Supplemental Guide: Abdominal Radiology

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Milestones Supplemental Guide

This document provides additional guidance and examples for the Abdominal Radiology 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: Consultant **Overall Intent:** To provide a high-quality clinical consultation	
Milestones	**Examples**
Level 1 *For routine radiology consultations, delineates the clinical question, obtains appropriate clinical information, uses evidence-based imaging guidelines, and recommends next steps with assistance*	● Looks up glomerular filtration rate (GFR) prior to protocoling a study with intravenous contrast ● Reviews relevant history and laboratory results for a patient with abdominal pain
Level 2 *For complex radiology consultations, delineates the clinical question, obtains appropriate clinical information, uses evidence-based imaging guidelines, and recommends next steps with assistance*	● Determines that patient has right lower quadrant pain, refers to American College of Radiology (ACR) Appropriateness Criteria and suggests appropriate exam ● Determines that a pregnant patient has right lower quadrant pain, refers to ACR Appropriateness Criteria and suggests appropriate exam
Level 3 *Manages radiology consultations independently, taking into consideration cost effectiveness and risk benefit analysis*	● Provides consultation to a primary care physician regarding a patient with cirrhosis and a liver mass on ultrasound to determine the next steps in imaging ● Provides consultation for a patient with a pacemaker who requires magnetic resonance imaging (MRI)
Level 4 *Provides comprehensive radiology consultations at the expected level of an abdominal radiologist*	● Independently recommends a scrotal ultrasound and tumor markers first on a consultation for a lung biopsy on a 25-year-old male patient who presents with multiple lung masses on x-ray and a retroperitoneal mass on computerized tomography (CT)
Level 5 *Participates in research, development, and implementation of abdominal imaging guidelines*	● Develops an MRI protocol for a pulmonologist with a hereditary hemorrhagic telangiectasia patient to perform flow quantification of the hepatic artery and portal vein
Assessment Models or Tools	● Case conferences ● Direct observation ● Faculty evaluation ● Multisource feedback ● Report review of recommendations
Curriculum Mapping	● *This section is intentionally left blank so that programs can add information specific to their program and how they'll assess their learners.*
Notes or Resources	● American College of Radiology (ACR). ACR Appropriateness Criteria. https://www.acr.org/Clinical-Resources/ACR-Appropriateness-Criteria. 2021. ● ACR. Appropriateness Modules for Radiology Residents. http://jhrad.com/acr/. 2021. ● ACR. Manual on Contrast Media. https://www.acr.org/Clinical-Resources/Contrast-Manual. 2021. ● Consultations can be over the phone, in the reading room, at tumor boards, etc. ● Institutional policies

Patient Care 2: Competence in Procedures **Overall Intent:** To proficiently and independently perform procedures; to anticipate and manage complications of procedures	
Milestones	**Examples**
Level 1 *Performs simple procedures, with direct supervision* *Recognizes complications of procedures and enlists help*	● Performs ultrasound guided paracentesis with direct supervision ● Recognizes subsequent hypotension and asks for help
Level 2 *Competently performs simple procedures, with indirect supervision and complex procedures, with direct supervision* *Manages complications of procedures, with supervision* *Mentors learners on the indications for procedures and management of complications*	● Performs ultrasound guided paracentesis with indirect supervision ● Performs ultrasound guided renal biopsy with direct supervision ● Recognizes subsequent hypotension after paracentesis and initiates hydration with supervision ● Reviews and discusses upcoming renal biopsy and best needle approach
Level 3 *Proficiently performs simple and complex procedures, with indirect supervision* *Anticipates and independently manages complications of procedures* *Instructs learners on performing simple procedures and managing complications*	● Performs ultrasound guided paracentesis with indirect supervision ● Performs ultrasound guided liver biopsy with indirect supervision ● Recognizes patient has coagulopathy prior to procedure and develops a plan for management prior, during, and after procedure ● Reviews mechanisms of biopsy device prior to procedure
Level 4 *Proficiently and independently performs simple and complex procedures* *Proficiently and independently manages complications of procedures* *Instructs learners on performing simple and complex procedures and managing complications*	● Performs CT-guided retroperitoneal lymph node biopsy independently ● Recognizes bleeding and embolizes the biopsy tract ● Recognizes when routine complication management is contraindicated due to individual patient comorbidity ● Teaches resident that a color Doppler tract after liver biopsy increases the risk for post-procedural bleeding and requires a longer duration of manual compression and reassessment
Level 5 *Participates in research or innovation involving abdominal imaging procedures*	● Uses image fusion software combining various imaging modalities to direct biopsies

Participates in research on innovative methods designed to reduce procedural complications *Develops educational materials for learners regarding procedures*	● Observing that there are variable complication rates among faculty members performing renal biopsies, collects data, assesses individual operator outcomes, and develops best methods to standardize biopsy procedure methods ● Develops an educational simulation module on treating a hemorrhage after adrenal biopsy
Assessment Models or Tools	● Direct observation ● Faculty evaluation ● Multisource feedback ● Point-of-care procedural checklist ● Procedure logs ● Simulation
Curriculum Mapping	● *This section is intentionally left blank so that programs can add information specific to their program and how they'll assess their learners.*
Notes or Resources	● Background and Intent: The ACGME Glossary of Terms defines conditional independence as "graded, progressive responsibility for patient care with defined oversight." ● The care of patients is undertaken with appropriate faculty supervision and conditional independence, allowing fellows to attain the knowledge, skills, attitudes, and empathy required for autonomous practice. ● Invasive procedures expected of an abdominal radiologist may include: paracentesis, thoracentesis, abscess drainage, superficial lymph node, liver biopsy, kidney biopsy, omental biopsy, and/or deep lymph node biopsy ● The New England Journal of Medicine. Videos in Clinical Medicine. https://www.nejm.org/multimedia/medical-videos. 2021. ● Radiological Society of North America (RSNA). Physics Modules. https://www.rsna.org/education/trainee-resources/physics-modules. 2021. ● Society of Interventional Radiology. https://www.sirweb.org/. 2021.

