Neuroendovascular Intervention Milestones



The Accreditation Council for Graduate Medical Education



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Neuroendovascular Intervention Milestones

The Milestones are designed only for use in evaluation of fellows in the context of their participation in ACGME-accredited residency or fellowship programs. The Milestones provide a framework for the assessment of the development of the fellow in key dimensions of the elements of physician competency in a specialty or subspecialty. They neither represent the entirety of the dimensions of the six domains of physician competency, nor are they designed to be relevant in any other context.

Neuroendovascular Intervention Milestones

Work Group

Jim Anderson, MD

Laura Edgar, EdD, CAE

Farah Fourcand, MD

Johanna Fifi, MD

Brian Hoh, MD

Paul Jacobson, MD, MPH

Min Park, MD

Howard Riina, MD

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Society of Neurological Surgeons

Understanding Milestone Levels and Reporting

This document presents the Milestones, which programs use in a semi-annual review of fellow performance, and then report to the ACGME. Milestones are knowledge, skills, attitudes, and other attributes for each of the ACGME Competencies organized in a developmental framework. The narrative descriptions are targets for resident/fellow performance throughout their educational program.

Milestones are arranged into levels. Tracking from Level 1 to Level 5 is synonymous with moving from novice to expert fellow in the specialty or subspecialty. For each reporting period, the Clinical Competency Committee will review the completed evaluations to select the milestone levels that best describe each learner's current performance, abilities, and attributes for each subcompetency.

These levels *do not* correspond with post-graduate year of education. Depending on previous experience, a junior fellow may achieve higher levels early in his/her educational program just as a senior fellow may be at a lower level later in his/her educational program. There is no predetermined timing for a resident to attain any particular level. Fellows may also regress in achievement of their milestones. This may happen for many reasons, such as over scoring in a previous review, a disjointed experience in a particular procedure, or a significant act by the resident/fellow.

Selection of a level implies the resident/fellow substantially demonstrates the milestones in that level, as well as those in lower levels (see the diagram on page v).

Additional Notes

Level 4 is designed as a graduation *goal* but *does not* represent a graduation *requirement*. Making decisions about readiness for graduation and unsupervised practice is the purview of the program director. Furthermore, Milestones 2.0 include revisions and changes that preclude using Milestones as a sole assessment in high-stakes decisions (i.e., determination of eligibility for certification or credentialing). Level 5 is designed to represent an expert fellow whose achievements in a subcompetency are greater than the expectation. Milestones are primarily designed for formative, developmental purposes to support continuous quality improvement for individual learners, education programs, and the specialty. The ACGME and its partners will continue to evaluate and perform research on the Milestones to assess their impact and value.

Some milestone descriptions include statements about performing independently. These activities must occur in conformity to ACGME supervision guidelines as described in the Program Requirements, as well as to institutional and program policies. For example, a fellow who performs a procedure independently must, at a minimum, be supervised through oversight.

A Supplemental Guide is also available to provide the intent of each subcompetency, examples for each level, assessment methods or tools, and other available resources. The Supplemental Guide, like examples contained within the Milestones, is designed only to assist the program director and Clinical Competency Committee, and is not meant to demonstrate any required element or outcome.

Supplemental Guides and other resources are available on the Milestones page of each specialty section of the ACGME website. On www.acgme.org, choose the applicable specialty under the "Specialties" menu, then select the "Milestones" link in the lower navigation bar.

The diagram below presents an example set of milestones for one subcompetency in the same format as the ACGME Report Worksheet. For each reporting period, a fellow's performance on the milestones for each subcompetency will be indicated by selecting the level of milestones that best describes that fellow's performance in relation to those milestones.

| Level 1 | Level 2 | Level 3 | Level 4 | Level 5 |
|--|---|--|---|---|
| Demonstrates how to access and use available evidence to guide routine patient care | Articulates clinical questions and elicits patient preferences and values in order to guide evidence-based care | Locates and applies the best available evidence, integrated with patient preference and values, to care for complex patients | Critically appraises conflicting evidence to guide care, tailored to the individual patient | Coaches others to critically appraise and apply evidence for complex patients; and/or participates in the development of guidelines |
| Discusses the evolution of device or other technology development | Discusses regulatory framework (e.g., FDA, IRB, HDE) of a device and its consent and use | Discusses evidence for currently available devices, limitations for use, and reporting requirements | Critically assesses new technology and available evidence | |
| | | | | |
| Comments: | | | Not Yet | Completed Level 1 |
| Selecting a resp middle of a level milestones in that levels have been demonstrated. | implies that at level and in lower | Selecting a response be between levels indicates in lower levels have bee demonstrated as well as milestones in the higher | s that milestones en substantially s some | |

