that documentation is still inefficient

Uses performance data to measure the effectiveness of the learning plan and when necessary, improves it	● Gets quality monitoring reports from IT to review the learning plan
Level 5 *Role models seeking performance data with adaptability and humility* *Coaches others on reflective practice* *Facilitates the design and implementation of learning plans for others*	● Asks other learners for feedback and asks for feedback from faculty in front of learners ● Encourages other learners on the team to consider how their behavior affects the rest of the team ● Implements “Feedback Fridays” with modification of learning plans following each session
Assessment Models or Tools	● Direct observation ● Multisource feedback ● Portfolio review ● Review of learning plan ● Semiannual review
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_Correates_of_Physicians__Lifelong.21.aspx. 2021. ● 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. ● Burke AE, Benson B, Englander R, Carraccio C, Hicks PJ. Domain of competence: practice-based learning and improvement. *Academic Pediatrics*. 2014;14(2 Suppl):S38-S54. https://www.academicpedsjnl.net/article/S1876-2859(13)00333-1/pdf. 2021.

Professionalism 1: Professional Behavior and Ethical Principles **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* *Demonstrates knowledge of ethical principles related to patient care*	● Understands that sleep deprivation can be a trigger for a lapse in professionalism ● Demonstrates knowledge of system to report breaches of professionalism in own institution ● 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* *Analyzes straightforward situations using ethical principles*	● Acts professionally in daily interactions ● Acknowledges lapses without becoming defensive, making excuses, or blaming others, and takes steps to make amends ● Monitors and responds to fatigue, hunger, stress, etc. in self and team members ● Applies ethical principles to straightforward informed consent
Level 3 *Demonstrates professional behavior in complex or stressful situations* *Analyzes complex situations using ethical principles*	● Navigates situations while under stress or when there are system barriers ● Applies ethical principles to end-of-life situations
Level 4 *Intervenes to prevent professionalism lapses in self and others* *Recognizes and uses appropriate resources for managing and resolving ethical dilemmas as needed*	● Assumes positive intent in evaluating others' perspective ● Takes action to help colleague who is distressed ● Requests ethics consult for patients who are unable to make their own decisions
Level 5 *Coaches others when their behavior fails to meet professional expectations* *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 ● Serves as a member of the Institutional Review Board (IRB), Ethics, or Peer-Review Committee ● Identifies and works to resolve institutional policies that contribute to clinician stress
Assessment Models or Tools	● Case-based assessment ● Direct observation

	● Multisource feedback ● Simulation
Curriculum Mapping	●
Notes or Resources	● American Medical Association. Ethics. https://www.ama-assn.org/delivering-care/ama-code-medical-ethics. 2021. ● Bernat JL. *Ethical Issues in Neurology*. 3rd ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2008. ISBN:978-0781790604. ● 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. ● 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 **Overall Intent:** To take responsibility for one's own actions and the impact on patients and other members of the health care 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*	● Takes responsibility for consistently coming late to rounds and identifies sleep issues with newborn at home as contributing to tardiness ● When sleep deprived, sets multiple alarms
Responds promptly to requests or reminders to complete tasks and responsibilities	● 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*	● Performs follow-up on results to outpatients ● Addresses inbox before leaving for vacation
Recognizes situations that may impact own ability to complete tasks and responsibilities in a timely manner	● Asks colleague to cover their inbox the week before board exams
Level 3 *Performs tasks and responsibilities in a timely manner with appropriate attention to detail in complex or stressful situations*	● Appropriately notifies colleagues on day service about overnight call events during transition of care or hand-off ● Notifies attending of multiple competing demands on call, appropriately triages tasks, and asks for assistance from other colleagues, if needed
Proactively implements strategies to ensure that the needs of patients, teams, and systems are met	● When post call or on vacation, creates an away message
Level 4 *Manages situations that may impact others' ability to complete tasks and responsibilities in a timely manner*	● Senior residents advise junior residents how to manage their time in completing patient care tasks; escalates to communicating with program director if problem requires a system-based approach and needs addressing at a higher administrative level
Role models the strategies to ensure that the needs of patients, teams, and systems are met	● Takes responsibility for potential adverse outcomes and professionally discusses with the interprofessional team
Level 5 *Identifies and seeks to address system-level factors that impact completion of tasks*	● Sets up a meeting with the nurse manager to streamline patient discharges

