Supplemental Guide: Pediatric Radiology

ACGME

July 2021

TABLE OF CONTENTS

INTRODUCTION **3**

PATIENT CARE **4**

Consultant 4
Competence in Procedures 6

MEDICAL KNOWLEDGE **8**

Protocol Selection and Optimization of Images 8
Interpretation 10
Knowledge of Basic and Clinical Science 12

SYSTEMS-BASED PRACTICE **14**

Patient Safety 14
Quality Improvement 16
System Navigation for Patient-Centered Care 17
Physician Role in Health Care Systems 20
Contrast Agent Safety 22
Radiation Safety 24
Magnetic Resonance Safety 25

PRACTICE-BASED LEARNING AND IMPROVEMENT **26**

Evidence-Based and Informed Practice 26
Reflective Practice and Commitment to Professional Growth 28

PROFESSIONALISM **30**

Professional Behavior and Ethical Principles 30
Accountability/Conscientiousness 33
Self-Awareness and Help-Seeking 34

INTERPERSONAL AND COMMUNICATION SKILLS **36**

Patient- and Family-Centered Communication 36
Interprofessional and Team Communication 39
Communication within Health Care Systems 41

MAPPING OF 1.0 TO 2.0 ..... **42**

RESOURCES **43**

Milestones Supplemental Guide

This document provides additional guidance and examples for the Pediatric 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 *Uses electronic health records (EHRs) to obtain relevant clinical information; contacts referring physician when reason for exam is unclear*	● Reviews relevant history and laboratory results for a patient being assessed for abdominal pain ● Notes patient's glomerular filtration rate prior to protocolling a study with intravenous contrast
Level 2 *With assistance, delineates the clinical question, obtains appropriate clinical information, uses evidence-based imaging guidelines, and recommends next steps for emergent and routine consultations*	● Determines that patient has right lower quadrant pain, refers to American College of Radiology (ACR) Appropriateness Criteria and suggests appropriate imaging exam ● Determines that an 8-year-old boy has right lower quadrant pain, refers to ACR Appropriateness Criteria and suggests appropriate imaging exam
Level 3 *With assistance, delineates the clinical question, obtains appropriate clinical information, uses evidence-based imaging guidelines, and recommends next steps for complex consultations*	● A primary care physician has a teen with cirrhosis and a liver mass on ultrasound; the fellow provides consultation with attending radiologist guidance to address the next step in imaging ● Provides consultation to the primary care physician regarding a patient with a pacemaker who the primary care physician would like assessed via magnetic resonance imaging (MRI)
Level 4 *Manages consultations independently, taking into consideration cost effectiveness and risk-benefit analysis*	● Independently consults about advanced MRI techniques and sequences in preparation for brain tumor analysis
Level 5 *Provides comprehensive consultations at the expert level*	● Independently recommends preliminary scrotal ultrasound and tumor marker analysis first on consultation for a lung biopsy on an 18-year-old male patient who presents with multiple lung masses on x-ray and a retroperitoneal mass on CT
Assessment Models or Tools	● Case conferences ● Direct observation ● End-of-rotation evaluation ● Faculty and director of fellowship evaluation ● Multisource feedback
Curriculum Mapping	●
Notes or Resources	● American College of Radiology (ACR). ACR Appropriateness Criteria. https://www.acr.org/Clinical-Resources/ACR-Appropriateness-Criteria. 2021. ● American College of Radiology. Manual on Contrast Media. https://www.acr.org/Clinical-Resources/Contrast-Manual. 2021. ● Complex consultation is defined as clinical concerns in which the patient has a complex clinical history/presentation

	● Consultations can be over the phone, in the reading room, at tumor boards, etc.Routine consultation is defined as clinical concerns in which the patient has a routine clinical history/presentation ● Image Gently. Pediatric Radiology and Imaging. http://www.Imagegently.org. 2021. ● 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 procedures with direct supervision*	● Performs outpatient fluoroscopic procedures including upper gastrointestinal series, voiding cystourethrogram, modified barium swallow ● Performs gastronomy tube (G-tube) checks ● Performs intussusception reduction ● Performs ultrasound studies including hip, cranial, pyloric, spine
Discusses potential procedural complications	● Knows complications of intussusception reduction and treatments ● Knows of potential complications from misplaced tubes
Level 2 *Competently performs basic pediatric procedures with indirect supervision*	● Performs outpatient fluoroscopic procedures and discusses indications for studies with supervising physician ● Completes studies with indirect supervision
Recognizes complications of procedures and enlists help	● Recognizes ultrasound findings that may hamper intussusception reduction ● Recognizes extravasation from G-tube studies
Level 3 *Competently performs basic and advanced pediatric procedures with direct supervision*	● Performs more complex fluoroscopic studies including neonatal enemas, post-operative ostomy studies ● Assists sonographers with complex ultrasound studies including Doppler in routine and complex cases, like transplant patients
Manages complications of procedures with supervision	● Knows how to treat perforation after contrast enema ● Knows how to optimize Doppler evaluation
Level 4 *Competently performs basic and advanced pediatric procedures with indirect supervision*	● Performs joint aspiration with ultrasound ● Performs joint injection with ultrasound or fluoroscopic guidance
Anticipates and independently manages complications of procedures	● Recognizes potentially complex patients and the need for surgical consultation prior to exam being performed, for example, bowel obstruction in intussusception
Level 5 *Assists in the development of departmental procedure methodologies*	● Participates in annual review of fluoroscopic examination protocols ● Helps initiate a musculoskeletal ultrasound program
Assists in the development of departmental rules of management for complications of procedures	● Develops on-call manual to aide learners and others to recognize complications