| Patient Care 1: Pre-Proc | edural Consultations | | | |
|--|--|--|--|---|
| Level 1 | Level 2 | Level 3 | Level 4 | Level 5 |
| Gathers a complete history and performs a physical | Chooses pre-procedural laboratory and imaging studies | Interprets pre-procedural imaging studies | Adjusts procedural plan based upon pre- procedural laboratory and imaging results | Mentors other learners in the pre-procedural consultation |
| Formulates a pre- procedural assessment and plan, including risks, benefits, and alternatives, with guidance from a faculty member | Formulates a pre- procedural assessment and plan with minimal guidance from a faculty member | Independently formulates pre-procedural assessments and plans for common disorders | Independently formulates pre-procedural assessments and plans for complex disorders | Develops patient care protocols/teaching materials |
| | | | | |
| Comments: | | | | Completed Level 1 |

| Patient Care 2: Performa | nce of Procedures | | | |
|---|---|--|---|----------------------------------|
| Level 1 | Level 2 | Level 3 | Level 4 | Level 5 |
| Performs basic procedures (e.g., cerebral angiography, hemostasis, vascular access) | Performs advanced basic procedures (e.g., spinal angiography, venous angiography, Wada test) | Performs moderately complex procedures (e.g., coiling of aneurysm, carotid stent, mechanical thrombectomy) | Performs complex procedures (e.g., intracranial stent, flow diverter, liquid embolics) | Develops new techniques or tools |
| Effectively uses basic image guidance (e.g., visualize needle tip with ultrasound) | Demonstrates basic catheter and wire skills | Integrates catheter and wire skills with imaging of complex anatomy | Integrates catheter and wire skills with advanced imaging guidance and device utilization | |
| | | | | |
| Comments: | | | | Completed Level 1 Assessable |

| Patient Care 3: Post-Pro | cedural Care | | | |
|---|--|--|---|--|
| Level 1 | Level 2 | Level 3 | Level 4 | Level 5 |
| Manages routine post- procedural care with guidance | Manages post-procedural care with minimal guidance | Formulates and implements post-procedural imaging and clinical follow-up for patients after basic procedures | Formulates and implements post-procedural imaging and clinical follow-up for patients after complex procedures | Mentors other learners in post-procedural care and management of complications |
| Evaluates post- procedural complications | Manages minor post- procedural complications | Manages major post- procedural complications | Anticipates and mitigates post-procedural complications | Develops a clinical pathway or guideline for post-procedural care |
| Generates reports with appropriate elements for coding | Efficiently generates clear and concise reports that do not require substantive correction | Efficiently generates clear and concise reports that rarely require correction | Generates tailored reports meeting the needs of the care provider and complex interventional reports with appropriate elements for coding | |
| | | | | |
| Comments: | | | Not Yet C Not Yet A | ompleted Level 1 ssessable |

| Medical Knowledge 1: In | naging and Procedural Ana | itomy | | |
|---|---|---|---|---|
| Level 1 | Level 2 | Level 3 | Level 4 | Level 5 |
| Demonstrates knowledge of imaging anatomy | Applies knowledge of anatomy to make common imaging diagnoses | Applies knowledge of anatomy to make uncommon imaging diagnoses | Proficiently integrates knowledge of anatomic imaging with pathophysiology to formulate a diagnosis | Proficiently integrates knowledge of anatomic imaging with pathophysiology to formulate a diagnosis and treatment plan at the expected level of a subspecialist |
| Identifies normal anatomy during procedures | Identifies anatomic variants during procedures | Articulates the implications of varying anatomy for procedural planning | Identifies post-operative anatomy and its implications for procedures | Develops simulation models or other resources |
| | | | | |
| Comments: | | | Not Yet Co Not Yet As | ompleted Level 1 ssessable |

