Supplemental Guide:
Nuclear Radiology

ACGME

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Milestones Supplemental Guide

This document provides additional guidance and examples for the Nuclear 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: Diagnostic Non-Cardiac Examinations **Overall Intent:** To evolve from providing basic interpretive skills to consultations to independent practice	
Milestones	**Examples**
Level 1 *Selects protocols for common non-cardiac examinations*	● Knows indications for hepatobiliary scintigraphy in setting of acute right upper-quadrant pain, and recommends appropriate patient preparation (e.g., fasting) ● Discusses patient preparation (diet, insulin) for routine 18F-fluorodeoxyglucose (^{18}F-FDG) positron emission tomography (PET)/computerized tomography (CT) imaging in oncology
Makes efficient and accurate interpretations of common non-cardiac examinations	● Accurately interprets bone scans for metastatic prostate cancer, and differentiates between benign and malignant processes
Level 2 *Tailors protocols for common and hybrid non-cardiac examinations*	● When performing hepatobiliary scintigraphy for functional gallbladder disorder, understands that cholecystokinin analogue or fatty meal would be administered ● Applies clinical indications for single-photon emission computed tomography (SPECT)/CT (e.g., bone scintigraphy) in athletes with lower back pain
Makes efficient, accurate, and comprehensive interpretations of common and hybrid non-cardiac examinations, including secondary findings	● Identifies bone lesions at risk of fracture, relays these findings to referring provider, and documents accurately in nuclear radiology report
Level 3 *Tailors protocols for uncommon and hybrid non-cardiac examinations*	● Identifies pitfalls of improper CT positioning for attenuation correction and can reprocess the data to improve fused findings ● Applies protocol for cerebrospinal fluid shunt studies, including obtaining additional imaging and positioning patient
Makes efficient, accurate, and comprehensive interpretations of uncommon and hybrid non-cardiac examinations, including secondary findings and subtle observations	● Accurately interprets brain death scintigraphy, including correlation with anatomic imaging
Level 4 *Teaches common, uncommon, and hybrid non-cardiac examinations to junior learners*	● Assists more junior learners with questions or knows how to find additional resources/assistance
Independently serves as a consultant to interdisciplinary clinical care teams	● Functions independently as presenter in multidisciplinary conferences, coordinating opinions of consulting provider to determine treatment plans ● Provides consultations for clinical questions

Level 5 *Creates protocols for emerging non-cardiac diagnostic applications* *Leads interdisciplinary clinical care teams*	● Reads literature from clinical trials and/or vendors and translates into imaging protocols at own institution working in interdisciplinary teams, as needed ● Creates protocols for emerging PET/CT studies, such as 18F-prostate-specific membrane antigen (^{18}F-PMSA) imaging
Assessment Models or Tools	● The American Board of Radiology Subspecialty Certification Examination and/or American Board of Nuclear Medicine Certification Examination ● Direct observation from team including attendings, technologists, and other staff members ● End-of-rotation evaluation ● Exam and quiz scores ● Multisource feedback
Curriculum Mapping	●
Notes or Resources	● American College of Radiology (ACR). Practice Parameters by Modality. https://www.acr.org/Clinical-Resources/Practice-Parameters-and-Technical-Standards/Practice-Parameters-by-Modality. 2021. ● ACR. Technical Standards. https://www.acr.org/Clinical-Resources/Practice-Parameters-and-Technical-Standards/Technical-Standards. 2021. ● Institutional procedure protocols ● Lists of interfering pharmaceuticals ● Society of Nuclear Medicine and Molecular Imaging (SNMMI). Clinical Guidelines. http://www.snmmi.org/ClinicalPractice/content.aspx?ItemNumber=10817&navItemNumber=10786. 2021.

