The Musculoskeletal Radiology Milestone Project

A Joint Initiative of

The Accreditation Council for Graduate Medical Education and

The American Board of Radiology





February 2014

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

Musculoskeletal Radiology Milestones

Chair: Donald J. Flemming, MD

Working Group

Laura Edgar, EdD, CAE

Elaine Gould, MD

Charles S. Resnik, MD

Carolyn M. Sofka, MD

Corrie M. Yablon, MD

Advisory Group

Gary Becker, MD

Lawrence P. Davis, MD, FACR

Louis Ling, MD

Kay H. Vydareny, MD

Milestone Reporting

This document presents milestones designed for programs to use in semi-annual review of fellow performance and reporting to the ACGME. Milestones are knowledge, skills, attitudes, and other attributes for each of the ACGME competencies organized in a developmental framework from less to more advanced. They are descriptors and targets for fellow performance as a fellow moves from entry into fellowship through graduation. In the initial years of implementation, the Review Committee will examine milestone performance data for each program's fellows as one element in the Next Accreditation System (NAS) to determine whether fellows overall are progressing.

For each period, review and reporting will involve selecting milestone levels that best describe a fellow's current performance and attributes. Milestones are arranged into numbered levels. Tracking from Level 1 to Level 5 is synonymous with moving from novice to expert in the subspecialty.

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

- **Level 1:** The fellow demonstrates milestones expected of an incoming fellow.
- **Level 2:** The fellow is advancing and demonstrates additional milestones, but is not yet performing at a mid-fellowship level.
- **Level 3:** The fellow continues to advance and demonstrate additional milestones, consistently including the majority of milestones targeted for fellowship.
- **Level 4:** The fellow has advanced so that he or she now substantially demonstrates the milestones targeted for fellowship. This level is designed as the graduation target.
- **Level 5:** The fellow has advanced beyond performance targets set for fellowship and is demonstrating "aspirational" goals which might describe the performance of someone who has been in practice for several years. It is expected that only a few exceptional fellows will reach this level.

Additional Notes

Level 4 is designed as the graduation *target* and *does not* represent a graduation *requirement*. Making decisions about readiness for graduation is the purview of the fellowship program director. Study of Milestone performance data will be required before the ACGME and its partners will be able to determine whether milestones in the first four levels appropriately represent the developmental framework, and whether Milestone data are of sufficient quality to be used for high-stakes decisions.

Examples are provided with some milestones. Please note that the examples are not the required element or outcome; they are provided as a way to share the intent of the element.

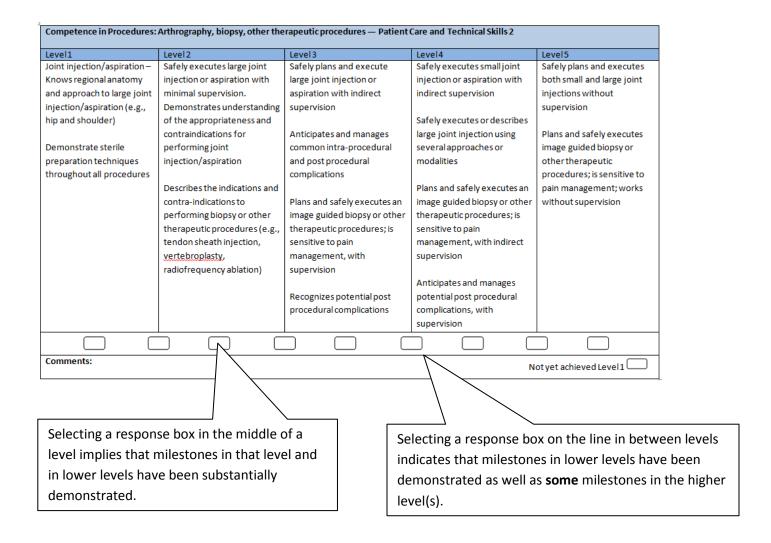
Some milestone descriptions include statements about performing independently. These activities must occur in conformity to the ACGME supervision guidelines, as well as to institutional and program policies. For example, a fellow who performs a procedure independently must, at a minimum, be supervised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

Answers to Frequently Asked Questions about the Next Accreditation System and Milestones are posted on the Next Accreditation System section of the ACGME website.