Coaches others to develop strategies to ensure that the needs of patients, teams, and systems are met	● Coaches other learners to do a QI project to improve clinic workflow
Assessment Models or Tools	● Compliance with deadlines and timelines ● Direct observation ● Multisource feedback ● Self-evaluations and reflective tools ● Simulation
Curriculum Mapping	●
Notes or Resources	● Code of conduct from fellow/resident institutional manual ● Expectations of residency program regarding accountability and professionalism ● Levinson W, Ginsburg S, Hafferty FW, Lucey CR. *Understanding Medical Professionalism*. 1st ed. New York, NY: McGraw-Hill Education; 2014. ISBN:978-0071807432. ● Bynny RL, Paauw DS, Papadakis MA, Pfeil S, Alpha Omega Alpha. *Medical Professionalism Best Practices: Professionalism in the Modern Era.* Menlo Park, CA: Alpha Omega Alpha Honor Medical Society; 2017. http://alphaomegaalpha.org/pdfs/Monograph2018.pdf. 2021. ● AMA. GME Modules on Professionalism. https://edhub.ama-assn.org/gcep. 2021.

Professionalism 3: Self-Awareness and Well-Being **Overall Intent:** To identify, use, manage, improve, and seek help for personal and professional well-being for self and others	
Milestones	**Examples**
Level 1 *Recognizes status of personal and professional well-being, with assistance* *Recognizes limits in knowledge/skills, with assistance*	● Accepts feedback and exhibits positive responses to constructive criticism or suggestions for change ● The attending notes that the resident was unable to identify small sharp spikes in sleep
Level 2 *Independently recognizes status of personal and professional well-being* *Independently recognizes limits in knowledge/skills*	● Recognizes that they are sleep deprived ● Admits to attending that the resident is not sure if this is normal sleep architecture on EEG
Level 3 *With assistance, proposes a plan to promote personal and professional well-being* *With assistance, proposes a plan to remediate or improve limits in knowledge/skills*	● With guidance from the program director, makes room in daily schedule for personal time and hobbies ● With guidance from program director, develops a reading plan incorporating unknown EEGs to increase skill of recognition of normal EEG variants
Level 4 *Independently develops a plan to promote personal and professional well-being* *Independently develops a plan to remediate or improve limits in knowledge/skills*	● Arranges for team-building activities to help reduce stress ● The fellow makes his own EEG repository of difficult and challenging cases to help him learn from interpretation errors.
Level 5 *Coaches others when emotional responses or limitations in knowledge/skills do not meet professional expectations*	● Mentors colleagues in self-awareness and establishes plans to limit stress and burnout
Assessment Models or Tools	● Direct observation ● Group interview or discussions for team activities ● Individual interview ● Institutional online training modules ● Participation in institutional well-being programs ● Personal learning plan ● Self-assessment ● Self-reflection
Curriculum Mapping	●

Notes or Resources	● This subcompetency is not intended to evaluate a fellow's well-being, but to ensure each fellow has the fundamental knowledge of factors that impact well-being, the mechanisms by which those factors impact well-being, and available resources and tools to improve well-being. ● AAN. Residency Program Wellness. https://www.aan.com/tools-and-resources/academic-neurologists-researchers/program-and-fellowship-director-resources/residency-program-wellness/. 2021. ● ACGME. "Well-Being Tools and Resources." https://dl.acgme.org/pages/well-being-toolsresources. Accessed 2022. ● Hicks PJ, Schumacher D, Guralnick S, Carraccio C, Burke AE. Domain of competence: personal and professional development. *Acad Pediatr*. 2014;14(2 Suppl):S80-97. https://www.academicpedsjnl.net/article/S1876-2859(13)00332-X/fulltext. 2021. ● Local resources, including Employee Assistance ● National Academy of Medicine. Action Collaborative on Clinical Well-Being and Resilience. https://nam.edu/initiatives/clinician-resilience-and-well-being/. 2021.