Patient Care 2: Diagnostic Cardiac Examinations **Overall Intent:** To evolve from providing basic interpretive skills to consultations to independent practice	
Milestones	**Examples**
Level 1 *Describes and applies Appropriate Use Criteria for cardiac stress imaging, and describes protocols for cardiac examination*	● Describes protocols for cardiac SPECT studies, including stress options and radiopharmaceuticals ● Describes procedures for stress imaging with pharmacologic or exercise stress from beginning to end
Level 2 *Ensures appropriateness and quality of cardiac planar and single-photon emission computed tomography (SPECT) or SPECT/CT examinations and recognizes adequacy of interpretation and reporting*	● References appropriate use criteria to select optimal imaging test according to patient indication ● Observes exercise and pharmacologic stress tests ● Knows when to inject radiopharmaceutical and when to terminate exercise stress study ● Recognizes common imaging artifacts in cardiac SPECT or SPECT/CT studies ● Discusses non-myocardial perfusion SPECT or SPECT/CT indications including amyloid and viability imaging ● Discusses advantages and disadvantages of imaging equipment choices
Level 3 *Ensures appropriateness and quality of cardiac positron emission tomography (PET) or PET/CT examinations, and recognizes adequacy of interpretation and reporting*	● Assesses adequacy of cardiac PET or PET/CT imaging, including gating and flow reserve calculations ● Identifies pitfalls of improper CT positioning for attenuation correction and can reprocess imaging to improve quality ● Discusses non-myocardial perfusion PET or PET/CT indications including sarcoid and viability imaging ● Understands when and how to achieve myocardial fluorodeoxyglucose (FDG) suppression versus myocardial FDG uptake maximization
Level 4 *Independently serves as a consultant to multidisciplinary care teams to direct cardiac SPECT or SPECT/CT and/or PET or PET/CT examinations*	● Answers clinical questions of referring providers and explains imaging findings, including implications for treatment ● Participates in multidisciplinary catheterization correlation conferences
Level 5 *Evaluates new paradigms for assessing cardiac disease with SPECT or SPECT/CT and/or PET or PET/CT examinations*	● Incorporates new imaging techniques into clinical algorithms ● Participates in clinical trial to evaluate new radiopharmaceutical
Assessment Models or Tools	● The American Board of Radiology Subspecialty Certification Examination and/or American Board of Nuclear Medicine Certification Examination ● Direct observation from team including attendings, technologists, and other staff members ● End-of-rotation evaluation ● Exam and quiz scores ● Multisource feedback

Curriculum Mapping	●
Notes or Resources	● ACR. Practice Parameters by Modality. https://www.acr.org/Clinical-Resources/Practice-Parameters-and-Technical-Standards/Practice-Parameters-by-Modality. 2021. ● ACR. Technical Standards. https://www.acr.org/Clinical-Resources/Practice-Parameters-and-Technical-Standards/Technical-Standards. 2021. ● American Society of Nuclear Cardiology (ASNC). Clinical Guidelines and Quality Standards. https://www.asnc.org/guidelinesandstandards. 2021. ● Case JA, Bateman TM. Taking the perfect nuclear image: Quality control, acquisition, and processing techniques for cardiac SPECT, PET, and hybrid imaging. *J Nucl Cardiol*. 2013;20(5):891–907. https://pubmed.ncbi.nlm.nih.gov/23868070/. 2021. ● Institutional procedure protocols ● Society of Nuclear Medicine and Molecular Imaging (SNMMI). Clinical Guidelines. http://www.snmmi.org/ClinicalPractice/content.aspx?ItemNumber=10817&navItemNumber=10786. 2021.

Patient Care 3: Radiopharmaceutical Therapies: Oral ^{131}I NaI and Parenteral **Overall Intent:** To evolve from providing basic therapeutic skills to consultations to independent practice	
Milestones	**Examples**
Level 1 *Knows indications and contraindications for radioiodine therapy for benign and malignant thyroid diseases*	● Knows indications/contraindications for treatment of Graves' disease, multinodular goiter, and hyperfunctioning nodule ● Knows indications/contraindications for treatment of thyroid cancer and understands role of radioiodine therapy in overall patient management
Level 2 *Evaluates, selects, and prepares patients for radioiodine therapy, including obtaining consent, and performs procedure* *Knows the indications and contraindications for routine parenteral radiopharmaceutical therapies*	● Discusses patient preparation for radioiodine therapy for benign causes includes discontinuing medications such as methimazole ● Discusses patient preparation for radioiodine therapy for malignant causes including recombinant human thyrotropin versus hormone withdrawal and prior intravenous iodinated contrast ● Discusses low iodide diet and directs patients to relevant resources
Level 3 *Selects and applies appropriate patient release criteria, and follows patient after radioiodine therapy* *Evaluates, selects, and prepares patients for routine parenteral radiopharmaceutical therapies, including obtaining consent*	● Advises clinical care team and patients about appropriate inpatient versus outpatient therapy ● Explains radiation safety instructions ● Evaluates and prepares patients for ^{177}Lu dotatate therapy or ^{223}Ra dichloride therapy, and understands role of radiopharmaceutical therapy in overall treatment plan
Level 4 *Plans and performs radioiodine therapy in complicated clinical situations (e.g., renal failure, mentally or physically challenged patients)* *Performs routine parenteral radiopharmaceutical therapies*	● Participates in the administration of ^{177}Lu dotatate and ^{223}Ra dichloride therapy ● Works with dialysis center to determine best timing of dialysis after radiopharmaceutical therapy ● Applies dosimetry considerations in patients with lung metastases prior to ^{131}I-NaI therapy
Level 5 *Acts as an expert consultant for radioiodine therapies* *Acts as an expert for emerging parenteral therapeutic radiopharmaceuticals*	● Participates independently in multidisciplinary clinical care conference discussions and recommends radioiodine therapy as appropriate ● Advises collaborating providers on appropriate follow-up after radioiodine therapy ● Collaborates with other treating providers to offer new therapeutic radiopharmaceuticals