Radiology Subspecialty Assessment tools:

- End-of-Rotation Global Assessment
- Direct observation and feedback
- Reading out with resident
- Review of reports
- Rate of major discrepancies
- Self-Assessment and Reflections/Portfolio
- OSCE/simulation
- Completion of institutional safety modules, BCLS/ACLS
- Case/Procedure Logs, including complications
- Multi-Source Evaluations

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



Patient Safety — Patient Care 1				
Level 1	Level 2	Level 3	Level 4	Level 5
Radiation safety: Aware of national and	Radiation safety: Accesses resources to	Radiation safety: Knows exam-specific radiation	Radiation Safety: Modifies computed	Radiation safety: Develops and teaches
departmental guidelines for	determine exam-specific	doses; uses this information to	tomography (CT) protocols and	departmental and or national
patient safety, including "time-	average radiation dose	tailor examinations to specific	patient positioning to lower	guidelines for patient safety
out," contrast safety, hand-	information; communicates	patients	radiation dose to patient	gardenies for patient surety
washing, and "hand-offs"	relative risk of exam-specific	•	·	
_	radiation exposure to patients	Utilizes alternative modalities to		
Demonstrates understanding of As	and practitioners	reduce radiation risk to patients		
Low As Reasonably Achievable				
(ALARA) principles and Image				
Wisely® and Image Gently®				
initiatives				
Magnetic Resonance (MR) Safety: Describes MR safety risks, anticipates risks, and demonstrates knowledge of MR imaging complications, MR safety zones, and pre-MR screening	MR Safety: Knows the effects of different magnet strengths on implanted devices and retained metal	MR Safety: Anticipates and recognizes patient-specific risks for MR complications (e.g., radio frequency [RF] burns)	MR Safety: Teaches MR Safety to technologists, residents, and other departments	MR Safety: Develops and teaches departmental and or national guidelines for MR safety
Accesses resources to determine the MR safety of implanted devices and retained metal	Assesses the risks of sedated MR exams, performing MR exams on pregnant and pediatric patients			
Contrast Agents: Recognizes and manages contrast reactions; knows appropriate renal function laboratory values for MR contrast administration; understands nephrogenic systemic fibrosis	Contrast Agents: Assesses the risks of using contrast in pregnant patients, and chooses alternate modalities	Contrast Agents: Uses the various gadolinium- based and iodinated contrast agents appropriately, and understands the advantages and risks of each	Contrast Agents: Teaches junior learners and staff members about contrast use and management of contrast complications	Contrast Agents: Performs research on expanded use of known and or novel contrast agents
Comments:			-	Not yet achieved Level 1

Consultant — Patient Care and Technical Skills 1				
Level 1	Level 2	Level 3	Level 4	Level 5
Independently recommends	Independently recommends	With some supervision,	Independently recommends	Operates at the level of expert
appropriate imaging of	appropriate imaging of	recommends appropriate	appropriate imaging of	subspecialty consultant in his
common general conditions	common musculoskeletal	imaging of uncommon	uncommon_musculoskeletal	or her practice
	conditions (e.g., osteomyelitis,	musculoskeletal conditions	conditions	
	trauma, metastatic disease)	(e.g., primary bone tumors,		Provides consultation at a
		post- operative complications)		regional, national, or
				international level
Comments:			N	Not yet achieved Level 1

Competence in Procedures: A	Competence in Procedures: Arthrography, Biopsy, other Therapeutic Procedures — Patient Care and Technical Skills 2				
Level 1	Level 2	Level 3	Level 4	Level 5	
Knows regional anatomy and	Safely executes large joint	Safely plans and executes large	Safely executes small joint	Safely plans and executes	
approach to large joint	injection/aspiration with	joint injection/aspiration with	injection/aspiration with	both small and large joint	
injection/aspiration (e.g., hip	minimal supervision	indirect supervision	indirect supervision	injections without supervision	
and shoulder)					
	Demonstrates understanding	Anticipates and manages	Safely executes or describes	Plans and safely executes	
Demonstrates sterile	of the appropriateness and	common intra-procedural and	large joint injection using	image-guided biopsy or other	
preparation techniques	contraindications for	post-procedural complications	several approaches or	therapeutic procedure; is	
throughout all procedures	performing joint		modalities	sensitive to pain	
	injection/aspiration	Plans and safely executes an		management; works without	
		image-guided biopsy or other	Plans and safely executes an	supervision	
	Describes the indications and	therapeutic procedure; is	image-guided biopsy or other		
	contra-indications to	sensitive to pain management,	therapeutic procedure; is		
	performing biopsy or other	with supervision	sensitive to pain management,		
	therapeutic procedures (e.g.,		with indirect supervision		
	tendon sheath injection,	Recognizes potential post-			
	vertebroplasty, radiofrequency	procedural complications	Anticipates and manages		
	ablation)		potential post-procedural		
			complications with supervision		
Comments:			No	ot yet achieved Level 1	