Patient Care 3: Image Interpretation **Overall Intent:** To appropriately prioritize differential diagnosis for imaging findings and recommend management	
Milestones	**Examples**
Level 1 *Identifies primary, secondary, and critical imaging findings and formulates differential diagnoses*	● Identifies non-enhancing bowel reflecting acute mesenteric ischemia ● Identifies free intraperitoneal air and assesses the gastrointestinal tract for viscus perforation ● Provides a differential diagnosis for an enhancing liver lesion in a young woman of hemangioma, adenoma, and focal nodular hyperplasia
Level 2 *Prioritizes differential diagnoses and recommends management options*	● Provides an ordered differential diagnosis for an enhancing liver lesion in a young woman on oral contraceptive therapy of adenoma, focal nodular hyperplasia, and hemangioma; recommends a gadoxetate-enhanced liver MRI for further evaluation to distinguish adenoma
Level 3 *Provides a single diagnosis with integration of current guidelines to recommend management, when appropriate*	● Identifies dilation of the appendix greater than 2 cm in a patient with acute appendicitis and suggests the possibility of an underlying appendiceal mucinous neoplasm to guide intraoperative management
Level 4 *Demonstrates expertise in diagnosis at a level expected of an abdominal radiologist*	● Reviews a liver MRI showing an arterially enhancing mass with washout and microscopic fat in a young woman on oral contraceptive therapy, diagnoses a hepatocyte nuclear factor 1 alpha-inactivated hepatic adenoma and recommends hepatology consultation
Level 5 *Integrates state-of-the-art research and literature into image interpretation*	● Applies the Bosniak 2019 proposed classification to diagnose a homogenous renal lesion with attenuation of 25 Hounsfield units on a portal venous phase CT as a Bosniak 2 lesion ● Uses dual-energy CT to quantify the iodine content in a renal neoplasm
Assessment Models or Tools	● Direct observation ● Faculty evaluation ● Individualized peer review assessments
Curriculum Mapping	● *This section is intentionally left blank so that programs can add information specific to their program and how they'll assess their learners.*
Notes or Resources	● American College of Radiology. ACR Appropriateness Criteria. https://www.acr.org/Clinical-Resources/ACR-Appropriateness-Criteria. 2021. ● Conferences ● Fellowship goals and objectives for recommended reading ● Tumor Board

Medical Knowledge 1: Imaging Technology and Physics **Overall Intent:** To optimize image acquisition and to apply knowledge of physics to imaging, including dose reduction strategies, and minimizing risk to patient	
Milestones	**Examples**
Level 1 *Demonstrates knowledge of basic image acquisition and image processing, and recognizes common imaging artifacts and technical problems* *Applies knowledge of basic medical physics and radiobiology to abdominal imaging*	● Selects correct transducer to image the kidney; identifies aliasing artifact with Doppler imaging ● Appropriately positions image intensifier to reduce radiation and minimizes use of fluoroscopy during procedure
Level 2 *Demonstrates knowledge of instrument quality control and image reconstruction and troubleshoots for artifact reduction* *Demonstrates knowledge of more advanced medical physics and radiobiology to abdominal imaging*	● Knows strategies to reduce aliasing artifact for Doppler imaging ● Reports image quality issues when automated dose modulation produces insufficient volume CT dose index for patient size
Level 3 *Proficiently optimizes image acquisition and processing in collaboration with the technology/imaging team* *Applies physical principles to optimize dose reduction in abdominal imaging*	● Changes scale to optimize color Doppler imaging ● Uses pulse fluoroscopy to minimize radiation dose to patient ● Alters the x-ray tube voltage (kV) and milliampere-seconds (mAs) on a CT exam using iterative reconstruction to reduce dose
Level 4 *Demonstrates expertise in image acquisition and processing optimization, and provides instruction to trainees and imaging team* *Teaches principles of physics and dose optimization to learners*	● Teaches residents about alternative methods of T2 turbo speed echo (TSE) acquisition in a patient with hip arthroplasties to reduce metal susceptibility artifact ● Teaches residents techniques for appropriate use of collimation and magnification when performing fluoroscopy ● Teaches residents about using high-pitch CT techniques to reduce dose and motion artifact at the expense of lower signal to noise
Level 5 *Presents or publishes research on imaging technology*	● Presents an abstract on optimizing a prostate MRI protocol beyond the minimum Prostrate Imaging-Reporting and Data System (PI-RADS) Version 2.1 technical standards ● Publishes literature on appropriate use and limitations of compressed sensing MRI in abdominal imaging
Assessment Models or Tools	● Direct observation

	● Evaluation of fluoroscopy times ● Faculty evaluation ● Multisource feedback
Curriculum Mapping	● *This section is intentionally left blank so that programs can add information specific to their program and how they'll assess their learners.*
Notes or Resources	● ACR. Appropriateness Criteria. https://www.acr.org/Clinical-Resources/ACR-Appropriateness-Criteria. 2021. ● ACR. Manual on Contrast Media. https://www.acr.org/Clinical-Resources/Contrast-Manual. 2021. ● ACR. Radiation Safety in Adult Medical Imaging. https://www.imagewisely.org/. 2021. ● ACR. Radiology Safety. https://www.acr.org/Clinical-Resources/Radiology-Safety. 2021. ● Image Gently. Pediatric Radiology and Imaging. https://www.imagegently.org/. 2021. ● RSNA. Physics Modules. https://www.rsna.org/en/education/trainee-resources/physics-modules. 2021.

Medical Knowledge 2: Protocol Selection and Contrast Agent Selection/Dosing **Overall Intent:** To apply knowledge of protocol selection to optimize imaging	
Milestones	**Examples**
Level 1 *Discusses the protocols and contrast agent/dose for abdominal imaging*	● Is familiar with and uses department protocols for imaging
Level 2 *Selects appropriate protocols and contrast agent/dose for routine abdominal imaging*	● Evaluates patient's renal function prior to CT with contrast ● Understands that a patient with flank pain should have an unenhanced CT of the abdomen and pelvis
Level 3 *Selects appropriate protocols and contrast agent/dose for complex abdominal imaging*	● Knows the indications and specific features of a three-phase liver CT scan, including timing for characterization of a liver lesion
Level 4 *Modifies protocols and contrast agent/dose as determined by clinical circumstances*	● Adjusts imaging techniques to limit metallic or motion artifacts in CT and MR ● Modifies standard contrast dosing for reduced renal function
Level 5 *Develops and implements imaging protocols*	● Develops a protocol for contrast enhanced ultrasound characterization of a renal mass
Assessment Models or Tools	● Direct observation ● End-of-rotation evaluation ● Evaluation of fluoroscopy times ● Exam and quiz scores ● Multisource feedback ● Protocol engagement report
Curriculum Mapping	● *This section is intentionally left blank so that programs can add information specific to their program and how they'll assess their learners.*
Notes or Resources	● ACR. Appropriateness Criteria. https://www.acr.org/Clinical-Resources/ACR-Appropriateness-Criteria. 2021. ● ACR. Radiation Safety in Adult Medical Imaging. https://www.imagewisely.org/. 2021. ● ACR. Radiology Safety. https://www.acr.org/Clinical-Resources/Radiology-Safety. 2021. ● Image Gently. Pediatric Radiology and Imaging. https://www.imagegently.org/. 2021. ● RSNA. Physics Modules. https://www.rsna.org/en/education/trainee-resources/physics-modules. 2021.