Assessment Models or Tools	● The American Board of Radiology Subspecialty Certification Examination and/or American Board of Nuclear Medicine Certification Examination ● Direct observation from team including attendings, technologists, and other staff members ● End-of-rotation evaluation ● Exam and quiz scores ● Multisource feedback
Curriculum Mapping	●
Notes or Resources	● ACR. Practice Parameters by Modality. https://www.acr.org/Clinical-Resources/Practice-Parameters-and-Technical-Standards/Practice-Parameters-by-Modality. 2021. ● ACR. Technical Standards. https://www.acr.org/Clinical-Resources/Practice-Parameters-and-Technical-Standards/Technical-Standards. 2021. ● ASNC. Clinical Guidelines and Quality Standards. https://www.asnc.org/guidelinesandstandards. 2021. ● Haugen BR, Alexander EK, Bible CK, et al. 2015 American Thyroid Association management guidelines for adult patients with thyroid nodules and differentiated thyroid cancer: The American Thyroid Association Guidelines Task Force on thyroid nodules and differentiated thyroid cancer. *Thyroid*. 2015;26(1):1-133. https://pubmed.ncbi.nlm.nih.gov/26462967/. 2021. ● NRC regulations ● North American Neuroendocrine Tumor Society (NANETS). NET Guidelines Library. https://nanets.net/net-guidelines-library. 2021. ● Society of Nuclear Medicine and Molecular Imaging (SNMMI). Clinical Guidelines. http://www.snmmi.org/ClinicalPractice/content.aspx?ItemNumber=10817&navItemNumber=10786. 2021. ● ThyCa: Thyroid Cancer Survivors' Association. http://www.thyca.org/. 2021.

Medical Knowledge 1: Physics and Instrumentation **Overall Intent:** To apply knowledge of physics and instrumentation to diagnostic imaging, and minimize risk of error	
Milestones	**Examples**
Level 1 *Identifies instrumentation quality control requirements and recognizes potential sources of error*	● Understands optimal instrument performance to obtain diagnostic images, and understands how image quality may be compromised
Level 2 *Demonstrates knowledge of routine instrumentation, including calibration and attenuation correction*	● Discusses calibration and attenuation correction of routine instrumentation in nuclear radiology
Level 3 *Demonstrates knowledge of advanced instrumentation, including calibration, attenuation correction, and quantitation*	● Discusses application of quantitative methods in nuclear radiology
Level 4 *Applies knowledge in use of advanced instrumentation, including calibration, attenuation correction, and quantitation*	● Discusses and applies calibration of advanced instrumentation and quantitative methods in nuclear radiology
Level 5 *Teaches others about advanced instrumentation, including calibration, attenuation correction, quantitation, and dosimetry*	● Discusses and applies personalized dosimetry for optimal therapies
Assessment Models or Tools	● The American Board of Radiology Subspecialty Certification Examination and/or American Board of Nuclear Medicine Certification Examination ● Direct observation ● End-of-rotation evaluation ● Exam and quiz scores ● Multisource feedback
Curriculum Mapping	●
Notes or Resources	● ACR. Appropriateness Criteria. https://www.acr.org/Clinical-Resources/ACR-Appropriateness-Criteria. 2021. ● ACR. Practice Parameters by Modality. https://www.acr.org/Clinical-Resources/Practice-Parameters-and-Technical-Standards/Practice-Parameters-by-Modality. 2021. ● ACR. Radiology Safety. https://www.acr.org/Clinical-Resources/Radiology-Safety. 2021. ● ACR. Technical Standards. https://www.acr.org/Clinical-Resources/Practice-Parameters-and-Technical-Standards/Technical-Standards. 2021. ● Image Gently. https://www.imagegently.org/. 2021. ● RSNA. Physics Modules. https://www.rsna.org/en/education/trainee-resources/physics-modules. 2021.