| Medical Knowledge 2: P | hysics and Imaging Techno | ology | | |
|---|--|---|---|--|
| Level 1 | Level 2 | Level 3 | Level 4 | Level 5 |
| Discusses the basic physics for imaging and image-guided intervention | Demonstrates knowledge of basic medical physics and radiobiology in imaging and image- guided intervention | Applies knowledge of basic medical physics and radiobiology to imaging and image-guided intervention | Applies physical principles to optimize image quality, including dose reduction strategies | Teaches physical principles to optimize image quality to other specialties |
| Discusses imaging technology and image acquisition | Demonstrates knowledge of basic image acquisition and image processing, and recognizes common imaging artifacts and technical problems | Demonstrates knowledge of instrument quality control and image reconstruction; troubleshoots for artifact reduction | Proficiently optimizes image acquisition and processing in collaboration with the technology/imaging team | Presents or publishes research on imaging technology |
| | | | | |
| Comments: | | | Not Yet Co Not Yet As | ompleted Level 1 |

| Medical Knowledge 3: Pa | athophysiology and Treatm | ent | | |
|---|--|--|---|---|
| Level 1 | Level 2 | Level 3 | Level 4 | Level 5 |
| Demonstrates knowledge of pathophysiology of common conditions (e.g., stroke, ruptured aneurysm) | Demonstrates knowledge of pathophysiology and treatment of patients with common conditions | Demonstrates knowledge of pathophysiology and treatment of patients with complex conditions (e.g., arteriovenous [AV] fistula, arteriovenous malformation [AVM]) | Demonstrates knowledge of the pathophysiologic changes after treatment | Contributes to peer- reviewed literature on pathophysiology and/or treatment |
| | | | | |
| Comments: | | | | Completed Level 1 Assessable |

| Medical Knowledge 4: P | harmacology and Contrast | | | |
|---|---|--|---|---|
| Level 1 | Level 2 | Level 3 | Level 4 | Level 5 |
| Demonstrates basic knowledge of the pharmacologic and contrast agents used in endovascular surgical neuroradiology procedures | Demonstrates knowledge of dosing and drug choice for contrast agents, sedation drugs, and commonly used pharmacologic agents | Demonstrates knowledge of the indications, contraindications, side- effects, and complications of pharmacologic agents | Applies functional knowledge of pharmacology to endovascular surgical neuroradiology procedures and periprocedural care | Develops pharmacologic protocols or departmental guidelines |
| | | | | |
| Comments: | | | | Completed Level 1 |

| Systems-Based Practice | e 1: Patient Safety | | | |
|--|---|--|---|---|
| Level 1 | Level 2 | Level 3 | Level 4 | Level 5 |
| Demonstrates knowledge of common patient safety events | Identifies system factors that lead to patient safety events | Participates in analysis of patient safety events (simulated or actual) | Conducts analysis of patient safety events and offers error prevention strategies (simulated or actual) | Actively engages teams and processes to modify systems to prevent patient safety events |
| Demonstrates knowledge of how to report patient safety events | Reports patient safety events through institutional reporting systems (simulated or actual) | Participates in disclosure of patient safety events to patients and families (simulated or actual) | Discloses patient safety events to patients and families (simulated or actual) | Role models or mentors others in the disclosure of patient safety events |
| | | | | |
| Comments: | | | Not Yet C | ompleted Level 1 |

| Systems-Based Practice | 2: Quality Improvement | | | |
|---|---|---|---|---|
| Level 1 | Level 2 | Level 3 | Level 4 | Level 5 |
| Demonstrates knowledge of basic quality improvement methodologies and metrics | Describes local quality improvement initiatives | Participates in local quality improvement initiatives | Demonstrates the skills required to identify, develop, implement, and analyze a quality improvement project | Creates, implements, and assesses quality improvement initiatives at the institutional or community level |
| | | | | |
| Comments: | | | Not Yet C | ompleted Level 1 |

| Level 1 | Level 2 | Level 3 | Level 4 | Level 5 |
|--|---|---|--|--|
| Demonstrates knowledge of care coordination in endovascular surgical neuroradiology imaging/procedures | Coordinates care of patients in routine endovascular surgical neuroradiology imaging/procedures effectively using the roles of interprofessional team members | Coordinates care of patients in complex endovascular surgical neuroradiology imaging/procedures effectively using the roles of interprofessional team members | Role models effective coordination of patient- centered care among different disciplines and specialties | Analyzes the process of care coordination and leads in the design and implementation of improvements |
| Identifies key elements for safe and effective transitions of care and hand-offs | Performs safe and effective transitions of care/hand-offs in routine clinical situations | Performs safe and effective transitions of care/hand-offs in complex clinical situations | Role models safe and effective transitions of care/hand-offs | Improves quality of transitions of care to optimize patient outcomes |
| Demonstrates knowledge of population and community health needs and disparities | Identifies specific population and community health needs and inequities for the local population | Identifies local resources available to meet the needs of a patient population and community | Participates in adapting the practice to provide for the needs of specific populations (actual or simulated) | Leads innovations and advocates for populations and communities with health care inequities |
| | | | | |