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 common patient safety events* *Demonstrates knowledge of how to report patient safety events*	● Is aware extravasation of contrast is a safety event and knows where and how to report
Level 2 *Identifies system factors that lead to patient safety events* *Reports patient safety events through institutional reporting systems (simulated or actual)*	● Identifies that poor communications and poor patient hand-offs contribute to patient safety events ● Has identified and reported a patient safety issue (real or simulated), along with system factors contributing to that issue
Level 3 *Participates in analysis of patient safety events (simulated or actual)* *Participates in disclosure of patient safety events to patients and families (simulated or actual)*	● Has reviewed a patient safety event (e.g., preparing for morbidity and mortality (M and M) presentations), joining a root cause analysis group and has communicated with patients/families about such an event
Level 4 *Conducts analysis of patient safety events and offers error prevention strategies (simulated or actual)* *Discloses patient safety events to patients and families (simulated or actual)*	● Fellow presents root cause analysis at M and M conference and develops an action plan where appropriate ● Collaborates with a team to lead the analysis of a patient safety event and can competently communicate with patients/families about those events
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*	● Competently assumes a leadership role at the departmental or institutional level for patient safety, possibly even being the person to initiate action or call attention to the need for action
Assessment Models or Tools	● Direct observation ● Documentation of patient safety project processes or outcomes ● E-module multiple choice tests (e.g., Institute for Healthcare Improvement module, institutional module)

	● Medical record (chart) audit ● M and M conference ● Multisource feedback ● Reflection ● Simulation
Curriculum Mapping	● *This section is intentionally left blank so that programs can add information specific to their program and how they'll assess their learners.*
Notes or Resources	● Institute of Healthcare Improvement. http://www.ihi.org/Pages/default.aspx. 2021.

Systems-Based Practice 2: Quality Improvement (QI) **Overall Intent:** To demonstrate knowledge of core QI concepts and how they inform the modern practice of medicine, to demonstrate an ability to conduct a QI project	
Milestones	**Examples**
Level 1 *Demonstrates knowledge of basic quality improvement methodologies and metrics*	● Knows that quality improvement methodologies include root cause analysis and fishbone diagraming
Level 2 *Describes local quality improvement initiatives*	● Is aware of institutional QI initiatives including the handwashing initiative and time-outs
Level 3 *Participates in local quality improvement initiatives*	● Fellow participates in departmental or hospital QI committee ● Has participated in a QI project
Level 4 *Demonstrates the skills required to identify, develop, implement, and analyze a quality improvement project*	● Participates in the analysis of a QI project
Level 5 *Creates, implements, and assesses quality improvement initiatives at the institutional or community level*	● Competently assumes a leadership role at the departmental or institutional level for patient safety and/or QI initiatives, possibly even being the person to initiate action or call attention to the need for action ● Obtains advanced QI training (e.g., Lean Six Sigma)
Assessment Models or Tools	● Direct observation ● Documentation of QI processes or outcomes ● E-module multiple choice tests ● Learning portfolio ● Medical record (chart audit) ● Multisource feedback ● Reflection ● Simulation
Curriculum Mapping	● *This section is intentionally left blank so that programs can add information specific to their program and how they'll assess their learners.*
Notes or Resources	● Institute of Healthcare Improvement. http://www.ihi.org/Pages/default.aspx. 2021. ● Institutional resources

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 in radiology imaging/procedures* *Identifies key elements for safe and effective transitions of care and hand-offs* *Demonstrates knowledge of population and community health needs*	● Identifies the members of the interprofessional team and describes their roles ● Describes an effective sign-out to the next radiology team member ● Knows that patients without insurance are less likely to obtain follow-up imaging for incidental abdominal findings
Level 2 *Coordinates care of patients in routine radiology imaging/procedures effectively using the roles of interprofessional teams* *Performs safe and effective transitions of care/hand-offs in routine clinical situations* *Identifies specific population and community health needs for their local population*	● Works with other members of the radiology team (nurses, technologists) to coordinate patient imaging, but requires supervision to ensure all necessary imaging is performed ● Hands off a follow-up of chest x-ray after thoracentesis ● Identifies that Black and Native American patients are underserved with the current common options for colorectal cancer screening where outreach with CT colonography have been shown to increase screening adherence in these at-risk cohorts
Level 3 *Coordinates care of patients in complex radiology imaging/procedures effectively using the roles of interprofessional teams* *Performs safe and effective transitions of care/hand-offs in complex clinical situations* *Identifies local resources available to meet the needs of a patient population and community*	● Coordinates the imaging sequencing for complex patients such as multi-injured trauma patients ● Prioritizes urgent patients from the intensive care unit (ICU), trauma, and medicine for imaging/procedures and hands off the plan to the team on the next shift ● Identifies a prostate cancer outreach program in the community
Level 4 *Role models effective coordination of patient-centered care among different disciplines and specialties*	● Role models and educates students and junior team members regarding the engagement of the radiology team as needed for each patient, and ensures the necessary resources have been arranged ● Provides efficient hand-offs to ICU team at the end of a rapid response event that occurred in radiology

Role models safe and effective transitions of care/hand-offs *Participates in adapting the practice to provide for the needs of specific populations (actual or simulated)*	● Coordinates and prioritizes consultant input for a new high-risk diagnosis (such as malignancy) to ensure the patient gets appropriate follow-up ● Guides residents in an effective post-procedure hand-off to the referring service ● Participates in screening outreach programs, such as screening CT colonography programs
Level 5 *Analyzes the process of care coordination and leads in the design and implementation of improvements* *Improves quality of transitions of care to optimize patient outcomes* *Leads innovations and advocates for populations and communities with specific health care needs*	● Works with hospital or ambulatory site team members or leadership to analyze care coordination in that setting, and takes a leadership role in designing and implementing changes to improve the care coordination process ● Works with a QI mentor to identify better hand-off tools or to improve teaching sessions ● Works with local outreach programs to develop screening for pancreatic cancer
Assessment Models or Tools	● Direct observation ● Learning portfolio ● Medical record (chart) audit ● Multisource feedback ● Objective structured clinical examination ● Review of sign-out tools ● Use/Completion of checklists
Curriculum Mapping	● *This section is intentionally left blank so that programs can add information specific to their program and how they'll assess their learners.*
Notes or Resources	● Institutional hand-off guidelines ● Joint Commission Center for Transforming Healthcare. Hand-off Communications Targeted Solutions Tool. https://www.centerfortransforminghealthcare.org/tsthoc.aspx. 2021. ● Working with the local population the fellow can participate in areas within or outside of radiology (e.g., open door clinics, diabetes screening)

Systems-Based Practice 4: Physician Role in Health Care Systems **Overall Intent:** To understand the physician's role in the complex health care system and how to optimize the system to improve patient care and the health system's performance	
Milestones	**Examples**
Level 1 *Identifies key components of the complex healthcare system (e.g., hospital, finance, personnel, technology)*	● Recognizes that multiple components exist in a health care system, including various practice settings, reimbursement models, and types of insurance
Describes the mechanisms for reimbursement, including types of payors	● Describes various payment systems, such as Medicare, Medicaid, the US Department of Veterans Affairs (VA), and commercial third-party payors ● Describes various practice models
Level 2 *Describes how components of a complex health care system are interrelated, and how this impacts patient care*	● Understands that pre-authorization may impact patient care and remuneration to the health system
States relative cost of common abdominal radiology procedures	● States relative costs of abdominal x-ray versus abdominal CT
Level 3 *Discusses how individual practice affects the broader system (e.g., length of stay, readmission rates, clinical efficiency)*	● Understands that turnaround times and dictation errors may affect patient care, e.g., length of stay, which impacts the broader system
Describes the technical and professional components of imaging costs	● Differentiates between the technical and professional costs of an abdominal CT
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 pertinent stakeholders to improve procedural start times ● Works collaboratively to improve informed consent for non-English-speaking patients requiring interpreter services
Describes the radiology revenue cycle and measurements of productivity (e.g., relative value units)	● Understands the multiple components of the revenue cycle applied to an MRI exam ● Understands how relative value units differ between imaging exams and how they are calculated
Level 5 *Advocates for or leads systems change that enhances high-value, efficient, and effective patient care and transition of care*	● Publishes original research on high-value patient care in peer-reviewed journal
Participates in health policy advocacy activities	● Works with community or professional organizations to advocate for enrollment in colon cancer screening program
Assessment Models or Tools	● Direct observation