Medical Knowledge 2: Radiopharmaceuticals and Pharmaceuticals **Overall Intent:** To apply knowledge of radiopharmaceuticals and pharmaceuticals to diagnostic and therapeutic applications	
Milestones	**Examples**
Level 1 *Demonstrates knowledge of diagnostic radiopharmaceuticals in routine practice* *Demonstrates knowledge of radiopharmaceuticals for routine radiopharmaceutical therapies* *Demonstrates knowledge of indications and contraindications of common pharmaceuticals in routine practice*	● Discusses appropriate selection of radiopharmaceutical, dosage, and indication for routine examinations, including pediatric dosing considerations ● Discusses which therapeutic radiopharmaceutical and dosage is used for routine therapies, including ^{131}I Nal for hyperthyroidism ● Discusses indications and contraindications of commonly used pharmaceuticals in nuclear radiology, including furosemide and sincalide
Level 2 *Applies knowledge of diagnostic radiopharmaceuticals in routine practice* *Applies knowledge of radiopharmaceuticals for routine radiopharmaceutical therapies* *Applies knowledge of indications and contraindications of, and alternatives to common pharmaceuticals in routine practice*	● Translates diagnostic indications into appropriate nuclear radiology procedures ● Understands that right upper-quadrant pain may be an indication for a hepatobiliary scan ● Translates therapeutic indications into appropriate procedures ● Understands hyperthyroidism may be an indication for ^{131}I Nal using uptake and gland size to determine administered dosage ● Proposes fatty meal when patient cannot tolerate sincalide (cholecystokinin analog) for gallbladder contraction
Level 3 *Demonstrates knowledge of diagnostic radiopharmaceuticals in advanced practice* *Demonstrates knowledge of radiopharmaceuticals for complex radiopharmaceutical therapies* *Demonstrates knowledge of indications and contraindications of uncommon pharmaceuticals in advanced practice*	● Demonstrates knowledge of indications for ^{18}F FDG PET/CT in various malignancies ● Demonstrates knowledge of indications for pediatric ^{123}I metaiodobenzylguanidine (^{123}I MIBG) diagnosis versus ^{131}I MIBG therapy in neuroblastoma patients ● Knows somatostatin receptor physiology and when to propose ^{177}Lu dotatate therapy in patients with metastatic carcinoid tumor
Level 4 *Applies knowledge of diagnostic radiopharmaceuticals in advanced practice*	● Applies knowledge of amino acid ^{18}F fluciclovine versus ^{18}F-PSMA PET/CT for prostate cancer

Applies knowledge of radiopharmaceuticals for complex radiopharmaceutical therapies *Applies knowledge of indications and contraindications of, and alternatives to uncommon pharmaceuticals in advanced practice*	● Adjusts dosage of ^{131}I NaI in treatment of thyroid cancer in patients with renal failure ● Applies knowledge of low platelets in rescheduling patient scheduled for ^{223}Ra dichloride therapy
Level 5 *Functions independently as an integral member of multidisciplinary clinical care team or tumor board to identify and manage patients*	● Actively manages patients with referring oncology services ● Participates in case reviews, compilation of clinical and diagnostic data and therapeutic recommendations together with oncological tumor committees and boards
Assessment Models or Tools	● The American Board of Radiology Subspecialty Certification Examination and/or American Board of Nuclear Medicine Certification Examination ● Direct observation ● End-of-rotation evaluation ● Exam and quiz scores ● Multisource feedback
Curriculum Mapping	●
Notes or Resources	● ACR. Practice Parameters by Modality. https://www.acr.org/Clinical-Resources/Practice-Parameters-and-Technical-Standards/Practice-Parameters-by-Modality. 2021. ● ACR. Technical Standards. https://www.acr.org/Clinical-Resources/Practice-Parameters-and-Technical-Standards/Technical-Standards. 2021. ● SNMMI. Clinical Guidelines. http://www.snmmi.org/ClinicalPractice/content.aspx?ItemNumber=10817&navItemNumber=10786. 2021.