Assessment Models or Tools	● Direct observation ● End-of-rotation evaluation ● Point-of-care procedural checklist ● Procedure logs ● Simulation
Curriculum Mapping	●
Notes or Resources	● 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. ● Background and Intent: The ACGME Glossary of Terms defines conditional independence as “graded, progressive responsibility for patient care with defined oversight.” ● Invasive procedures expected of a general radiologist may include: paracentesis, thoracentesis, thyroid biopsy, superficial lymph node, lumbar puncture, and/or abscess drainage. ● The New England Journal of Medicine. Videos in Clinical Medicine. https://www.nejm.org/multimedia/medical-videos. 2021. ● RSNA. Physics Modules. https://www.rsna.org/education/trainee-resources/physics-modules. 2021. ● Society of Interventional Radiology. https://www.sirweb.org/. 2021.

Medical Knowledge 1: Protocol Selection and Optimization of Images **Overall Intent:** To apply knowledge of protocol selection to optimize imaging	
Milestones	**Examples**
Level 1 *With supervision, selects appropriate protocol and contrast agent/dose for commonly performed pediatric imaging exams* *Recognizes suboptimal imaging*	● Correctly describes appropriate department protocols for pediatric imaging ● Competently places orders for intravenous contrast agents ● Chooses appropriate enteric contrast for fluoroscopy studies based on patient age and indication
Level 2 *With supervision, selects appropriate protocol and contrast agent/dose for less commonly performed pediatric imaging exams* *Describes basic techniques to optimize image quality*	● Evaluates patient's renal function prior to CT or MRI with contrast ● Understands that a trauma patient should have an unenhanced CT of the brain prior to additional trauma imaging with contrast
Level 3 *With supervision, selects appropriate protocol and contrast agent/dose for complex pediatric imaging exams* *With supervision, applies techniques to optimize image quality*	● Knows the indications and specific features of a three-phase magnetic resonance urography scan, including timing ● Understands appropriate indication for hepatobiliary gadolinium agents
Level 4 *Adjusts departmental protocols for optimal imaging of an individual patient's needs* *Independently applies techniques to optimize image quality*	● Adjusts imaging techniques to limit metallic or motion artifacts in CT and MR ● Modifies standard contrast dosing for reduced renal function; initiates direct communication with clinical team to discuss use of contrast agents with impaired renal function
Level 5 *Modifies protocols and assists in developing new protocols and/or techniques for pediatric imaging*	● Designs a CT protocol to assess for brain trauma but includes 3D skull for fracture analysis ● Develops an MR protocol for fetal evaluation of ultrasound proven ventriculomegaly ● Develops an ultrasound protocol for contrast enhanced assessment for renal scarring or liver tumors.
Assessment Models or Tools	● Direct observation while on clinical service ● 360-degree feedback from radiology technologists

Curriculum Mapping	●
Notes or Resources	● ACR. Appropriateness Criteria. https://www.acr.org/Clinical-Resources/ACR-Appropriateness-Criteria. 2021. ● ACR. Radiology Safety. https://www.acr.org/Clinical-Resources/Radiology-Safety. 2021. ● Image Gently. https://www.imagegently.org/. 2021. ● Image Wisely. https://www.imagewisely.org/. 2021. ● Institutional protocols ● RSNA. Physics Modules. https://www.rsna.org/en/education/trainee-resources/physics-modules. 2021.