Level 1	Level 2	Level 3	Level 4	Level 5
Demonstrates basic	Demonstrates basic knowledge	Demonstrates advanced	Teaches basic biomechanics	Advances knowledge of
knowledge of image	of biomechanics and application	knowledge of biomechanics and	and application to mechanisms	musculoskeletal
acquisition (positioning,	to injury patterns and image	its application to injury patterns	of injury	conditions through
technique, and artifacts),	acquisition (e.g., flexion and	and radiographic findings		research and
views, and radiographic	extension views)		Provides feedback to technical	presentation at local,
anatomy		Understands and appropriately	staff members and other	national, and
	Demonstrates knowledge of	uses more advanced or less	learners regarding film	international meetings
Recognizes common	usual radiographic presentations	commonly obtained views	acquisition in complex cases	
musculoskeletal conditions	of common musculoskeletal			Teaches peers, or at a
with obvious findings (e.g.,	diseases, both bone and soft	Recognizes subtle findings and	Teaches junior learners how to	regional/national level
fracture, joint effusion)	tissue, in pediatric and adult	integrates information leading to	recognize subtle findings and	about radiographic
	populations (e.g., typical	appropriate diagnosis, imaging,	give an approach to	appearance of
Demonstrates basic	arthritis, tumors, infection,	and clinical management in	radiographic analysis	orthopaedic procedure
knowledge of bone	metabolic bone disease)	complex cases		and hardware
physiology			Teaches bone physiology;	
	Recognizes differences between	Distinguishes clinically relevant	understands drug- and	
Recognizes normal post-	normal variants and pathology	from benign incidental findings	treatment-induced changes in	
operative findings of		(e.g., non-ossifying fibroma or	bone	
common orthopaedic	Recognizes obvious immediate	bone island)		
procedures and hardware	and delayed complications of		Demonstrates a comprehensive	
(e.g., anterior cruciate	orthopaedic hardware (e.g.,	Recognizes subtle immediate	understanding of orthopaedic	
ligament [ACL]	periprosthetic fracture or gross	and delayed complications of	procedures (i.e., how they are	
reconstruction, total hip	loosening)	orthopaedic hardware	performed and why) and their	
arthroplasty, fracture			radiographic presentation	
fixation)				

Level 1	Level 2	Level 3	Level 4	Level 5
Recognizes normal	Demonstrates knowledge of	Recognizes subtle findings and	Defines more advanced	Conducts research on cross-
appearance of tissues,	usual imaging presentations	integrates imaging information	imaging findings, such as post-	sectional imaging, and
anatomy, and common	and injury patterns of	leading to the appropriate	operative appearance (e.g.,	presents findings at local,
artifacts on all cross	common musculoskeletal	diagnosis, with additional imaging	post-tumor resection and	national, and/or internation
sectional modalities	diseases (e.g., sports injuries,	as needed and clinical	treatment changes, ACL	meetings
	trauma, tumor, infection,	management in complex cases	revision)	
Recognizes abnormal MR	arthritides)			
signal, CT attenuation, US		Demonstrates anatomical	Describes detailed anatomy	
echotexture	Differentiates between	knowledge specific to the	(e.g., extrinsic carpal	
	normal reparative physiology	musculoskeletal system, (e.g.,	ligaments, muscles and	
Understands the normal	of bone, marrow, and soft	course of peripheral nerves,	ligaments of the pelvis,	
post-operative findings of	tissue vs. pathology as	tendons, muscles)	accessory muscles)	
common orthopaedic	demonstrated on cross-			
procedures and hardware	sectional imaging; integrates	Efficiently recognizes and	Demonstrates a	
(e.g., ACL reconstruction,	all prior imaging studies into	characterizes abnormal findings,	comprehensive understanding	
total hip arthroplasty,	constructing a pertinent	leading to increased clinical	of orthopaedic procedures	
intramedullary rod)	differential diagnosis	productivity (increased accuracy	(i.e., how they are performed	
		and speed)	and why) and their cross-	
	Recognizes the majority of		sectional imaging	
	immediate and delayed	Distinguishes clinically relevant	presentation	
	complications of orthopaedic	from benign incidental findings		
	hardware (periprosthetic	(e.g., non-ossifying fibroma or		
	fracture or gross loosening)	bone island)		
	as demonstrated on cross-			
	sectional imaging	Recognizes subtle immediate and		
		delayed complications of		
		orthopaedic hardware		