Medical Knowledge 3: Molecular Imaging and Radiotheranostics **Overall Intent:** To apply knowledge of molecular imaging and radiotheranostics to diagnostic and therapeutic applications	
Milestones	**Examples**
Level 1 *Demonstrates knowledge of molecular imaging findings in common diseases*	● Discusses limitations of bone scanning (technetium 99m-methyl diphosphonate (^{99m}Tc MDP) versus 18F sodium fluoride (^{18}F NaF)) in lytic versus blastic cancers
Level 2 *Applies principles of molecular imaging and radiotheranostics in common diseases*	● Determines appropriateness of PET/CT with ^{18}F FDG in various cancers
Level 3 *Demonstrates knowledge of molecular imaging findings in complex diseases*	● Evaluates disease progression in patients on immunological therapy and ^{18}F FDG PET/CT examination with understanding of pseudo progression ● Demonstrates knowledge of role of standard uptake value and KI-67 proliferation index in understanding cancer behavior
Level 4 *Applies principles of molecular imaging and radiotheranostics in complex diseases*	● Applies response criteria to ^{18}F FDG PET/CT patients, including response evaluation criteria in solid tumors, positron emission tomography response criteria in solid tumors, and immune response evaluation criteria in solid tumors ● Applies tumor metabolic trending to tumor response to treatments
Level 5 *Independently integrates principles of advanced radiotheranostic concepts into clinical practice*	● Evaluates newly approved radiotheranostic protocol and writes imaging and ordering procedures
Assessment Models or Tools	● The American Board of Radiology Subspecialty Certification Examination and/or American Board of Nuclear Medicine Certification Examination ● Direct observation ● End-of-rotation evaluation ● Exam and quiz scores ● Multisource feedback
Curriculum Mapping	●
Notes or Resources	● ACR. Practice Parameters by Modality. https://www.acr.org/Clinical-Resources/Practice-Parameters-and-Technical-Standards/Practice-Parameters-by-Modality. 2021. ● ACR. Technical Standards. https://www.acr.org/Clinical-Resources/Practice-Parameters-and-Technical-Standards/Technical-Standards. 2021. ● Published literature on SUV and KI-67 index. ● SNMMI. Clinical Guidelines. http://www.snmmi.org/ClinicalPractice/content.aspx?ItemNumber=10817&navItemNumber=10786. 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 mechanism for reporting patient safety events*	● Understands that a radiopharmaceutical administration error is a safety event and knows where and how to report such an error
Level 2 *Identifies system factors leading 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 while preparing for morbidity and mortality (M and M) presentations or 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)*	● 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 reporting and 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 ● Portfolio ● Report from radiation safety office ● Simulation
Curriculum Mapping	●
Notes or Resources	● Institute of Healthcare Improvement. http://www.ihi.org/Pages/default.aspx. 2021. ● United States Nuclear Regulatory Commission (NRC). NRC Regulations Title 10, Code of Federal Regulations. https://www.nrc.gov/reading-rm/doc-collections/cfr/index.html. 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*	● Participates in departmental or hospital QI committee ● Has participated in a QI project
Level 4 *Demonstrates skills required to identify, develop, implement, and analyze quality improvement projects*	● Participates in the analysis of a QI project
Level 5 *Creates, implements, and assesses quality improvement initiatives at 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 ● Medical record (chart audit) ● Multisource feedback ● Simulation
Curriculum Mapping	●
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 nuclear radiology imaging/procedures*	● Identifies the members of the interprofessional 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 next nuclear radiology team member
Demonstrates knowledge of population and community health needs	● Knows that patients without insurance are less likely to seek care
Level 2 *Coordinates care of patients in routine nuclear radiology imaging/procedures effectively using interprofessional teams*	● Works with other members of the nuclear radiology team (e.g., nurses, technologists) to coordinate patient imaging, but requires supervision to ensure all necessary imaging is performed
Performs safe and effective transitions of care/hand-offs in routine clinical situations	● Hands off a patient after administering a radionuclide therapy to an oncologist
Identifies specific population and community health needs for local population	● Understands that there are population differences in disease prevalence
Level 3 *Coordinates care of patients in complex nuclear radiology imaging/procedures effectively using interprofessional teams*	● Coordinates the imaging sequencing for complex cancer patients
Performs safe and effective transitions of care/hand-offs in complex clinical situations	● Prioritizes urgent patients from the intensive care unit (ICU), surgery, and medicine for imaging/procedures and hands off the plan to the team on the next shift
Identifies local resources available to meet needs of specific patient populations and community	● Identifies a community cancer outreach program
Level 4 *Role models effective coordination of patient-centered care across different disciplines and specialties*	● Role models and educates students and more junior team members regarding the engagement of the nuclear radiology team as needed for each patient, and ensures the necessary resources have been arranged

Role models safe and effective transitions of care/hand-offs	● Provides efficient hand-offs to ICU team at the end of a rapid response event that occurred in radiology ● Guides more junior residents in an effective post-procedure hand-off to the referring service
Participates in adapting practice to provide for needs of specific populations (actual or simulated)	● Coordinates and prioritizes consultant input for a new, unexpected high-risk diagnosis to ensure the patient gets appropriate follow-up ● Participates in outreach programs
Level 5 *Analyzes the process of care coordination and leads in the design and implementation of systematic improvements*	● 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
Improves the process of quality of transitions of care/hand-offs to optimize patient outcomes	● Works with a QI mentor to identify better hand-off tools or to improve teaching sessions
Leads innovations and advocates for populations and communities with health care needs	● Works with local outreach programs
Assessment Models or Tools	● Direct observation ● Learning portfolio ● Medical record (chart) audit ● Multisource feedback ● 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 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 complex health care systems (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 mechanisms for reimbursement, including types of payors	● Describes various payment systems, such as Medicare, Medicaid, the US Department of Veterans Affairs (the VA), and commercial third-party payors ● Describes various practice models
Level 2 *Describes how components of complex health care systems are interconnected and impact patient care*	● Understands that pre-authorization may impact patient care and remuneration to the health system
States relative cost of common procedures in nuclear radiology	● States relative costs of chest x-ray versus chest CT versus FDG PET/CT
Level 3 *Discusses how individual practice affects broader health care systems (e.g., length of stay, readmission rates, clinical efficiency)*	● Understands that turnaround times and poor reports may affect patient care, e.g., length of stay, which impacts the broader system
Describes technical and professional components of imaging costs	● Differentiates between the technical and professional costs of a 99mTcMDP bone scan versus FDG PET/CT
Level 4 *Manages various components of complex health care systems to provide efficient and effective patient care*	● Works collaboratively with pertinent stakeholders to improve procedural workflow ● Works collaboratively to improve informed consent for 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 a PET/CT exam ● Understands how relative value units differ between imaging exams and how they are calculated
Level 5 *Advocates for or leads systems change to enhance high-value, efficient, and effective patient 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 no smoking ordinances or enrollment in lung cancer screening program
Assessment Models or Tools	● Direct observation