Interpersonal and Communication Skills 1: Patient- and Family-Centered Communication **Overall Intent:** To deliberately use language and behaviors to form constructive relationships with patients	
Milestones	**Examples**
Level 1 *Uses language and nonverbal behavior to demonstrate respect and establish rapport* *Identifies the need to individualize communication strategies based on patient/family expectations and understanding*	● Monitors and controls tone, non-verbal responses, and language to encourage dialogue ● Accurately communicates role in the health care system to patients/families ● Ensures communication is at the appropriate level for a lay-person
Level 2 *Establishes a therapeutic relationship in straightforward encounters using active listening and clear language* *Communicates compassionately with patient/family to clarify expectations and verify understanding of the clinical situation*	● Restates patient perspective when discussing diagnosis and management ● Counsels patient with new onset epilepsy about driving restrictions ● Participates in a family meeting to discuss patient care goals
Level 3 *Establishes a therapeutic relationship in challenging patient encounters* *Communicates medical information in the context of patient/family values, uncertainty and conflict*	● Effectively counsels a patient with epilepsy on medication compliance ● Organizes a family meeting to address caregiver expectations for an ALS patient; reassesses patient and family understanding and anxiety
Level 4 *Easily establishes therapeutic relationships, with attention to patient/family concerns and context, regardless of complexity* *Uses shared decision making to align patient/family values, goals, and preferences with treatment options*	● Continues to engage family members with disparate goals in the care of a patient with intractable epilepsy ● Recommends a plan for a patient with ALS 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* *Role models shared decision making in the context of patient/family values, uncertainty and conflict*	● Leads debriefing after a difficult family meeting ● Leads teaching session on conflict resolution ● Establishes effective relationships with families after a grievance

Assessment Models or Tools	● Direct observation ● Self-assessment including self-reflection exercises ● Standardized patients ● 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. ● 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 **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)*	● Demonstrates respect for different cultural practices ● 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 ● Develops programs that mitigate barriers to patient education
Assessment Models or Tools	● Direct observation ● Self-assessment ● Standardized patients ● 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. ● 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: Patient and Family Education **Overall Intent:** To effectively educate patients and use shared decision making to improve outcomes	
Milestones	**Examples**
Level 1 *Recognizes link between patient outcomes and education*	● Recognizes that the patient should understand their diagnosis of epilepsy and the importance of taking their medication to prevent seizures
Level 2 *Describes methods for effective patient education*	● Tells a resident how to access an appropriate seizure action plan ● Coordinates additional teaching opportunities for families, such as a nursing teaching session about rescue medication for a patient with newly diagnosed epilepsy
Level 3 *Educates patients effectively in straightforward situations, including eliciting understanding of information provided*	● Provides succinct and relevant family education on rounds, which families find helpful and understandable
Level 4 *Educates patients effectively in complex situations*	● For a patient with ALS, educates the family about what is known and the limits of treatment saying, “I don’t know” when that is the case and follows up appropriately
Level 5 *Educates patients in self-advocacy, community outreach, and activism*	● Goes to local schools to educate students and staff about epilepsy and seizure first aid
Assessment Models or Tools	● Direct observation ● Multisource feedback ● Self-assessment ● Self-reflection ● Standardized patients or structured case discussions
Curriculum Mapping	●
Notes or Resources	● Jotterand F, Amodio A, Elger BS. Patient education as empowerment and self-rebiasing. *Med Health Care Philos*. 2016;19(4):553-561. https://link.springer.com/article/10.1007%2Fs11019-016-9702-9. 2021. ● Lindeman, CA. Patient education. *Annu Rev Nur Res*. 1988;6:29-60. ● Parent K, Jones K, Phillips L, Stojan JN, House JB. Teaching patient and family-centered care: Integrating shared humanity into medical education curricula. *AMA J Ethics*. 2016;18(1):24-32. https://journalofethics.ama-assn.org/sites/journalofethics.ama-assn.org/files/2018-06/medu1-1601.pdf. 2021. ● Vital Talks