evel 1	Level 2	Level 3	Level 4	Level 5
Demonstrates basic	Demonstrates a basic	Demonstrates advanced	Provides feedback to technical	Designs protocols tailored to
knowledge of image	knowledge of advanced MR	knowledge of protocol	staff members and other	specific imaging conditions
acquisition (MR pulse	and CT safety, MR pulse	selection, tailoring protocols to	learners regarding image	
sequences, physics, basic CT	sequences (e.g., gradient echo	individual patients, adjusting	acquisition and optimization,	Design software or coils
physics)	imaging, MR and CT	parameters to image around	and coil selection in complex	
	arthrography, radial imaging)	hardware, and minimize	cases	
Demonstrate knowledge of	and utilization of contrast	artifacts		
pasic ultrasound physics	material (both intravenous and			
and artifacts	intra-articular) when			
	appropriate			
	Understands appropriate			
	probe selection for the			
	performance of			
	musculoskeletal ultrasound			
	studies			

Quality Improvement (QI) —	Systems-based Practice 1			
Level 1	Level 2	Level 3	Level 4	Level 5
Describes specialty-specific	Incorporates specialty-specific	Works in inter-professional	Participates in identifying	Leads a team in the design
QI initiatives	QI into clinical practice	teams to enhance patient	system errors and	and implementation of a QI
		safety and improve patient	implementing potential	project for the subspecialty
Describes the departmental	Participates in the	care quality	systems solutions	program
incident/occurrence	departmental			
reporting system	incident/occurrence reporting			Routinely participates in root
	system			cause analysis
Comments:			١	Not yet achieved Level 1

Healthcare Economics — Syst	ems-based Practice 2			
Level 1	Level 2	Level 3	Level 4	Level 5
Describes the technical and professional components of imaging costs in the subspecialty division	Understands departmental cost savings initiatives	Understands revenue cycle Creates reports that contain the elements necessary to support exam coding	Describes billing and coding of subspecialty-specific exams, and recognizes and corrects incorrect coding	Participates in creating evaluation and re-evaluation of CPT codes
Comments:			N	lot yet achieved Level 1

Self-directed Learning — Practice-based Learning and Improvement 1				
Level 1	Level 2	Level 3	Level 4	Level 5
Is aware of one's own level	Continually seeks and	Demonstrates a balanced and	Performs self-directed	Develops an educational
of knowledge and expertise	incorporates feedback to	accurate self-assessment of	learning with little external	curriculum and/or assessment
and uses feedback from	improve performance	competence; investigates	guidance using evidence-	tools
teachers, colleagues, and		clinical outcomes and areas for	based information	
patients	Develops a learning plan and	continued improvement		
	uses published review articles		Develops a process to remain	
	and guidelines	Selects evidence-based	current in knowledge over	
		information to answer specific	time	
	Assesses and provides	questions		
	feedback to junior learners		Organizes educational	
			activities	
Comments:			N	Not yet achieved Level 1

Scholarly Activity — Practice-	Scholarly Activity — Practice-based Learning and Improvement 2				
Level 1	Level 2	Level 3	Level 4	Level 5	
Demonstrates critical	Critically reviews and	Makes progress on scholarly	Demonstrates understanding	Independently plans and	
thinking skills and	interprets the literature with	project	of basic statistical analyses and	executes research project	
understands research design	the ability to identify study		epidemiology		
	aims, hypotheses, design, and	Applies the principles of ethics		Explores funding mechanisms	
Demonstrates knowledge of	biases	and good clinical practice to	Presents completed scholarly	on local, regional, and	
basic principles underlying		the protection of human	project to peers for review and	national levels	
the ethical conduct of	Identifies a mentor and a	subjects recruited to	critique		
research and the protection	potential scholarly project	participate in research		Obtains extramural funding	
of Human Subjects				for research study	
		Analyzes data			
Maintains data safety and					
patient monitoring to ensure					
continued protection of					
Human Subjects					
Comments:			No	ot yet achieved Level 1	