	● Medical record (chart) audit ● Multiple choice test ● QI project
Curriculum Mapping	●
Notes or Resources	● Agency for Healthcare Research and Quality. 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. 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. ● 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: Radiation Safety **Overall Intent:** To demonstrate competence in and to be an advocate for radiation safety awareness	
Milestones	**Examples**
Level 1 *Demonstrates knowledge of radiation biology 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 exposure (dose)*	● Readily accesses online resources to determine a ^{99m}Tc-MDP bone scan versus 18F PET/CT average dose information.
Level 3 *Communicates the relative risk of exam-specific radiation exposure (dose) to patients and practitioners*	● Effectively communicates relative risks of the radiation exposure during a bone scan and PET/CT of the head to the patient, patient's family or referring provider
Level 4 *Applies principles of ALARA consistently in daily practice*	● Modifies parameters for an 18F PET/CT dosing based on body size in keeping with the ALARA ("as low as reasonably achievable") principles routinely in daily practice
Level 5 *Creates, implements, and assesses radiation safety initiatives at the institutional level*	● Begins a radiation safety initiative with the radiation safety officer addressing SPECT/CT studies in pediatrics
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 (OSCE)
Curriculum Mapping	●
Notes or Resources	● ACR. 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. ● ACR. Radiation Safety. https://www.acr.org/Clinical-Resources/Radiology-Safety/Radiation-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 6: Regulatory Requirements **Overall Intent:** To demonstrate understanding of regulatory requirements for nuclear radiology	
Milestones	**Examples**
Level 1 *Demonstrates awareness of the Nuclear Regulatory Commission (NRC), pertinent state-specific agencies, and methods of accreditation* *Knows the purpose and functions of radiation safety program in nuclear radiology*	● Locates relevant Nuclear Regulatory Commission (NRC) or agreement state regulations
Level 2 *Knows basic NRC regulations and state-specific laws applying to radioactive materials use, storage and disposal, definition of authorized user, and components of written directives* *Demonstrates knowledge of composition and function of Radiation Safety Committee and responsibilities of Radiation Safety Officer*	● Navigates an issue that would require knowledge of regulations and/or input from the radiation safety committee ● Identifies the role of the radiation safety officer, physicians, health/medical physics, nurses, administration, and technologists as members of the radiation safety committee
Level 3 *Applies appropriate laws and regulations to daily clinical scenarios in nuclear radiology clinic/laboratory (e.g., receives packages, performs ambient surveys)* *Knows how to disclose reportable or recordable incidents*	● Performs or can describe in detail basic radiopharmaceutical quality control testing ● Receives radioactive packages ● Performs ambient surveys ● Reports a medical event
Level 4 *Demonstrates knowledge of rules and regulations required to function as medical director of nuclear radiology unit* *Demonstrates knowledge of radiation safety inspection processes (e.g., The Joint Commission, NRC, state)*	● Understands role of authorized user on a radioactive materials license ● Can skillfully respond to common issues related to regulations/radiation protection within the nuclear radiology division ● Coordinates with radiation safety committee in addressing less-common issues including recordable versus reportable events
Level 5 Participates as a member of regulatory committee (e.g., Radiation Use Committee, Radiation Safety Committee)	● Actively participates with and assists authorized user in the preparation for and conduction of an inspection