Medical Knowledge 2: Interpretation **Overall Intent:** To assess proficiency of image interpretation skills	
Milestones	**Examples**
Level 1 *Makes primary observations and formulates differential diagnoses, including consideration of normal pediatric imaging anatomy* *With guidance, recognizes key critical reportable findings (e.g., pneumothorax, pneumoperitoneum)*	● Identifies lobar pneumonia, bronchiolitis, and pneumothoraces with radiography ● Identifies respiratory distress syndrome, transient tachypnea of the newborn, pulmonary interstitial pneumonia, and neonatal pneumonia with radiography ● Identifies line position within the chest and abdomen with radiography ● Identifies pneumoperitoneum with radiography ● Identifies acute intracranial hemorrhage with CT imaging ● Identifies commonly encountered fractures with radiography
Level 2 *Makes secondary observations, understands normal developmental variants, and formulates a more specific differential diagnosis* *Identifies secondary and critical imaging findings and demonstrates knowledge of clinical management options*	● Identifies midgut volvulus with fluoroscopic imaging ● Identifies vesicoureteral reflux with fluoroscopic imaging ● Identifies intussusception, pyloric stenosis, and appendicitis with ultrasonography ● Identifies ovarian and testicular torsion with ultrasonography ● Identifies germinal matrix hemorrhage with ultrasonography ● Identifies developmental hip dysplasia with ultrasonography
Level 3 *Provides accurate, focused interpretations and, with supervision, prioritizes differential diagnoses* *With supervision, recommends management options to clinical team*	● Identifies congenital anomalies versus disease processes ● Identifies congenital pulmonary and cardiovascular anomalies with cross-sectional imaging such as pulmonary sequestration, congenital pulmonary airway malformation, and pulmonary venous return anomalies ● Identifies oncologic entities that affect children and adolescents such as neuroblastoma, Wilms tumor, hepatoblastoma, and pancreatoblastoma ● Identifies oncologic entities that affect the central nervous system of children and adolescents such as juvenile pilocytic astrocytoma, medulloblastoma, ependymoma, and pleomorphic xanthoastrocytoma ● Identify oncologic entities that affect the musculoskeletal system of children and adolescents such as Ewing sarcoma and osteosarcoma ● Identify the many manifestations of syndromes and diseases that affect children and adolescents such as Langerhans Cell Histiocytosis, von Hippel-Lindau Syndrome, Sturge-Weber Syndrome, Li-Fraumeni Syndrome, Parkes Weber Syndrome, and Klippel-Trenaunay Syndrome ● Identifies the many manifestations of non-accidental trauma with multiple imaging modalities

Level 4 *Independently differentiates pediatric normal from abnormal findings and suggests a single diagnosis when appropriate* *Independently recommends management options to clinical team*	● Differentiates neoplastic from non-neoplastic processes, such as sarcoidosis. ● Identifies imaging findings using nuclear medicine and interventional radiology in order to confirm multi-focal/multi-organ diagnoses
Level 5 *Demonstrates interpretative and management recommendation skills at a level expected of a specialist pediatric radiologist*	● Optimizes cardiovascular imaging in the evaluation of individual patients with congenital cardiovascular anomalies ● Optimizes central nervous system imaging in the evaluation of specific patients with multiple findings within the brain and spine ● Optimizes MRI imaging of multifocal intra-thoracic and intra-abdominal processes to facilitate diagnosis ● Optimizes nuclear medicine and molecular imaging examinations in the evaluation of individual pediatric patients
Assessment Models or Tools	● Direct observation ● End-of-rotation evaluation ● Evaluation of acquired fluoroscopic images and times ● Examination and quiz scores ● Multisource feedback ● Multidisciplinary conferences, including morbidity and mortality (M and M) conferences
Curriculum Mapping	●
Notes or Resources	● Cleveland Clinic Children's Hospital. Pediatric Radiology. https://www.cchs.net/onlinelearning/cometvs10/pedrad/default.htm. 2021. ● Merrow C. *Diagnostic Imaging*: *Pediatrics.* 3rd ed. Philadelphia, PA: Elsevier; 2017. ISBN:978-0323443067. ● Smith WL, Schlesinger AE. A curriculum in pediatric radiology for diagnostic radiology residents. *Pediatr Radiol*. 1995;25:403-407. https://link.springer.com/article/10.1007/BF02021722. 2021. ● The Society for Pediatric Radiology. Resources. https://www.pedrad.org/Education/Resources. 2021.

Medical Knowledge 3: Knowledge of Basic and Clinical Science **Overall Intent:** To apply knowledge of anatomy, pathophysiology, and cellular and molecular systems to generate a differential diagnosis	
Milestones	**Examples**
Level 1 *Demonstrates knowledge of imaging anatomy of an infant, child, and adolescent* *Demonstrates knowledge of pathophysiology of common pediatric disease processes*	● Identifies pulmonary lobar anatomy ● Describes explanation for findings evaluated by common genitourinary fluoroscopic studies, such as vesicoureteral reflux, duplex collecting systems ● Understands and can discuss the spectrum of pathologic processes that commonly affect pediatric patients ● Demonstrates an understanding of neonatal pulmonary processes evaluated by chest radiography
Level 2 *Applies knowledge of anatomy to make imaging diagnoses of common pediatric conditions* *Applies knowledge of pathophysiology to make imaging diagnoses of common pediatric conditions*	● Accurately identifies lobar pneumonia ● Distinguish abdominal neuroblastoma from lymphoma ● Discusses and uses nuclear medicine examinations in the evaluation of commonly encountered pediatric diseases including vesicoureteral reflux, hepatobiliary diseases, and bone lesions ● Accurately identifies a thyroid nodule on ultrasound, raises the possibility of toxic adenoma in a patient with a thyroid nodule and hyperthyroidism, uses I-123 uptake and scan to identify a hyperfunctioning thyroid adenoma
Level 3 *Applies knowledge of anatomy to make imaging diagnoses of less common pediatric conditions* *Applies knowledge of pathophysiology to make imaging diagnoses of less common pediatric conditions*	● Accurately identifies pediatric pulmonary diseases with CT imaging ● Accurately identifies less commonly encountered pediatric intra-abdominal and intra-pelvic diseases with cross-sectional imaging, such as benign and malignant liver neoplasms ● Properly uses nuclear medicine examinations to diagnosis less commonly encountered pediatric diseases, including positron emission tomography (PET)-CT or PET-MRI, such as lymphoma, germ cell tumor, sarcoma, Wilms tumors, and metastatic neuroblastoma ● Uses somatostatin receptor imaging to diagnose neuroendocrine tumor
Level 4 *Proficiently integrates knowledge of anatomic and molecular imaging with pathophysiology to formulate a diagnosis*	● Suggests sarcoidosis over malignancy on patient with metabolically active mediastinal and hilar lymphadenopathy and appropriately distributed pulmonary nodules ● Correctly uses and describes the use of molecular imaging, MR angiographic, and interventional radiologic examinations in the diagnosis and treatment of less-commonly encountered disease processes such as neuroendocrine tumors as well as lymphovascular diseases such as Parkes-Weber and Klippel-Trenaunay syndromes