| Level 1 | Level 2 | Level 3 | Level 4 | Level 5 |
|---|--|---|--|---|
| Identifies key components of the complex health care system (e.g., hospital, finance, personnel, technology) | Describes how components of a complex health care system are interrelated, and how this impacts patient care | Discusses how individual practice affects the broader system (e.g., length of stay, readmission rates, clinical efficiency) | Manages various components of the complex health care system to provide efficient and effective patient care and transitions of care | Advocates for or leads systems change that enhances high-value, efficient, and effective patient care and transitions of care |
| Describes the mechanisms for reimbursement, including types of payors | States relative cost of common procedures | Describes the technical and professional components of neurointerventional procedural costs | Describes the endovascular surgical neuroradiology revenue cycle and measurements of productivity (e.g., relative value units) | Participates in health policy advocacy activities |
| | | | | |

| Systems-Based Practice 5: Radiation Safety | | | | | | |
|--|--|---|---|---|--|--|
| Level 1 | Level 2 | Level 3 | Level 4 | Level 5 | | |
| Demonstrates knowledge of the mechanisms of radiation injury and the ALARA ("as low as reasonably achievable") concept | Accesses resources to determine exam-specific average radiation dose information | Communicates the relative risk of examspecific radiation exposure to patients and practitioners | Applies principles of ALARA in daily practice | Creates, implements, and assesses radiation safety initiatives at the institutional level | | |
| | | | | | | |
| Comments: | Comments: Not Yet Completed Level 1 | | | | | |

| Level 1 | Level 2 | Level 3 | Level 4 | Level 5 |
|--|--|--|---|---|
| Demonstrates how to access and use available evidence to guide routine patient care | Articulates clinical questions and elicits patient preferences and values to guide evidence-based care | Locates and applies the best available evidence, integrated with patient preference and values, to care for complex patients | Critically appraises conflicting evidence to guide care, tailored to the individual patient | Coaches others to critically appraise and apply evidence for complex patients, and/or participates in the development of guidelines |
| Discusses the evolution of device or other technology development | Discusses regulatory framework (e.g., FDA, IRB, HDE) of a device and its consent and use | Discusses evidence for currently available devices, limitations for use, and reporting requirements | Critically assesses new technology and available evidence | |
| | | | | |

| Level 1 | Level 2 | Level 3 | Level 4 | Level 5 |
|--|--|---|---|---|
| Accepts responsibility for professional development by establishing goals | Is receptive to performance data and feedback and uses them to inform goals | Episodically seeks performance data and feedback with humility and adaptability | Consistently seeks performance data and feedback with humility and adaptability | Coaches other learners to consistently seek performance data and feedback |
| Identifies factors that contribute to gap(s) between expectations and actual performance | Analyzes and reflects on factors that contribute to gap(s) between expectations and actual performance | Analyzes, reflects on, and institutes behavioral change(s) to narrow the gap(s) between expectations and actual performance | Analyzes effectiveness of behavioral changes, where appropriate, and considers alternatives in narrowing the gap(s) between expectations and actual performance | Coaches others on reflective practice |
| Actively seeks opportunities to improve performance | Designs and implements a learning plan, with prompting | Designs and implements a learning plan independently | Uses performance data to measure the effectiveness of the learning plan, and improves it when necessary | Facilitates the design and implements learning plans for others |
| | | | | |