Participates in radiation safety inspection team (e.g., The Joint Commission, NRC, state)	
Assessment Models or Tools	● Direct observation ● Documentation of QI or radiation safety project processes or outcome ● Multiple choice test ● Oral examination reviewing scenarios relating to regulations
Curriculum Mapping	●
Notes or Resources	● RSO/radiation safety team at home institution ● State specific regulations website ● NRC. https://www.nrc.gov/. 2021. (10 CFR Part 20 and 35) ● NRC. Frequently Asked Questions About Licensing Medical Uses of Byproduct Material Under Revised 10 CFR Part 35. https://www.nrc.gov/materials/miau/med-use-toolkit/faqs-part35.html. 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 best imaging examination for routine patient/diagnosis*	● Understands the importance of imaging safety literature and websites
Level 2 *Articulates clinical questions and elicits patient preferences and values to guide evidence-based imaging*	● Identifies patients with conditional risks for PET/CT safety, radiation safety, or contrast use, including in pregnancy and renal failure
Level 3 *Locates and applies best available evidence, and integrates with patient preferences and values, to care for complex patients*	● Uses radiology literature to determine patient safety, radiation safety, or contrast use
Level 4 *Critically appraises conflicting evidence to guide care as tailored to individual patient*	● Knows how to direct the clinical team for atypical situations in imaging, including ventilation–perfusion scan in pregnant patients
Level 5 *Coaches others to critically appraise and apply evidence for complex patients and/or participates in development of guidelines*	● Writes or revises department policy on SPECT/CT and PET/CT safety, radiation safety, or contrast use according to best practices
Assessment Models or Tools	● Direct observation ● Learning portfolio ● Oral or written examination ● Simulation (OSCE)
Curriculum Mapping	●
Notes or Resources	● American Board of Radiology (ABR). 2019 Noninterpretive Skills Study Guide. https://www.theabr.org/wp-content/uploads/2018/11/NIS-Study-Guide-2019.pdf. 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 ● Moriates C, Arora V, Shah N. *Understanding Value Based Healthcare*. 1st ed. New York, NY: McGraw Hill Education; 2015. ● National Institutes of Health (NIH). PubMed Online Training. https://www.nlm.nih.gov/bsd/disted/pubmedtutorial/cover.html. 2021. ● NIH. Write Your Application. https://grants.nih.gov/grants/how-to-apply-application-guide/format-and-write/write-your-application.htm. 2021.

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 *Is 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 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 gap(s) between expectations and actual performance* *Designs and implements 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 which they have dictated reports

Analyzes effectiveness of behavioral changes as appropriate, and considers alternatives in narrowing gap(s) between expectations and actual performance *Uses performance data to measure effectiveness of learning plan and, when necessary, improves it*	● Consistently identifies learning gaps and addresses areas to work on ● 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 practices* *Facilitates 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 ● Provides relevant learning plans 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*	● 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
Demonstrates knowledge of ethical principles underlying informed consent, surrogate decision making, advance directives, confidentiality, error disclosure, and stewardship of limited resources	● 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 therapeutic procedures
Level 2 *Demonstrates insight into professional behavior in routine situations and takes responsibility for own professionalism lapses*	● 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
Analyzes straightforward situations using ethical principles	● Articulates strategies for preventing similar lapses in the future
Level 3 *Demonstrates professional behavior in complex or stressful 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 need to seek help in managing and resolving complex ethical situations	● 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 self and others* *Recognizes and uses appropriate resources for managing and resolving ethical dilemmas as needed*	● 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 subcommittee, 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 ● 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. ● American Medical Association (AMA). Ethics. https://www.ama-assn.org/delivering-care/ethics. 2021. ● Association of University Radiologists (AUR). Professionalism and Ethics Competencies for Radiology Residents. https://www.aur.org/resources/professionalism-and-ethics-competencies. 2021. ● AUR. Professionalism Curriculum Resources. http://www.aur.org/ProfessionalCurriculum/. 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 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*	● Takes responsibility for getting informed consent for a procedure
Level 2 *Performs tasks and responsibilities in a timely manner to ensure that 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 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 ● On-call example: advises more junior residents how to manage their time, communicate effectively, and guide ordering providers and other team members 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 ● Self-evaluations ● Simulation
Curriculum Mapping	●
Notes or Resources	● Code of conduct from institutional manual ● 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 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 knowledge/skills of self or team, with assistance*	● Requests and/or accepts feedback and exhibits positive responses to corrective feedback ● Is aware of or can identify one's own potential stressors, or stressors prevalent in this specialty
Level 2 *Independently recognizes status of personal and professional well-being using available resources, as appropriate* *Independently recognizes limits in 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 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 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. Rather, the intent is to ensure that each fellow has the fundamental knowledge of factors that impact well-being, the mechanism by which those factors impact well-being, and available resources and tools to improve well-being. ● ACGME. "Well-Being Tools and Resources." https://dl.acgme.org/pages/well-being-tools-resources. 2021. ● American Academy of Pediatrics (AAP). 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 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 need to retreat metastatic cancer with a radiopharmaceutical
Level 2 *Identifies barriers to effective communication* *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 them if they are 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 bias about sexuality and identity ● With guidance, communicates with a patient the presence of a potentially metastatic lesion in the femur on bone scan; after discussion with the patient, recommends obtaining radiographs to characterize the lesion and assess fracture potential
Level 4 *Actively minimizes communication barriers* *Independently, uses shared decision making to align patient goals, and preferences with treatment options to create a personalized care plan*	● Takes responsibility and apologizes after using wrong pronoun with a patient ● Independently communicates with a patient the presence of a potentially metastatic lesion in the femur on bone scan; after discussion with the patient, recommends obtaining radiographs to characterize the lesion and assess fracture potential
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