	● Recognizes intracranial tumors and intraspinous tumors that may be part of a tumor syndrome
Level 5 *Proficiently integrates knowledge of anatomic and molecular imaging with pathophysiology to formulate a diagnosis at the expected level of a specialized pediatric radiologist*	● Optimizes cardiovascular imaging in the evaluation of individual patients with congenital cardiovascular anomalies ● Optimizes central nervous system imaging in the evaluation of specific patients with multiple findings within the brain and spine ● Optimizes MRI imaging of multifocal intra thoracic and intra-abdominal processes to facilitate diagnosis ● Optimizes nuclear medicine and molecular imaging examinations in the evaluation of individual pediatric patients ● Optimizes the use of interventional radiology examinations in the evaluation of individual pediatric patients
Assessment Models or Tools	● Case conference ● Direct observation ● Exam scores ● Report review
Curriculum Mapping	●
Notes or Resources	● ACR. Practice Parameters and Technical Standards. https://www.acr.org/Clinical-Resources/Practice-Parameters-and-Technical-Standards. 2021. ● Glastonbury CM, Mukherji SK, O'Sullivan B, Lydiatt WM. Setting the stage for 2018: How the changes in the American Joint Committee on Cancer/Union for International Cancer Control Cancer Staging Manual eighth edition impact radiologists. *AJNR Am J Neuroradiol.* 2017;38(12):2231-2237. http://www.ajnr.org/content/38/12/2231.long. 2021. ● Louis DN, Perry A, Reifenberger G, et al. The 2016 World Health Organization classification of tumors of the central nervous system: A summary. *Acta Neuropathol*. 2016;131(6):803-820. https://link.springer.com/article/10.1007%2Fs00401-016-1545-1. 2021. ● Lydiatt WM, Patel SG, O'Sullivan B, et al. Head and neck cancers - major changes in the American Join Committee on cancer eighth edition cancer staging manual. *CA Cancer J Clin*. 2017;67(2):122-137. https://onlinelibrary.wiley.com/doi/full/10.3322/caac.21389. 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 pediatric patient safety events* *Demonstrates knowledge of how to report pediatric patient safety events*	● Is aware that extravasation of contrast is a safety event and knows where and how to report
Level 2 *Identifies system factors that lead to pediatric patient safety events* *Reports pediatric 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 pediatric patient safety events (simulated or actual)* *Participates in disclosure of pediatric patient safety events to patients and families (simulated or actual)*	● Reviews a patient safety event (e.g., preparing for M and M presentations, preparing for departmental meeting on reading discrepancies), joining a root cause analysis group and has communicated with patients/families about such an event
Level 4 *Conducts analysis of pediatric patient safety events and offers error prevention strategies (simulated or actual)* *Discloses pediatric patient safety events to patients and families (simulated or actual)*	● Participates in a root cause analysis group or M and M conference or quality assurance (QA) radiation safety conference of a patient safety event 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 pediatric patient safety events* *Role models or mentors others in the disclosure of pediatric 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 ● Chairs an M and M committee or a QA/discrepancy committee meeting
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 ● Portfolio ● Reflection ● Simulation
Curriculum Mapping	●
Notes or Resources	● ACR. Radiology Safety. https://www.acr.org/Clinical-Resources/Radiology-Safety. 2021. ● Image Gently. https://www.imagegently.org/. 2021. ● 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 fish-bone diagramming
Level 2 *Describes local quality improvement initiatives*	● Is aware of institutional QI initiatives including the handwashing initiative, time-outs, and ALARA (“as low as reasonably achievable”) principles of pediatric imaging
Level 3 *Participates in local quality improvement initiatives*	● Participates in departmental or hospital QI/QA 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 and the conducting 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 ● Teaches radiation safety principles ● Obtains advanced QI training ○ 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	●
Notes or Resources	● ACR. Radiology Safety. https://www.acr.org/Clinical-Resources/Radiology-Safety. 2021. ● Image Gently. https://www.imagegently.org/. 2021. ● Image Wisely. https://www.imagewisely.org/. 2021. ● Institute of Healthcare Improvement. http://www.ihi.org/Pages/default.aspx. 2019. ● 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 pediatric radiology imaging/procedures*	● Identifies the members of the interprofessional imaging team and describes their roles
Identifies key elements for safe and effective transitions of care and hand-offs	● Describes an effective sign-out to the covering radiology team members
Demonstrates knowledge of population and community health needs	● Knows that non-English-speaking patients without insurance are at risk for receiving a lesser degree of care than English-speaking patients ● Knows that income may impact pre exam prep or appearance of patient at an appointment and takes precautions to avoid missed/no show exams
Level 2 *Coordinates care of patients in routine pediatric radiology imaging/procedures effectively using the roles of interprofessional teams*	● Works with other members of the radiology team (nurses, technologists) to coordinate patient imaging, but requires supervision to ensure all necessary imaging is performed ● Requests Child Life assistance when needed ● Requests the help of Child Life Specialists when working with an upset, anxious child
Performs safe and effective transitions of care/hand-offs in routine clinical situations	● Effectively performs sign-outs between shifts to ensure that pending studies and their clinical implications are known to incoming team
Identifies specific population and community health needs for the local population	● Identifies that underrepresented minority patients from a community clinic may need additional levels of assistance to obtain proper follow-up following imaging ● Identifies that sickle cell patients may require transcranial US as a screening exam for determination of need for transfusions to prevent stroke
Level 3 *Coordinates care of patients in complex pediatric radiology imaging/procedures effectively using the roles of interprofessional teams*	● Coordinates the imaging sequencing for complex patients such as multi-injured trauma patients
Performs safe and effective transitions of care/hand-offs in complex clinical situations	● Prioritizes urgent patients from the intensive care unit (ICU), trauma, and emergency department for imaging/procedures and hands off the plan to the team on the next shift
Identifies local resources available to meet the needs of a patient population and community	● Identifies a special-needs outreach program in the community to assist children with complex care