	● Medical record (chart) audit ● Multiple choice test ● Objective structured clinical examination ● QI project
Curriculum Mapping	● *This section is intentionally left blank so that programs can add information specific to their program and how they'll assess their learners.*
Notes or Resources	● Agency for Healthcare Research and Quality. Major Physician Performance Sets. https://www.ahrq.gov/talkingquality/measures/setting/physician/measurement-sets.html. 2021. ● The Commonwealth Fund. Health System Data Center. http://datacenter.commonwealthfund.org/?_ga=2.110888517.1505146611.1495417431-1811932185.1495417431#ind=1/sc=1. 2021. ● Dzau VJ, McClellan M, Burke S, et al. Vital directions for health and health care: priorities from a National Academy of Medicine Initiative. *NAM Perspectives*. Discussion Paper, National Academy of Medicine, Washington, DC. https://nam.edu/vital-directions-for-health-health-care-priorities-from-a-national-academy-of-medicine-initiative/. 2021. ● Henry J Kaiser Family Foundation. https://www.kff.org/. 2021. ● Henry J Kaiser Family Foundation. Health Reform. https://www.kff.org/health-reform/. 2021. ● Lam DL, Medverd JR. How radiologists get paid: resource-based relative value scale and the revenue cycle. *AJR*. 2013;201:947-958. https://www.ajronline.org/doi/full/10.2214/AJR.12.9715. 2021. ● Oklahoma State University Medical Center Diagnostic Radiology Residency. Business of Radiology. http://www.osumcradiology.org/educationalschedule/lecutres/BusinessofRadiology/#0. 2021. ● RSNA Online Learning Center. Level 2: Service Valuation and Costs. http://education.rsna.org/diweb/catalog/item?id=2223133. 2021. ● RSNA Online Learning Center. Level 1: Reimbursement Basic. http://education.rsna.org/diweb/catalog/item?id=2210377. 2021.

Systems-Based Practice 5: Contrast Agent Safety **Overall Intent:** Demonstrates competence in recognizing and managing contrast (iodinated and gadolinium) reactions	
Milestones	**Examples**
Level 1 *Demonstrates knowledge of contrast reactions, and efficiently accesses critical resources for management*	● Has basic knowledge and awareness of contrast reactions, including their recognition and management ● Describes the management of: ○ Bronchospasm ○ Contrast extravasation ○ Hives ○ Hypotension with bradycardia ○ Hypotension with tachycardia ○ Laryngeal edema ○ Premedication regimens
Level 2 *Recognizes contrast reactions (simulated or actual), and identifies specific patient-based management issues*	● Consistently and reliably recognizes different signs of a patient's contrast reaction in simulation or actual in the CT or MRI department ● Recognizes the following: ○ Bronchospasm ○ Hives ○ Hypotension with bradycardia ○ Hypotension with tachycardia ○ Laryngeal edema
Level 3 *Manages contrast reactions, with supervision (simulated or actual)*	● Consistently and reliably manages (with supervision) contrast reactions in simulation or actual in the CT or MRI department ● Chooses among premedication regimens to suit the clinical situation ● Manages the following: ○ Bronchospasm ○ Hives ○ Hypotension with bradycardia ○ Hypotension with tachycardia ○ Laryngeal edema
Level 4 *Independently manages contrast reactions (simulated or actual)*	● Consistently and reliably recognizes and manages contrast reactions independently in simulation or actual in the CT or MRI department
Level 5 *Leads educational experience in simulation laboratory for contrast reaction*	● Assumes a leadership role in the department or institution to conduct a seminar or experience for a variety of contrast reaction(s)
Assessment Models or Tools	● Direct observation ● Medical record (chart) audit

	● Multiple choice test ● Objective structured clinical examination ● Reflection ● Simulation
Curriculum Mapping	● *This section is intentionally left blank so that programs can add information specific to their program and how they'll assess their learners.*
Notes or Resources	● ACR. Contrast Card. https://www.acr.org/-/media/ACR/Files/Clinical-Resources/Contrast-Reaction-Card.pdf. 2021. ● ACR. Manual on Contrast Media. https://www.acr.org/Clinical-Resources/Contrast-Manual. 2021. ● BLS and ACLS certification courses

Systems-Based Practice 6: Radiation Safety **Overall Intent:** To demonstrate competence in and to be an advocate for radiation safety awareness	
Milestones	**Examples**
Level 1 *Demonstrates knowledge of the mechanisms of radiation injury and the ALARA ("as low as reasonably achievable") concept*	● Describes fundamental concepts in radiation biology addressing the mechanism of injury at different radiation exposures
Level 2 *Accesses resources to determine exam-specific average radiation dose information*	● Readily accesses online resources to determine a CT of the abdomen and pelvis average dose information
Level 3 *Communicates the relative risk of exam-specific radiation exposure to patients and practitioners*	● Effectively communicates relative risks of the radiation exposure during a CT of the abdomen and pelvis to the patient, patient's family, or referring provider
Level 4 *Applies principles of ALARA in daily practice, including methods of dose reduction and image optimization in fluoroscopy and computerized tomography (CT)*	● Modifies CT parameters for an abdominal CT in keeping with the ALARA (as low as reasonably allowed) principles routinely in daily practice ● Modifies acquisition of fluoroscopic images to optimize information and limiting radiation exposure ● Analyzes the risk-benefit ratio when considering increasing dose to obtain valuable information
Level 5 *Creates, implements, and assesses radiation safety initiatives at the institutional level*	● Begins a radiation safety initiative with the radiation safety officer addressing CT use for appendicitis in pregnant women
Assessment Models or Tools	● Chart, protocoling or other system documentation by fellow ● Direct observation ● Documentation of QI or radiation safety project processes or outcome ● Multiple choice test ● Objective structured clinical examination
Curriculum Mapping	● *This section is intentionally left blank so that programs can add information specific to their program and how they'll assess their learners.*
Notes or Resources	● ACR. ACR Appropriateness Criteria. https://www.acr.org/Clinical-Resources/ACR-Appropriateness-Criteria. 2021. ● ACR. Radiation Safety. https://www.acr.org/Clinical-Resources/Radiology-Safety/Radiation-Safety. 2021. ● ACR. Radiology Safety. https://www.acr.org/Clinical-Resources/Radiology-Safety. 2021. ● Image Gently. Pediatric Radiology and Imaging. https://www.imagegently.org/. 2021. ● Image Wisely. https://www.imagewisely.org/. 2021. ● RSNA. Physics Modules. https://www.rsna.org/en/education/trainee-resources/physics-modules. 2021.