| Professionalism 1: Profe | ssional Behavior and Ethic | cal Principles | | | |
|--|---|---|---|---|--|
| Level 1 | Level 2 | Level 3 | Level 4 | Level 5 | |
| Demonstrates knowledge of expectations for professional behavior and describes how to appropriately report professional lapses | Demonstrates insight into professional behavior in routine situations and takes responsibility for own professionalism lapses | Demonstrates professional behavior in complex or stressful situations | Recognizes situations that may trigger professionalism lapses and intervenes to prevent lapses in oneself and others | Coaches others when their behavior fails to meet professional expectations | |
| Demonstrates knowledge of the ethical principles underlying informed consent, surrogate decision making, advance directives, confidentiality, error disclosure, and stewardship of limited resources | Analyzes straightforward situations using ethical principles | Recognizes need to seek help in managing and resolving complex ethical situations | Recognizes and uses appropriate resources for managing and resolving ethical dilemmas as needed (e.g., ethics consultations, literature review, risk management/legal consultation) | Identifies and seeks to address system-level factors that induce or exacerbate ethical problems or impede their resolution | |
| | | | | | |
| Comments: | Comments: Not Yet Completed Level 1 | | | | |

| Level 1 | Level 2 | Level 3 | Level 4 | Level 5 |
|---|--|---|--|------------------------------------|
| Responds promptly to requests or reminders to complete tasks and responsibilities | Performs tasks and responsibilities in a timely manner to ensure the needs of patients, teams, and systems are met in routine situations | Performs tasks and responsibilities in a timely manner to ensure the needs of patients, teams, and systems are met in complex or stressful situations | Recognizes and raises awareness of situations that may impact others' ability to complete tasks and responsibilities in a timely manner | Takes ownership of system outcomes |
| | | | | |

| Professionalism 3: Self-Awareness and Help Seeking | | | | |
|---|--|--|---|--|
| Level 1 | Level 2 | Level 3 | Level 4 | Level 5 |
| Recognizes status of personal and professional well-being, with assistance, and is aware of available resources | Independently recognizes status of personal and professional well-being using available resources when appropriate | With assistance, proposes a plan to optimize personal and professional well-being | Independently develops a plan to optimize personal and professional well-being | Coaches others when emotional responses or limitations in knowledge/skills do not meet professional expectations |
| Recognizes limits in the knowledge/skills of oneself or the team, with assistance | Independently recognizes limits in the knowledge/skills of oneself or the team and demonstrates appropriate help-seeking behaviors | With assistance, proposes a plan to remediate or improve limits in the knowledge/skills of oneself or the team | Independently develops a plan to remediate or improve limits in the knowledge/skills of oneself or the team | |
| | | | | |
| Comments: | | | Not Yet C | ompleted Level 1 |

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 affect well-being, the mechanisms by which those factors affect well-being, and available resources and tools to improve well-being.

| Level 1 | Level 2 | Level 3 | Level 4 | Level 5 |
|--|--|---|--|---|
| Accurately communicates own role within the health care system | Identifies barriers to effective communication (e.g., language, health literacy, cultural) | Identifies biases that hinder effective communication | Actively minimizes communication barriers | Coaches other learners to minimize communication barriers |
| Identifies the need to adjust communication strategies based on assessment of the patient/patient's family's expectations and understanding of their health status and treatment options | Organizes and initiates communication with the patient/patient's family by clarifying expectations and verifying understanding of the clinical situation | With guidance, sensitively and compassionately delivers medical information, elicits patient goals and preferences, and acknowledges uncertainty and conflict | Independently uses shared decision making to align patient goals and preferences with treatment options to make a personalized care plan | Coaches other learners in shared decision making |
| | | | | |

| Interpersonal and Comm | nunication Skills 2: Interpro | fessional and Team Comm | Level 4 | Level 5 | |
|---|--|--|---|--|--|
| Respectfully receives a consultation request | Clearly and concisely responds to a consultation request | Checks understanding of recommendations when providing consultation | Coordinates recommendations from different members of the health care team to optimize patient care | Role models flexible communication strategies that value input from all health care team members, resolving conflict when needed | |
| Uses language that values all members of the health care team | Communicates information effectively with all health care team members | Uses active listening to adapt communication style to fit team needs | Solicits and communicates feedback to other members of the health care team | | |
| | | | | | |
| Comments: | Comments: Not Yet Completed Level 1 | | | | |

| Interpersonal and Communication Skills 3: Communication within Health Care Systems | | | | |
|--|--|--|---|--|
| Level 1 | Level 2 | Level 3 | Level 4 | Level 5 |
| Demonstrates knowledge of institutional communications policies | Communicates appropriately as required by institutional policy | Communicates systems concerns in a respectful manner | Communicates clear and constructive suggestions to improve systems | Facilitates dialogue regarding systems issues among larger community stakeholders (institution, health care system, field) |
| | | | | |
| Comments: | | | Not Yet C | ompleted Level 1 |