	● Works with child advocacy team in cases of non-accidental trauma
Level 4 *Role models effective coordination of pediatric patient- and family-centered care among different disciplines and specialties* *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)*	● Serves as a role model and educator for students and more 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 ● Coordinates and prioritizes consultant input for a new high-risk diagnosis (e.g., malignancy) to ensure the patient gets appropriate follow-up ● Guides more junior residents in an effective post-procedure hand-off to the referring service ● Participates in workflow improvement project to improve access of interpretation services within the radiology department for non-English-speaking immigrants and refugees ● Participates in screening outreach program for patients who may have nonaccidental trauma
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 pediatric patient outcomes* *Leads innovations and advocates for populations and communities with 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 ● Serves as a QI mentor to identify better hand-off tools ● Works with local outreach programs to educate community members about neonatal emergencies for new patients
Assessment Models or Tools	● Direct observation ● Learning portfolio ● Medical record (chart) audit ● Multisource feedback ● Objective structured clinical examination (OSCE) ● Review of sign-out tools ● Use/Completion of checklists
Curriculum Mapping	●
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 resident 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 health care system (e.g., hospital, finance, personnel, technology)* *Describes the mechanisms for reimbursement, including types of payors*	● Recognizes that multiple components exist in a health care system, including various practice settings, reimbursement models, and types of insurance ● Describes various practice models
Level 2 *Describes how components of a complex health care system are interrelated, and how this impacts patient care* *States relative cost of common procedures*	● Understands that pre-authorization may impact patient care and remuneration to the health system ● States relative costs of chest x-ray versus chest CT
Level 3 *Discusses how individual practice affects the broader system (e.g., length of stay, readmission rates, clinical efficiency)* *Describes the technical and professional components of imaging costs*	● Understands that turnaround times and dictation errors may affect patient care, e.g., length of stay, which impacts the broader system ● Differentiates between the technical and professional costs of a head CT
Level 4 *Manages various components of the complex health care system to provide efficient and effective pediatric patient care and transition of care* *Describes the pediatric radiology revenue cycle and measurements of productivity (e.g., relative value units)*	● Works collaboratively with pertinent stakeholders to improve procedural start times ● Works collaboratively to improve informed consent for non-English-speaking patients requiring interpreter services ● Understands the multiple components of the revenue cycle applied to an MRI exam ● Understands the relative value units of the differing imaging exams and how they are calculated
Level 5 *Advocates for or leads systems change that enhances high-value, efficient, and effective pediatric patient care and transition of care* *Participates in health policy advocacy activities*	● Publishes original research on high-value patient care in peer-reviewed journal ● Works with community or professional organizations to advocate for prenatal care availability and non-accidental trauma education, assessment, and prevention
Assessment Models or Tools	● Direct observation ● Medical record (chart) audit