Systems-Based Practice 7: Magnetic Resonance (MR) Safety **Overall Intent:** To understand the practical aspects of MR safety	
Milestones	**Examples**
Level 1 *Demonstrates knowledge of the risks of magnetic resonance imaging (MRI), including safety zones and pre-MR screening*	● Describes safety zones Level 1 through IV ● Lists key components of MRI screening process
Level 2 *Accesses resources to determine the safety of implanted devices and retained foreign bodies*	● Knows how to find out if it's safe to perform an MRI on a patient with a cochlear implant
Level 3 *Communicates MR safety, including implants and retained foreign bodies, to patients and practitioners*	● Communicates any risks of performing an MRI with shrapnel to a patient
Level 4 *Applies principles of MR safety to daily practice*	● Explains the principles of MR safety; handles a patient with a pacemaker, and can gets them through the scan (complex case), programmable shunt (complex case)
Level 5 *Creates, implements, and assesses MR safety initiatives at the institutional level*	● Is a member of the Hospital wide Safety Committee and is considered the definitive resource for MR safety
Assessment Models or Tools	● Multisource feedback, including MRI Technologist ● Safe MR Practices: Self-Assessment Module *AJR* 2007;188:S50–S54 0361-803X/07/1886–S50 ©American Roentgen Ray Society
Curriculum Mapping	● *This section is intentionally left blank so that programs can add information specific to their program and how they'll assess their learners.*
Notes or Resources	● ACR. MR Safety. https://www.acr.org/Clinical-Resources/Radiology-Safety/MR-Safety. 2021. ● Complete AAPM/RSNA Web Module: MRI Course#9 Quality/ Bioeffects/Safety ● Expert Panel on MR Safety, Kanal E, Barkovich AJ, et al. ACR guidance document on MR safe practices: 2013. *J Magn Reson Imaging*. 2013;37(3):501-530. https://onlinelibrary.wiley.com/doi/pdf/10.1002/jmri.24011. 2021. ● MRI Questions. MRI Suite: Safety Zones. http://mriquestions.com/acr-safety-zones.html. 2021. ● MRI Safety. http://mrisafety.com/. 2021. ● RSNA. Physics Modules. https://www.rsna.org/education/trainee-resources/physics-modules. 2021.

Practice-Based Learning and Improvement 1: Evidence-Based and Informed Practice **Overall Intent:** To incorporate evidence and patient values into clinical practice	
Milestones	**Examples**
Level 1 *Demonstrates how to access and use available evidence to determine the best imaging examination for a routine patient/diagnosis*	● Understands the importance of imaging safety literature and websites
Level 2 *Articulates clinical questions and elicits patient preferences and values in order to guide evidence-based imaging*	● Identifies patients with conditional risks for MRI safety, radiation safety, or contrast use
Level 3 *Locates and applies the best available evidence, integrated with patient preferences and values, to the care of complex patients*	● Uses radiology literature to determine patient MRI safety, radiation safety, or contrast use
Level 4 *Critically appraises conflicting evidence to guide care, tailored to the individual patient*	● Knows how to direct the clinical team for atypical situations in imaging (e.g., CT or MRI in pregnant patients, contrast use in chronic kidney disease, or pediatric patient imaging)
Level 5 *Coaches others to critically appraise and apply evidence for complex patients; and/or participates in the development of guidelines*	● Writes or revises department policy on MRI safety, radiation safety, or contrast use according to best practices
Assessment Models or Tools	● Direct observation ● Learning portfolio ● Oral or written examination ● Simulation (objective structured clinical examination)
Curriculum Mapping	● *This section is intentionally left blank so that programs can add information specific to their program and how they'll assess their learners.*
Notes or Resources	● ABR 2019 Noninterpretive Skills Study Guide. https://www.theabr.org/wp-content/uploads/2018/11/NIS-Study-Guide-2019.pdf. 2021. ● Expert Panel on MR Safety, Kanal E, Barkovich AJ, et al. ACR guidance document on MR safe practices: 2013. *J Magn Reson Imaging*. 2013;37(3):501-530. https://onlinelibrary.wiley.com/doi/pdf/10.1002/jmri.24011. 2021. ● Harvey L. Neiman Health Policy Institute. http://www.neimanhpi.org/. 2021. ● Image Gently. Pediatric Radiology and Imaging. www.imagegently.org. 2021. ● Image Wisely. www.imagewisely.org. 2021. ● Institutional Review Board (IRB) guidelines ● MRI Safety. http://mrisafety.com. 2021. ● Moriates C, Arora V, Shah N. *Understanding Value Based Healthcare*. 1st ed. New York, NY: McGraw Hill Education; 2015.

	● National Institutes of Health. Write Your Application. https://grants.nih.gov/grants/how-to-apply-application-guide/format-and-write/write-your-application.htm. 2021. ● NIH U.S. National Library of Medicine. PubMed Tutorial. https://www.nlm.nih.gov/bsd/disted/pubmedtutorial/cover.html. 2021. ● The University of Texas at Austin Dell Medical School. Discovering Value-Based Health Care. https://vbhc.dellmed.utexas.edu/. 2021. ● Various journal submission guidelines

Practice-Based Learning and Improvement 2: Reflective Practice and Commitment to Professional Growth **Overall Intent:** To seek clinical performance information with the intent to improve care; reflect on all domains of practice, personal interactions, and behaviors, and their impact on patients and colleagues (reflective mindfulness); develop clear objectives and goals for improvement in some form of a learning plan	
Milestones	**Examples**
Level 1 *Accepts responsibility for professional development by establishing goals* *Identifies factors which contribute to gap(s) between expectations and actual performance* *Actively seeks opportunities to improve performance*	● Is aware of need to improve ● Understands the importance of continued self-improvement ● Identifies that lack of sleep, incomplete preparation, and other social factors can lead to performance gaps ● Seeks additional material to review to prepare for call
Level 2 *Receptive to performance data and feedback in order to adjust goals* *Analyzes and reflects on factors which contribute to gap(s) between expectations and actual performance* *Designs and implements a learning plan, with prompting*	● Uses feedback to set goals to read more studies each day ● Reflects on factors contributing to lack of efficiency ● With prompting, develops a learning plan to improve efficiency
Level 3 *Episodically seeks performance data and feedback, with humility and adaptability* *Analyzes, reflects on, and institutes behavioral change(s) to narrow the gap(s) between expectations and actual performance* *Designs and implements a learning plan independently*	● Takes input from technologists, peers, and supervisors to gain insight into personal strengths and areas to improve ● Follows up on the outcomes of patient for which they have dictated reports, with prompting ● Changes daily practice habits to increase efficiency ● Documents goals in a more specific and achievable manner, such that attaining them is measurable
Level 4 *Consistently seeks performance data and feedback with humility and adaptability*	● Independently follows up on the outcomes of patients for whom they have dictated reports