Interpersonal and Communication Skills 4: Interprofessional and Team Communication **Overall Intent:** To effectively communicate with the health care team, including consultants, in both straightforward and complex situations	
Milestones	**Examples**
Level 1 U*ses language that values all members of the health care team* *Understands the importance of feedback*	● Shows respect in health care team communications through words and actions ● Uses respectful communication to all staff members with active listening ● Listens to and considers others' points of view, is nonjudgmental and actively engaged, and demonstrates humility
Level 2 *Communicates information effectively with all members of the health care team* *Solicits feedback on performance as a member of the health care team*	● Communicates back to referring provider the specific recommendations after performing a consult ● When transferring a patient to a different service, communicates change to all members of the team ● Asks other health care professionals for feedback after a rotation
Level 3 *Uses active listening to adapt communication style to fit team needs* *Communicates concerns and provides feedback to peers and learners*	● Verifies understanding of own communications by restating critical values and unexpected diagnoses using closed loop communication ● Demonstrates active listening by fully focusing on all members of the team, actively showing verbal and non-verbal signs (eye contact, posture, reflection, questioning, summarization) ● Uses good eye contact skills to recognize that a colleague disagrees with the recommendation and adjusts communication accordingly and improves from constructive criticism ● Respectfully and regularly provides feedback to junior members of the medical team for the purposes of improvement or reinforcement of correct knowledge, skills, and attitudes
Level 4 *Coordinates recommendations from different members of the health care team to optimize patient care* *Communicates feedback and constructive criticism to superiors*	● Incorporates recommendations from members of the medical team to adjust medication schedule so as not to interfere with patient sleep schedule ● Offers suggestions to negotiate or resolve conflicts among health care team members; raises concerns or provides opinions and feedback, when needed, to superiors on the team
Level 5 *Role models flexible communication strategies that value input from all health care team members, resolving conflict when needed*	● Junior residents seek advice from the fellow on how to resolve conflict within the health care team

Facilitates regular health care team-based feedback in complex situations	● Organizes a team meeting to discuss and resolve potentially conflicting points of view on a plan of care (e.g., therapeutic apheresis for rare neurological condition, use of rare resources)
Assessment Models or Tools	● Direct observation ● Medical record (chart) audit ● Multisource feedback ● Self-reflection ● Simulation
Curriculum Mapping	●
Notes or Resources	● 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. ● Green M, Parrott T, Cook G. Improving your communication skills. *BMJ*. 2012; 344:e357. https://www.bmj.com/content/344/bmj.e357. 2021. ● 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. ● Fay D, Mazzone M, Douglas L, Ambuel B. A validated, behavior-based evaluation instrument for family medicine residents. *MedEdPORTAL*. 2007. https://www.mededportal.org/publication/622/. 2021. ● Dehon E, Simpson K, Fowler D, Jones A. Development of the faculty 360. *MedEdPORTAL*. 2015;11:10174. https://www.mededportal.org/publication/10174/. 2021. ● Lane JL, Gottlieb RP. Structured clinical observations: A method to teach clinical skills with limited time and financial resources. *Pediatrics*. 2000;105(4 Pt 2):973-977. https://www.ncbi.nlm.nih.gov/pubmed/10742358. 2021. ● Braddock CH III, Edwards KA, Hasenberg NM, Laidley TL, Levinson W. Informed decision making in outpatient practice: Time to get back to basics. *JAMA*. 1999;282(24):2313-2320. https://jamanetwork.com/journals/jama/fullarticle/192233. 2021.

Interpersonal and Communication Skills 5: Communication within Health Care Systems **Overall Intent:** To communicate effectively using a variety of methods	
Milestones	**Examples**
Level 1 *Accurately records information in the patient record as required by institutional policy* *Describes appropriate use of documentation shortcuts as required by institutional policy*	● Notes are accurate but may not be optimally organized and include extraneous information ● Identifies smart phrases in the electronic health record for clinic note writing
Level 2 *Demonstrates organized diagnostic and therapeutic reasoning through notes in the patient record* *Demonstrates accurate, timely, and appropriate use of documentation shortcuts in formats specified by institutional policy*	● Creates organized and accurate notes that may contain extraneous information ● Uses smart phrases and templates appropriately
Level 3 *Concisely reports diagnostic and therapeutic reasoning in the patient record* *Appropriately selects direct (e.g., telephone, in-person) and indirect (e.g. progress notes, text messages) forms of communication based on context*	● Documentation is accurate, organized, and concise, but may not consistently contain contingency planning for change in condition (anticipatory guidance) ● Knows when to direct concerns locally, departmentally, or institutionally – appropriate escalation ● Uses appropriate method when sharing results needing urgent attention
Level 4 *Communicates clearly, concisely, timely, and in an organized written form, including anticipatory guidance* *Achieves written or verbal communication (patient notes, email, etc.) that streamlines and enhances patient care*	● Documentation is accurate, organized, and concise and includes anticipatory guidance ● Others turn to this fellow for examples of note template ● Attending evaluates this fellow as having timely notes
Level 5 *Models feedback to improve others' written communication*	● Teaches colleagues how to improve discharge summaries