	● Multiple choice test ● OSCE ● QI project
Curriculum Mapping	●
Notes or Resources	● Agency for Healthcare Research and Quality (AHRQ). Major Physician Measurement Sets. https://www.ahrq.gov/talkingquality/measures/setting/physician/measurement-sets.html. 2021. ● AHRQ. Measuring the Quality of Physician Care. https://www.ahrq.gov/talkingquality/measures/setting/physician/index.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. ● 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. ● National Academy of Medicine. Vital Detections for Health and Health Care: A Policy Initiative of the National Academy of Medicine. https://nam.edu/initiatives/vital-directions-for-health-and-health-care/. 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 1: Reimbursement Basic. http://education.rsna.org/diweb/catalog/item?id=2210377. 2021. ● RSNA Online Learning Center. Level 2: Service Valuation and Costs. http://education.rsna.org/diweb/catalog/item?id=2223133. 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*	● 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 ● Is aware of premedication regimens
Level 2 *Recognizes contrast reactions (simulated or actual)*	● 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 *With supervision, manages contrast reactions (simulated or actual)*	● Consistently and reliably manages (with supervision) contrast reactions in simulation or actual in the CT or MRI department ● 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

	● OSCE ● Reflection ● Simulation
Curriculum Mapping	●
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 head average dose information
Level 3 *Communicates the relative risk of exam-specific radiation exposure to pediatric patients, patients' families, and practitioners*	● Effectively communicates relative risks of the radiation exposure during a CT of the head to the patient, patient's family or referring provider
Level 4 *Applies principles of ALARA in daily practice*	● Modifies CT parameters for CT examinations in keeping with the ALARA principles routinely in daily practice ● Demonstrates appropriate fluoroscopic technique consistently to reduce radiation dose
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 resident ● Direct observation ● Documentation of QI or radiation safety project processes or outcome ● Multiple choice test ● OSCE
Curriculum Mapping	●
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. 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 determine if it is safe to perform an MRI on a patient with a cochlear implant
Level 3 *Communicates MR safety, including implants and retained foreign bodies, to pediatric patients, patients' families, and practitioners*	● Communicates any risks of performing an MRI with shrapnel to a patient/family
Level 4 *Applies principles of MR safety to daily practice*	● Explains the principles of MR safety; handles a patient with a pacemaker, and 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 ● RadExam patient safety assessment ● Safe MR Practices: Self-Assessment Module AJR 2007;188:S50–S54 0361-803X/07/1886–S50 © American Roentgen Ray Society
Curriculum Mapping	●
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*	● Familiar with ACR standards and obtains them for review
Level 2 *Articulates clinical questions and elicits patient's and patient's family's preferences and concerns to guide evidence-based imaging*	● Identifies patients with conditional risks for MRI safety, radiation safety, or administration of intravenous contrast ● Correlates reason for exam with ultrasound findings and information from family members to know how to approach the exam
Level 3 *Locates and applies the best available evidence, integrated with patient's and patient's family's preferences and concerns, to the care of complex patients*	● Uses radiology literature to determine imaging approach to a patient with complex medical issues for example genitourinary work-ups for a patient with myelomeningocele
Level 4 *Critically appraises conflicting evidence to guide care, tailored to the individual patient*	● Knows how to direct the clinical team for variable situations in imaging (e.g., choice of ultrasound versus CT versus MRI for analysis for Crohn's disease or appendicitis, choice of modality in work-ups of patients with chronic renal disease)
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 ● Teaches class on radiation safety based on ACR practice parameters ● Develops departmental best practices for various workups e.g., abdominal pain in children
Assessment Models or Tools	● Direct observation ● Learning portfolio ● Oral or written examination ● Simulation (OSCE)
Curriculum Mapping	●
Notes or Resources	● American Board of Radiology. 2019 Noninterpretive Skills Study Guide. https://www.theabr.org/wp-content/uploads/2018/11/NIS-Study-Guide-2019.pdf. 2021. ● ACR. Practice Parameters and Technical Standards. https://www.acr.org/Clinical-Resources/Practice-Parameters-and-Technical-Standards. 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. www.imagegently.org. 2021. ● Image Wisely. www.imagewisely.org. 2021.