Analyzes effectiveness of behavioral changes where appropriate and considers alternatives in narrowing the gap(s) between expectations and actual performance	● Consistently identifies learning gaps and addresses areas to work on
Uses performance data to measure the effectiveness of the learning plan and when necessary, improves it	● Uses data regarding complications from prior procedures to reflect on how better to approach various biopsies
Level 5 *Coaches other learners to consistently seek performance data and feedback*	● Actively discusses learning goals with supervisors and colleagues; may encourage other learners on the team to consider how their behavior affects the rest of the team
Coaches others on reflective practice	● Provides constructive feedback to peers for improvement
Facilitates the design and implements learning plans for others	● Provides relevant learning plans for peers to address gaps
Assessment Models or Tools	● Direct observation ● Review of learning plan ● Standardized assessments
Curriculum Mapping	● *This section is intentionally left blank so that programs can add information specific to their program and how they'll assess their learners.*
Notes or Resources	● 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. ● Collins J. Lifelong learning in the 21st century and beyond. *Radiographics.* 2009;29(2):613-622. https://pubs.rsna.org/doi/pdf/10.1148/rg.292085179. 2021. ● Hojat M, Veloski JJ, Gonnella JS. Measurement and correlates of physicians' lifelong learning. *Academic Medicine*. 2009;84(8):1066-1074. https://journals.lww.com/academicmedicine/fulltext/2009/08000/Measurement_and_Correlates_of_Physicians__Lifelong.21.aspx. 2021. ● Lockspeiser TM, Schmitter PA, Lane JL, Hanson JL, Rosenberg AA, Park YS. Assessing residents' written learning goals and goal writing skill: validity evidence for the learning goal scoring rubric. *Academic Medicine*. 2013;88(10):1558-1563. https://journals.lww.com/academicmedicine/fulltext/2013/10000/Assessing_Residents__Written_Learning_Goals_and.39.aspx. 2021.

Professionalism 1: Professional Behavior and Ethical Principles **Overall Intent:** To recognize and address lapses in ethical and professional behavior, demonstrate ethical and professional behaviors, and use appropriate resources for managing ethical and professional dilemmas	
Milestones	**Examples**
Level 1 *Demonstrates knowledge of expectations for professional behavior and describes how to appropriately report professional lapses* *Demonstrates knowledge of the ethical principles underlying informed consent, surrogate decision making, advance directives, confidentiality, error disclosure, and stewardship of limited resources*	● Identifies and describes potential triggers for professionalism lapses, describes when and how to appropriately report professionalism lapses, and outlines strategies for addressing common barriers to reporting ● Discusses the basic ethical principles (beneficence, nonmaleficence, justice, autonomy) and professionalism (professional values and commitments), and how they apply in various situations (e.g., informed consent process) ● Obtains informed consent for procedures
Level 2 *Demonstrates insight into professional behavior in routine situations and takes responsibility for own professionalism lapses* *Analyzes straightforward situations using ethical principles*	● Demonstrates professional behavior in routine situations and uses ethical principles to analyze straightforward situations, such as those where: ○ there are no or few conflicts (between values or patients) ○ the fellow may be tired or hungry, but is not excessively fatigued, overwhelmed, or otherwise distressed ○ workload is not unusually high, and there is no significant time pressure to make decisions ● Acknowledges and takes responsibility for lapse ● Apologizes and takes corrective action for the lapse(s) if necessary ● Articulates strategies for preventing similar lapses in the future
Level 3 *Demonstrates professional behavior in complex or stressful situations* *Recognizes need to seek help in managing and resolving complex ethical situations*	● Analyzes complex situations, such as how the clinical situation evokes strong emotions, conflicts (or perceived conflicts) between patients or between professional values; the fellow navigates a situation while not at personal best (due to fatigue, hunger, stress, etc.), or the system poses barriers to professional behavior (e.g., inefficient workflow, inadequate staffing, conflicting policies) ● Recognizes own limitations, and consistently demonstrates professional behavior ● Recognizes own limitations and seeks resources to help manage and resolve complex ethical situations ● Analyzes difficult (real or hypothetical) ethical dilemmas and situations, or professional case scenarios

Level 4 *Recognizes situations that may trigger professionalism lapses and intervenes to prevent lapses in self and others*	● Monitors and responds to fatigue, hunger, stress, etc. in self and team members ● Recognizes and responds effectively to the emotions of others ● Actively seeks to consider the perspectives of others ● Models respect for patients and expects the same from others
Recognizes and uses appropriate resources for managing and resolving ethical dilemmas as needed (e.g., ethics consultations, literature review, risk management/legal consultation)	● Recognizes and uses appropriate resources for managing and resolving ethical dilemmas (e.g., ethics consultations, literature review, risk management/legal consultation)
Level 5 *Coaches others when their behavior fails to meet professional expectations*	● Coaches others when behavior fails to meet professional expectations, either in the moment (for minor or moderate single episodes of unprofessional behavior) or after the moment (for major single episodes or repeated minor to moderate episodes of unprofessional behavior)
Identifies and seeks to address system-level factors that induce or exacerbate ethical problems or impede their resolution	● Identifies and seeks to address system-wide factors or barriers to promoting a culture of ethical and professional behavior through participation in a work group, committee, or taskforce (e.g., ethics committee or subcommittee, risk management committee, root cause analysis review, patient safety or satisfaction committee, professionalism work group, Institutional Review Board (IRB), fellow grievance committee)
Assessment Models or Tools	● Direct observation ● End-of-rotation evaluation ● Multisource feedback ● Objective structured clinical examination ● Oral or written self-reflection ● RSNA professionalism modules ● Simulation
Curriculum Mapping	●
Notes or Resources	● American Association of Physicists in Medicine. ABR/ACR/RSNA/AAPM/ASTRO/ARR/ARS Online Modules on Ethics and Professionalism. https://www.aapm.org/education/onlinemodules.asp. 2021. ● ACR. Code of Ethics. https://www.acr.org/-/media/ACR/Files/Governance/Code-of-Ethics.pdf. 2021. ● AMA. Ethics. https://www.ama-assn.org/delivering-care/ethics. 2021. ● Association of University Radiologists. Professionalism Curriculum Resources. http://www.aur.org/ProfessionalCurriculum/. 2021. ● Association of University Radiologists. Professionalism and Ethics Competencies for Radiology Residents. http://www.aur.org/Secondary.aspx?id=10263. 2021.

	● Byyny RL, Papadakis MA, Paauw DS, Pfiel S, Alpha Omega Alpha. *Medical Professionalism Best Practices*. Menlo Park, CA: Alpha Omega Alpha Honor Medical Society; 2015. https://alphaomegaalpha.org/pdfs/2015MedicalProfessionalism.pdf. 2021. ● Levinson W, Ginsburg S, Hafferty FW, Lucey CR. *Understanding Medical Professionalism*. 1st ed. New York, NY: McGraw-Hill Education; 2014. https://accessmedicine.mhmedical.com/book.aspx?bookID=1058. 2021. ● Radiological Society of North America. Professionalism for Residents. https://www.rsna.org/education/professionalism-and-quality-care/professionalism-self-assessments/professionalism-for-residents. 2021.