Individual — Professionalism 1				
Level 1	Level 2	Level 3	Level 4	Level 5
Is an effective health care team	Actively reflects on personal	Is an effective health care	Serves as a role model for	Mentors others regarding
member, promoting primacy of	professional behavior and	team leader, promoting	professional behavior as	professionalism and ethics
patient welfare, patient	discusses professionalism	primacy of patient welfare,	identified in Level 1	
autonomy, and social justice	issues, as identified in Level	patient autonomy, and social		
	1, with students and	justice		
Demonstrates the following	residents			
professional behaviors:				
■ is truthful				
recognizes personal				
limitations and seeks help				
when appropriate				
recognizes personal				
impairment and seeks help				
when needed				
responds appropriately to				
constructive criticism				
places needs of patients				
before self				
maintains appropriate				
boundaries with patients,				
colleagues, and others				
exhibits tolerance and				
acceptance of diverse				
individuals and groups				
Comments:				Not yet achieved Level 1

evel 1	Level 2	Level 3	Level 4	Level 5
s an effective health care	Recognizes opportunities to	Is an effective health care team	Serves as a role model for	Accepts leadership roles in
eam member that	improve professionalism in the	leader, promoting	professional behavior as	institutional, regional, and
lemonstrates the following	workplace, and takes part in	departmental and institutional	identified in Level 1	national organizations to
professional behaviors:	programs to improve clinical	goals regarding primacy of		advance professionalism
recognizes the	care and professional behavior	patient welfare, patient		
importance and priority	as identified in Level 1	autonomy, and social justice		
of patient care and				
advocates for patient				
interests				
fulfills work-related				
responsibilities				
maintains patient				
confidentiality				
fulfills Institutional and				
Program Requirements				
related to				
professionalism and				
ethics				
prepares for and attends				
required conferences				

Level 1	Level 2	Level 3	Level 4	Level 5
Exhibits basic	Communicates complex and	Working with program faculty	Serves as a role model for	Develops models and
communication skills and,	difficult information, such as	members, oversees and	effective and compassionate	guidelines for communication
with indirect supervision,	medical errors, complications,	teaches other more junior	communication for other	and seeks leadership
can effectively communicate	and adverse events, associated	learners on how to	more junior learners	opportunities in the
patient information in non-	with biopsy and/or high-risk	communicate effectively with		department and/or national
stressful situations (e.g.,	procedures (e.g., providing an	patients, families, and		professional organizations
obtaining informed consent)	unexpected grave diagnosis	caregivers		
for routine joint	(tumor) or describing risks for			
injection/aspiration	a complex procedure (C1			
	puncture)			

Effective Communication with Members of the Health Care Team (Written and Oral) — Interpersonal and Communication Skills 2							
Level 1	Level 2	Level 3	Level 4	Level 5			
Efficiently generates clear	Efficiently generates clear and	Working with program faculty	Generates tailored reports	Develops report templates			
and concise reports that do	concise reports that do not	members, oversees and	meeting the specific needs of				
not need substantial faculty	need substantial faculty	teaches other more junior	the referring physicians	Independently leads			
member corrections in	member corrections in all	learners on how to generate		departmental and			
common cases	cases	clear and concise reports	Serves as a role model for	interdisciplinary teaching			
			effective and professional	conferences			
Communicates effectively	Communicates effectively and	Working with program faculty	communication				
and professionally in most	professionally in all situations	members, oversees and		Develops models and			
stressful situations		teaches other more junior	With faculty member	guidelines for written and oral			
	Effectively manages transitions	learners on how to	supervision, helps to organize	communications and seeks			
	of care and patient hand-offs	communicate effectively and	departmental and	leadership opportunities in			
		professionally	interdisciplinary teaching	the department and/or			
			conferences	regional, national, or			
		Actively participates in		international professional			
		departmental and		organizations			
		interdisciplinary teaching					
		conferences					
Comments: Not yet achieved Level 1							