	● Institutional Review Board (IRB) guidelines ● MRI Safety. http://mrisafety.com. 2021. ● 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 that 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 *Is receptive to performance data and feedback to adjust goals* *Analyzes and reflects on factors that contribute to gap(s) between expectations and actual performance* *With prompting, designs and implements a learning plan*	● Uses feedback to set goals to read more studies each day ● Analyzes QA meeting information to provide more effective and correct readings ● Reflects on factors contributing to lack of efficiency ● With attending assistance, 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* *Independently designs and implements a learning plan*	● 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 ● Independently develops method to document goals in a specific and achievable manner, such that attaining them is measurable
Level 4 *Consistently seeks performance data and feedback with humility and adaptability* *Analyzes effectiveness of behavioral changes where appropriate, and considers alternatives in*	● Independently follows up on the outcomes of patients for which they have dictated reports ● Consistently identifies learning gaps and addresses areas to work on

narrowing the gap(s) between expectations and actual performance *Uses performance data to measure the effectiveness of the learning plan and improves it when necessary*	● Uses scores from standardized assessments (e.g., RadExam, ACR In-Training) to create a learning plan
Level 5 *Coaches other learners to consistently seek performance data and feedback* *Coaches others on reflective practice* *Facilitates the design and implements learning plans for others*	● 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 ● Provides constructive feedback to peers for improvement ● Develops learning methods for peers to address gaps
Assessment Models or Tools	● Direct observation ● Review of learning plan ● Standardized assessments
Curriculum Mapping	●
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 one's own professionalism lapses* *Analyzes straightforward situations using ethical principles*	● 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 ● 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 resident 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
Level 3 *Demonstrates professional behavior in complex or stressful situations* *Recognizes the 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 learner 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 seeks resources to help manage and resolve complex ethical situations ● Analyzes difficult (real or hypothetical) ethical dilemmas and situations, or professional case scenarios ● Recognizes own limitations, and consistently demonstrates professional behavior

Level 4 *Recognizes situations that may trigger professionalism lapses and intervenes to prevent lapses in oneself and others* *Recognizes and uses appropriate resources for managing and resolving ethical dilemmas as needed (e.g., ethics consultations, literature review, risk management/legal consultation)*	● 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 (e.g., ethics consultations, literature review, risk management/legal consultation)
Level 5 *Coaches others when their behavior fails to meet professional expectations* *Identifies and seeks to address system-level factors that induce or exacerbate ethical problems or impede their resolution*	● Coaches others when their 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-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 sub-committee, risk management committee, root cause analysis review, patient safety or satisfaction committee, professionalism work group, Institutional Review Board (IRB), fellow grievance committee, etc.
Assessment Models or Tools	● Direct observation ● End-of-rotation evaluation ● Multisource feedback ● Oral or written self-reflection ● OSCE ● 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 (AUR). Professionalism Curriculum Resources. http://www.aur.org/ProfessionalCurriculum/. 2021. ● AUR. Professionalism and Ethics Competencies for Radiology Residents. http://www.aur.org/Secondary.aspx?id=10263. 2021.

	● Bynny RL, Paauw DS, Papadakis MA, Pfeil S, Alpha Omega Alpha. *Medical Professionalism Best Practices: Professionalism in the Modern Era.* Menlo Park, CA: Alpha Omega Alpha Honor Medical Society; 2017. http://alphaomegaalpha.org/pdfs/Monograph2018.pdf. 2021. ● 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 (RSNA). 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 one's 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*	● Assumes responsibility for getting informed consent for a procedure
Level 2 *Performs tasks and responsibilities in a timely manner to ensure the needs of patients, families, 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 the needs of patients, families, 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 demonstrates leadership when addressing to address those issues ● On-call example: senior residents advise junior 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 ● RSNA. 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 *With assistance, recognizes status of personal and professional well-being, and is aware of available resources* *With assistance, recognizes limits in the knowledge/skills of self or team*	● Requests and/or accepts feedback and exhibits positive responses to corrective feedback ● Is aware of or 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 oneself or the 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 oneself or the 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 oneself or the 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. 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. ● ACGME. "Well-Being Tools and Resources." https://dl.acgme.org/pages/well-being-tools-resources. 2021. ● 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 one's own role within the health care system*	● Explains that they are a pediatric radiology fellow during patient and family interactions
Identifies the need to adjust communication strategies based on assessment of the patient's/patient's family's expectations and understanding of their health status and treatment options	● Demonstrates an understanding that communication for a patient with unexpected and difficult diagnosis at the time of imaging, such as fetal demise while undergoing an ultrasound or finding suspicious for neoplasm, must be adapted for the situation ● Understands that communication may need to be adjusted for children of different ages; and for families of variable educational backgrounds
Level 2 *Identifies barriers to effective communication (e.g., language, health literacy) for families and children of all ages*	● Identifies need for an interpreter; speaks in a manner at a level of understanding commensurate with education level of patient, and then realizes when the presence of a caregiver will be needed to aid in management decision making
Organizes and initiates communication with the patient/patient's family by clarifying expectations and verifying understanding of the clinical situation; adapts to changing needs of children as they age	● Before and/or after communication with patient/family members, closes the loop and asks them if they are clear about what is happening with their imaging care
Level 3 *Identifies biases that hinder effective communication*	● Recognizes bias about sexuality and/or identity ● Recognizes possible biases regarding patient and their family's religion, country of origin
With guidance, sensitively and compassionately delivers medical information, elicits patient goals and preferences, and acknowledges uncertainty and conflict	● With guidance, communicates with a patient the presence of unexpected finding requiring further evaluation by sampling the tissue to look for neoplasm ● With guidance, communicates with a patient the presence of an abnormality of concern and potential treatment involving patient and family in discussion thereby aligning with patient and guardian goals
Level 4 *Actively minimizes communication barriers*	● Assumes responsibility and apologizes if noted saying something insensitive for a particular culture
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 and their family members diagnoses at the bedside while performing imaging examinations; involves the patient, their family, and the referring clinician(s) in formulating a plan for subsequent clinical steps