Professionalism 2: Accountability/Conscientiousness **Overall Intent:** To take responsibility for own actions and the impact on patients and other members of the health care team	
Milestones	**Examples**
Level 1 *Responds promptly to requests or reminders to complete tasks and responsibilities*	● Takes responsibility for getting informed consent for a procedure
Level 2 *Performs tasks and responsibilities in a timely manner to ensure that the needs of patients, teams, and systems are met in routine situations*	● Dictates reports for routine cases in a timely fashion
Level 3 *Performs tasks and responsibilities in a timely manner to ensure that the needs of patients, teams, and systems are met in complex or stressful situations*	● Efficiently dictates reports and communicates results for emergent cases in a timely fashion
Level 4 *Recognizes and raises awareness of situations that may impact others' ability to complete tasks and responsibilities in a timely manner*	● Identifies issues that could impede others from completing tasks and provides leadership to address those issues ● Fellows advise residents on how to manage their time, communicate effectively, and guide ordering providers and other members of the team including technologists on call
Level 5 *Takes ownership of system outcomes*	● Sets up a meeting with the emergency medicine department to streamline patient flow
Assessment Models or Tools	● Compliance with deadlines and timelines ● Direct observation ● Multisource feedback ● OSCE ● Self-evaluations ● Simulation
Curriculum Mapping	●
Notes or Resources	● Code of conduct from institutional manual ● Radiological Society of North America. Professionalism for Residents. https://www.rsna.org/education/professionalism-and-quality-care/professionalism-self-assessments/professionalism-for-residents. 2021.

Professionalism 3: Self-Awareness and Help-Seeking **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, and is aware of available resources* *Recognizes limits in the knowledge/skills of self or team, with assistance*	● Requests and/or accepts feedback and exhibits positive responses to corrective feedback ● Is aware of/can identify potential stressors specific to the learner in the educational program, or in this specialty
Level 2 *Independently recognizes status of personal and professional well-being using available resources when appropriate* *Independently recognizes limits in the knowledge/skills of self or team and demonstrates appropriate help-seeking behaviors*	● Identifies possible sources of personal stress or lack of clinical knowledge and independently seeks help
Level 3 *With assistance, proposes a plan to optimize personal and professional well-being* *With assistance, proposes a plan to remediate or improve limits in the knowledge/skills of self or team*	● With supervision, develops a personal learning or action plan to address stress and/or burnout for self or team and gaps in personal clinical knowledge
Level 4 *Independently develops a plan to optimize personal and professional well-being* *Independently develops a plan to remediate or improve limits in the knowledge/skills of self or team*	● Independently develops a personal learning or action plan to address stress and/or burnout for self or team and gaps in personal clinical knowledge
Level 5 *Coaches others when emotional responses or limitations in knowledge/skills do not meet professional expectations*	● Mentors colleagues in self-awareness ● Establishes health management plans to limit stress and burnout
Assessment Models or Tools	● Direct observation ● Group interview or discussions for team activities ● Institutional online training modules ● Participation in institutional well-being programs

	● Personal learning plan ● Self-assessment ● Semi-annual review
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. ● ACGME. "Well-Being Tools and Resources." https://dl.acgme.org/pages/well-being-toolsresources. Accessed 2022. ● American Academy of Pediatrics. Resilience Curriculum: Resilience in the Face of Grief and Loss. https://www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/hospice-palliative-care/Pages/Resilience-Curriculum.aspx. 2021. ● Local resources, including Employee Assistance Program. ● Stanford Medicine. WellMD. https://wellmd.stanford.edu/. 2021.

Interpersonal and Communication Skills 1: Patient- and Family-Centered Communication **Overall Intent:** To deliberately use language and behaviors to form a therapeutic relationship with a patient and family members; to identify communication barriers, including self-reflection on biases, and minimize them in the doctor-patient relationship; to organize and lead communication around shared decision making	
Milestones	**Examples**
Level 1 *Accurately communicates own role within the health care system* *Identifies the need to adjust communication strategies based on assessment of patient/family expectations and understanding of their health status and treatment options*	● Identifies self as a fellow during patient interactions ● Understands that communication may need to be adjusted for a patient unaware of fetal demise while undergoing an ultrasound
Level 2 *Identifies barriers to effective communication (e.g., language, health literacy)* *Organizes and initiates communication with patient/family by clarifying expectations and verifying understanding of the clinical situation*	● Identifies need for an interpreter; knows to speak in a manner at a level of understanding commensurate with education level of patient; realizes when the presence of a caregiver will be needed to aid in management decision making ● Before and/or after communication with patient/family closes the loop and asks if the patient/family is clear about expectations and have knowledge of the clinical situation
Level 3 *Identifies biases that hinder effective communication* *With guidance, sensitively and compassionately delivers medical information, elicits patient goals and preferences, and acknowledges uncertainty and conflict*	● Recognizes own bias about sexuality ● With guidance, communicates with a patient the presence of an indeterminate liver mass, makes the decision to obtain additional imaging of the mass or if patient wishes biopsy the mass after involving the patient in discussion, thereby aligning with patient goals ● With guidance, communicates with an elderly, chronically ill patient the presence of an indeterminate cystic renal lesion on ultrasound, acknowledges that even with further imaging, the nature of this lesion may remain unclear, learns from the patient that they would not be interested in undergoing further imaging/tissue sampling for characterization or possible surgical resection, and communicates the patient's wishes to the referring provider ● With guidance, communicates to a patient after a CT-guided biopsy that due to the challenging location of the target, there is a reasonable likelihood that biopsy samples taken may be inconclusive. Acknowledges the patient's frustration with this news, and counsels the patient that options for further evaluation may include sampling another less suspicious but more accessible site versus follow-up imaging to determine if the target lesion has grown to a size that would increase the likelihood of successful sampling.

Level 4 *Actively minimizes communication barriers*	● Takes responsibility and apologizes after using medical jargon
Independently, uses shared decision making to align patient goals, and preferences with treatment options to make a personalized care plan	● Independently communicates with a patient the presence of an indeterminate liver mass, makes the decision to obtain additional imaging of the mass or if patient wishes biopsy the mass after involving the patient in discussion, thereby aligning with patient goals ● Independently communicates with an elderly, chronically ill patient the presence of an indeterminate cystic renal lesion on ultrasound, acknowledges that even with further imaging, the nature of this lesion may remain unclear, learns from the patient that they would not be interested in undergoing further imaging/tissue sampling for characterization or possible surgical resection, and communicates the patient's wishes to the referring provider ● Independently discusses with a patient after a potentially unsuccessful CT-guided biopsy that due the challenging location of the target, the biopsy sample may be inconclusive. Discusses options for further evaluation that would include sampling another site versus short-term follow-up imaging to determine if the target lesion is growing. Ascertains from the patient that they are more concerned with being able to enjoy an upcoming vacation than obtaining a definitive diagnosis at this time, and reaches a plan to communicate with the referrer the options for further evaluation that align with the patient's goals.
Level 5 *Coaches other learners to minimize communication barriers*	● Role models and supports colleagues in self-awareness and reflection to improve therapeutic relationships with patients, and demonstrates intuitive understanding of a patient's perspective; uses a contextualized approach to minimize barriers for patients and colleagues ● Role models proactive self-awareness and reflection with a context-specific approach to mitigating communication barriers
Coaches other learners in shared decision making	● Leads shared decision making with clear recommendations to patients and families even in more complex clinical situations
Assessment Models or Tools	● Direct observation ● Kalamazoo Essential Elements Communication Checklist (Adapted) ● Mini-clinical evaluation exercise (CEX) ● Multisource feedback ● Objective structured clinical examination ● Self-assessment including self-reflection exercises ● Simulation ● Skills needed to Set the state, Elicit information, Give information, Understand the patient, and End the encounter (SEGUE)