Coaches other learners in shared decision making	● Role models proactive self-awareness and reflection around biases with a context-specific approach to mitigating communication barriers ● Leads shared decision making with clear recommendations to patients and families even in more complex clinical situations
Assessment Models or Tools	● Direct observation ● Multisource feedback ● Self-assessment including self-reflection exercises ● Simulation ● Standardized patients or structured case discussions
Curriculum Mapping	●
Notes or Resources	● Laidlaw A, Hart J. Communication skills: an essential component of medical curricula. Part I: Assessment of clinical communication: AMEE Guide No. 51. *Med Teach*. 2011;33(1):6-8. https://www.tandfonline.com/doi/full/10.3109/0142159X.2011.531170. 2021. ● Symons AB, Swanson A, McGuigan D, Orrange S, Akl EA. A tool for self-assessment of communication skills and professionalism in residents. *BMC Med Educ*. 2009;9:1. https://bmcmededuc.biomedcentral.com/articles/10.1186/1472-6920-9-1. 2021.

Interpersonal and Communication Skills 2: 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 institutional and national communication guidelines*	● Accepts a request to do an inpatient examination and offers to discuss with the attending without offering resistance ● Documents communication of findings to the health care team
Level 2 *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 3 *Checks understanding of recommendations when providing consultation* *Communicates non-emergent findings where failure to act may adversely affect patient outcome*	● Discusses with referring provider the management of a nephrostomy tube on diuretic renogram ● Communicates finding a lung nodule on attenuation corrected CT of the chest and suggests a diagnostic chest CT
Level 4 *Coordinates recommendations from different members of the health care team to optimize patient care* *Communicates findings and management options, as appropriate, tailored to the referring provider*	● Coordinates multidisciplinary input for procedure optimization ● Identifies possible brain lesion on PET/CT, recommends follow-up imaging studies, and communicates with provider
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*	● Integrates role of nuclear radiologists within the multidisciplinary team ● Coaches more junior residents in subspecialty level communications
Assessment Models or Tools	● Direct observation ● End-of-rotation evaluation ● 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. ● 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 nuclear 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 reporting 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*	● Works within a multidisciplinary team to facilitate a ^{90}Y microspheres therapy program
Assessment Models or Tools	● Assessment of QI projects ● 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. ● 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: Patient and Personnel Safety (Diagnostic and Procedural)	SBP1: Patient Safety SBP5: Radiation Safety
PC2: Diagnostic Examinations: Patient Selection, Preparation, Examination Supervision, and Image Interpretation	PC1: Diagnostic Non-Cardiac Examinations PC2: Diagnostic Cardiac Examinations
PC3: Radionuclide Therapies: ^{131}I for Benign and Malignant Disease, Parenteral Therapies – Patient Selection, Preparation, Evaluation, Monitoring, and Follow-up	PC3: Radiopharmaceutical Therapies: Oral ^{131}I NaI and Parenteral
MK1: Anatomy, Physiology, and Pathophysiology	
MK2: Physics and Instrumentation	MK1: Physics and Instrumentation
MK3: Radiopharmaceuticals	MK2: Radiopharmaceuticals and Pharmaceuticals
	MK3: Molecular Imaging and Radiotheranostics
SBP1: Regulatory Requirements	SBP6: Regulatory Requirements
SBP2: Health Care Economics	SBP4: Physician Role in Health Care Systems
SBP3: Quality Improvement	SBP2: Quality Improvement
	SBP3: System Navigation for Patient-Centered Care
PBLI1: Self-Directed Learning	PBLI1: Evidence-Based and Informed Practice PBLI2: Reflective Practice and Commitment to Professional Growth
PBLI2: Scholarly Activity	
PROF1: Individual	PROF1: Professional Behavior and Ethical Principles PROF3: Self-Awareness and Help-Seeking
PROF2: Systems	PROF2: Accountability/Conscientiousness PROF3: Self-Awareness and Help-Seeking
ICS1: Effective Communication with Patients, Families, and Caregivers	ICS1: Patient- and Family-Centered Communication
ICS2: Effective Communication with Members of the Health Care Team (Written and Oral)	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/