	● Independently communicates with a patient the presence of an imaging abnormality and if potential needs include other imaging exams for further work-up such as urinary tract infection
Level 5 *Coaches other learners to minimize communication barriers* *Coaches other learners in shared decision making*	● 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 colleague ● Role models proactive self-awareness and reflection around biases with a context-specific approach to mitigating communication barriers based on religion, and country of origin ● Leads shared decision making with clear recommendations to patients and families even in complex clinical situations ● Leads department lecture on avoiding bias in imaging care and communication
Assessment Models or Tools	● Direct observation ● Kalamazoo Essential Elements Communication Checklist (Adapted) ● Mini-clinical evaluation exercise (CEX) ● Multisource feedback ● OSCE ● 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 *Respectfully receives a consultation request* *Demonstrates knowledge of the institutional and national communication guidelines*	● Accepts a request to do perform a late afternoon procedure and offers to discuss with the attending without offering resistance ● Documents communication of imaging findings to the health care team; uses time/date/person talked to
Level 2 *Clearly and concisely responds to a consultation request* *Communicates emergent findings according to institutional or national guidelines*	● Offers consulting service guidance to clinician on the necessity of the procedure and when it can be reasonably be performed after discussion with the radiology attending physician ● Communicates urgent and emergent findings within 60 minutes of observing the critical result and then documents the communication in the report; uses time/date/person talked to/info repeated back
Level 3 *Checks understanding of recommendations when providing consultation* *Communicates non-emergent findings where failure to act may adversely affect patient outcome*	● Communicates identification of a suspicious pulmonary nodule on chest x-ray and recommends a chest CT ● Communicates finding a corner fracture on plain film and suggests further imaging for possible non-accidental trauma
Level 4 *Coordinates recommendations from different members of the health care team to optimize patient care* *Communicates findings and management options (as appropriate) that are tailored to the referring provider*	● After encounter with uroradiologist the family uses ultrasound contrast venous compression ultrasound ● Communicates to a generalist the patient had a stroke but provides more detailed information to the consulting neurologist
Level 5 *Role models flexible communication strategies that value input from all health care team members, resolving conflict when needed* *Coaches other learners in tailored communications to referring providers*	● Role models the resolution of conflict between neurosurgery and the emergency department for MRI scan prioritization while accepting input from MRI technology and radiology administration ● Coaches more junior residents in subspecialty-level communications
Assessment Models or Tools	● Direct observation ● End-of-rotation evaluation

	● Multisource feedback ● OSCE ● Simulation
Curriculum Mapping	●
Notes or Resources	● ACR. 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*	● Describes the appropriate and inappropriate use of cell phone, email, and social media
Level 2 *Communicates appropriately as required by institutional policy*	● Uses secured email for communication of patient information
Level 3 *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 4 *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 5 *Facilitates dialogue regarding systems issues among larger community stakeholders (institution, health care system, field)*	● Through participation on the hospital stroke committee, helps facilitates improvement in the reporting of code stroke head CT results to the stroke team through a standardized reporting process, aiding in efficient and timely management of stroke patients
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	● ACR. 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: Safety	SBP1: Pediatric Imaging Patient Safety SBP5: Contrast Agent Safety SBP6: Radiation Safety SBP7: Magnetic Resonance Safety
PC3: Competence in Procedures	PC2: Competence in Procedures
MK1: Protocol Selection and Optimization of Images	MK1: Protocol Selection and Optimization of Images
MK2: Interpretation	MK2: Interpretation
MK3: Knowledge of Basic and Clinical Science Appropriate to Pediatric Radiology	MK3: Knowledge of Basic and Clinical Science
SBP1: Quality Improvement	SBP2: Quality Improvement
	SBP3: System Navigation for Pediatric Patient- and Family-Centered Care
SBP2: Health Care Economics	SBP4: Physician Role in Health Care Systems
PBLI1: Self-Directed Learning	PBLI2: Reflective Practice and Commitment to Professional Growth
PBLI2: Scholarly Activity	PBLI1: Evidence-Based and Informed Practice
PROF1: Personal	PROF1: Professional Behavior and Ethical Principles PROF2: Accountability/Conscientiousness
No match	PROF3: Self-Awareness and Help-Seeking
ICS1: Effective Communication with Patients, Families, and Caregivers	ICS1: Patient- and Family-Centered Care
ICS2: Effective Communication with Members of the Health Care Team (Written and Oral)	ICS2: Interprofessional and Team Communication ICS3: Communication within Health Care Systems
ICS3: Effective Teaching	No match

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/