	● Standardized patients or structured case discussions
Curriculum Mapping	●
Notes or Resources	● American Academy of Hospice and Palliative Medicine. Hospice and Palliative Medicine Competencies Project. http://aahpm.org/fellowships/competencies#competencies-toolkit. 2021. ● 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. ● Makoul G. Essential elements of communication in medical encounters: the Kalamazoo consensus statement. *Acad Med*. 2001;76(4):390-393. https://insights.ovid.com/crossref?an=00001888-200104000-00021. 2021. ● Makoul G. The SEGUE Framework for teaching and assessing communication skills. *Patient Educ Couns*. 2001;45(1):23-34. https://www.sciencedirect.com/science/article/abs/pii/S0738399101001367?via%3Dihub. 2021. ● O'Sullivan P, Chao S, Russell M, Levine S, Fabiny A. Development and implementation of an objective structured clinical examination to provide formative feedback on communication and interpersonal skills in geriatric training. *J Am Geriatr Soc*. 2008;56(9):1730-1735. https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.1532-5415.2008.01860.x. 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: Interprofessional and Team Communication **Overall Intent:** To effectively communicate with the health care team, including with consultants, in both straightforward and complex situations	
Milestones	**Examples**
Level 1 *Clearly and concisely responds to a consultation request* *Communicates emergent findings according to institutional or national guidelines*	● Offers consulting service guidance on the necessity of the procedure and when it can be reasonably be performed after discussion with the attending ● Communicates and documents communication of emergent findings
Level 2 *Checks understanding of recommendations when providing consultation* *Communicates non-emergent findings where failure to act may adversely affect patient outcome*	● Communicates postprocedural monitoring recommendations after renal biopsy ● Communicates finding a segment of thickened colon and suggests age-appropriate colon screening
Level 3 *Coordinates recommendations from different members of the health care team to optimize patient care* *Communicates findings and management options (as appropriate) which are tailored to the referring provider*	● After discussion with the infectious diseases doctor and oncologist who have been consulted on the case, decides to send a sample for infection analysis in addition to surgical pathology after being presented an immunocompromised patient for biopsy of a mass-like lesion in the liver by the primary care physician ● Communicates to a hospitalist that a pancreatic mass in CT is suspicious for locally invasive pancreatic adenocarcinoma, but communicates to the surgeon the affected vessels and extent of disease
Level 4 *Role models flexible communication strategies that value input from all health care team members, resolving conflict when needed*	● Role models the resolution of conflict between transplant surgery and the emergency department for MRI scan prioritization
Level 5 *Coaches other learners in tailored communications to referring providers*	● Coaches residents in subspecialty level communications
Assessment Models or Tools	● Direct observation ● End-of-rotation evaluation ● Multisource feedback ● OSCE ● Simulation
Curriculum Mapping	●
Notes or Resources	● American College of Radiology. Communication Curriculum for Radiology Residents. https://www.acr.org/Member-Resources/rfs/learning/Communication-for-Radiology-Residents. 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. ● François J. Tool to assess the quality of consultation and referral request letters in family medicine. Can Fam Physician. 2011;57(5):574–575. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3093595/. 2021.

Interpersonal and Communication Skills 3: Communication within Health Care Systems **Overall Intent:** To effectively communicate using a variety of methods	
Milestones	**Examples**
Level 1 *Demonstrates knowledge of institutional communications policies and systems*	● Describes the appropriate and inappropriate use of cell phone, email, and social media ● Uses secured email for communication of patient information
Level 2 *Communicates systems concerns in a respectful manner*	● Communicates with the appropriate radiology department supervisor or hospital reporting system about systems concerns in an objective respectful manner
Level 3 *Communicates clear and constructive suggestions to improve systems*	● Communicates that efficiency in the trauma reader could be significantly improved if phone calls were diverted to a radiology aide or to a central call center in the department
Level 4 *Facilitates dialogue regarding systems issues among larger community stakeholders (institution, health care system, field)*	● Through participation on the MRI safety committee, helps facilitates improvement in the throughput of inpatients with cardiac implanted electronic devices by identifying common challenges and methods to address them at the time the study is ordered, aiding in efficient scanning of these patients
Level 5 *Teaches and/or conducts research related to system and process improvement*	● Presents an abstract on process improvement methods to reduce errors in study protocolling through the electronic health record/health information system at a national meeting
Assessment Models or Tools	● Assessment of QI projects ● Audit of hospital notification system submissions ● Direct observation ● Medical record (chart) audit ● Multisource feedback ● Simulation
Curriculum Mapping	●
Notes or Resources	● American College of Radiology. Communication Curriculum for Radiology Residents. https://www.acr.org/Member-Resources/rfs/learning/Communication-for-Radiology-Residents. 2021. ● HIPAA training ● Hryhorczuk AL, Hanneman K, Eisenberg RL, Meyer EC, Brown SD. Radiologic professionalism in modern health care. *Radiographics*. 2015;35(6):1779-1788. https://pubs.rsna.org/doi/pdf/10.1148/rg.2015150041. 2021. ● Institutional communication policies ● Kelly AM, Mullan PB. Designing a curriculum for professionalism and ethics within radiology: identifying challenges and expectations. *Acad Radiol*. 2018;25(5):610-618. https://www.academicradiology.org/article/S1076-6332(18)30091-6/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: Consultant	PC1: Consultant
PC2: Competence in Procedures	PC2: Competence in Procedures
PC3: Patient Safety	SBP1: Patient Safety SBP5: Contrast Safety Agent SBP6: Radiation Safety SBP7: Magnetic Resonance (MR) Safety
MK1: Protocol Selection and Optimization of Imaging	MK1: Imaging Technology and Physics MK2: Protocol Selection and Contrast Agent Selection/Dosing
MK2: Interpretation	PC3: Image Interpretation
SBP1: Quality Improvement	SBP2: Quality Improvement
SBP2: Health Care Economics	SBP4: Physician Role in Health Care Systems
	SBP3: System Navigation for Patient-Centered Care
PBLI1: Self Directed Learning	PBLI2: Reflective Practice and Commitment to Personal Growth
PBLI2: Scholarly Activity	
	PBLI1: Evidence-Based and Informed Practice
PROF1: Individual	PROF1: Professional Behavior and Ethical Principles PROF3: Self-Awareness and Help-Seeking
PROF2: Systems	PROF2: Accountability/ Conscientiousness
ICS1: Effective Communication with Patients, Families, and Caregivers	ICS1: Patient- and Family-Centered Communication
ICS2: Effective communication with members of the health care team	ICS2: Interprofessional and Team Communication ICS3: 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/