Achieves written or verbal communication (patient notes, email, etc.) that serves as an example for others to follow	● Leads a QI initiative to improve house staff hand-offs
Assessment Models or Tools	● Direct observation ● Medical record (chart) audit ● Multisource feedback ● Portfolio review
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. ● 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.ncbi.nlm.nih.gov/pubmed/16617948. 2021. ● Starmer AJ, Spector ND, Srivastava R, et al. I-PASS, a mnemonic to standardize verbal handoffs. *Pediatrics*. 2012;129(2):201-204. https://ipassinstitute.com/wp-content/uploads/2016/06/I-PASS-mnemonic.pdf. 2021.

To help programs transition to the new version of the Milestones, the ACGME has mapped the original Milestones 1.0 to the new Milestones 2.0. Indicated below are where the subcompetencies are similar between versions. These are not exact matches, but are areas that include similar 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: Neurological Exam	PC2: Neurological Exam
PC3: Electroencephalogram (EEG)	PC3: Electroencephalogram (EEG)
PC4: Nerve Conduction Studies (NCS)	PC4: Nerve Conduction Studies (NCS)
PC5: EMG	PC5: Needle EMG
PC6: Evoked Potential (EP)/Intra-Operative Monitoring (IOM)	PC6: Intra-operative Monitoring (IOM) PC7: Evoked Potential (EP)
PC7: Sleep Disorders	PC8: Polysomnography
No match	PC9: Telemedicine
MK1: Localization	MK1: Localization
MK2: Planning Neurophysiologic Testing	MK1: Localization
MK3: Neuromuscular Disorders	MK2: Neuromuscular Disorders
MK4: Epilepsy	MK3: Epilepsy
MK5: Sleep Disorders	MK4: Sleep Disorders
MK6: EP/IOM	MK5: EP/IOM
SBP1: Systems thinking, including cost- and risk-effective practice	SBP2: Quality Improvement SBP4: Physician Role in Health Care Systems
SBP2: Work in inter-professional teams to enhance patient safety	SBP1: Patient Safety
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 and Informed Practice
PROF1: Compassion, integrity, accountability and respect for self and others	PROF1: Professional Behavior and Ethical Principles PROF2: Accountability/Conscientiousness
PROF2: Knowledge about, respect for, and adherence to the ethical principles relevant to the practice of medicine, remembering in particular that responsiveness to patients that supersedes self	PROF1: Professional Behavior and Ethical Principles
No match	PROF3: Self-Awareness and Well-Being

ICS1: Relationship development, teamwork, and managing conflict	ICS1: Patient- and Family-Centered Communication ICS2: Barrier and Bias Mitigation ICS4: Interprofessional and Team Communication
ICS2: Information sharing, gathering, and technology	SBP3: System Navigation for Patient-Centered Care ICS3: Patient and Family Education ICS5: Communication within Health Care Systems

Available Milestones Resources

Milestones 2.0: Assessment, Implementation, and Clinical Competency Committees Supplement, 2021 - *https://meridian.allenpress.com/jgme/issue/13/2s*

Milestones Guidebooks: https://www.acgme.org/milestones/resources/

- *Assessment Guidebook*
- *Clinical Competency Committee Guidebook*
- *Clinical Competency Committee Guidebook Executive Summaries*
- *Implementation Guidebook*
- *Milestones Guidebook*

Milestones Guidebook for Residents and Fellows: https://www.acgme.org/residents-and-fellows/the-acgme-for-residents-and-fellows/

- Milestones Guidebook for Residents and Fellows
- Milestones Guidebook for Residents and Fellows Presentation
- Milestones 2.0 Guide Sheet for Residents and Fellows

Milestones Research and Reports: https://www.acgme.org/milestones/research/

- *Milestones National Report*, updated each fall
- *Milestones Predictive Probability Report,* updated each fall
- *Milestones Bibliography*, updated twice each year

Developing Faculty Competencies in Assessment courses - https://www.acgme.org/meetings-and-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://team.acgme.org/

Improving Assessment Using Direct Observation Toolkit - https://dl.acgme.org/pages/acgme-faculty-development-toolkit-improving-assessment-using-direct-observation

Remediation Toolkit - https://dl.acgme.org/courses/acgme-remediation-toolkit

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