Improving the Assessment of Resident Competency

Physical Medicine and Rehabilitation Milestones 2.0

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Abstract: In 2015, the Accreditation Council for Graduate Medical Education published the Physical Medicine and Rehabilitation Milestones 1.0 as part of the Next Accreditation System. This was the culmination of more than 20 yrs of work on the part of the Accreditation Council for Graduate Medical Education to improve graduate medical education competency assessments. The six core competencies were patient care, medical knowledge, systems-based practice, practice-based learning and improvement, professionalism, and interpersonal and communication skills. While providing a good foundation for resident assessment, the Physical Medicine and Rehabilitation Milestones 1.0 was not without faults. With input from program directors, national organizations, and the public, the Physical Medicine and Rehabilitation Milestones 2.0 strives to further advance resident assessment, providing improvements through the integration of the harmonized Milestones and the addition of a supplemental guide.

Key Words: Education, ACGME, Milestones, Resident, Resident Assessment

(*Am J Phys Med Rehabil* 2021;100:S45–S50)

In 2015, the Accreditation Council for Graduate Medical Education (ACGME) published the Physical Medicine and Rehabilitation (PM&R) Milestones 1.0 as part of the Next Accreditation System (NAS). This was the culmination of more than 20 yrs of work on the part of the ACGME to improve graduate medical education competency assessments. The six core competencies were patient care (PC), medical knowledge (MK), systems-based practice (SBP), practice-based learning and improvement (PBLI), professionalism (PROF), and interpersonal and communication skills (ICS). These competencies were initially endorsed by the American Board of Medical Specialties and ACGME in 1999 but proved to be difficult to integrate into the graduate medical education programs of assessment because there was not a shared mental model of what they meant within each specialty. The ACGME initially instructed residency programs to establish assessment methods for the integration of the competencies into the resident curriculum. To facilitate this, the ACGME created a "toolbox" of online evaluation methodologies for programs to use as a basis of their assessments. This system, however, was proved to be cumbersome and was shown in peer review to be lacking when directly assessing the six core competencies.[1] Of this conundrum, the ACGME Milestones project was born. The milestones were officially launched for the first five core specialties in 2013, and by June 2016, milestones for the other core specialties were launched.[2]

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Financial disclosure statements have been obtained, and no conflicts of interest have been reported by the authors or by any individuals in control of the content of this article.

ISSN: 0894-9115
DOI: 10.1097/PHM.0000000000001650

CREATION OF PM&R MILESTONES 1.0

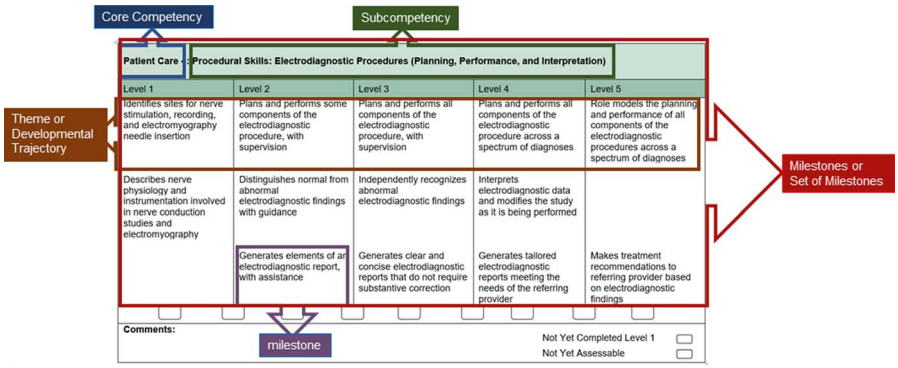
In 2011, a 12-member working committee representing the Residency and Fellowship Program Directors Council of the Association of Academic Physiatrists, the American Academy of Physical Medicine and Rehabilitation, the ACGME PM&R residency review committee, and the American Board of Physical Medicine and Rehabilitation was formed with the goal of creation of the initial set of PM&R milestones. Milestones were defined by the ACGME as "competency-based developmental outcomes (eg, knowledge, skills, attitudes, and performance) that can be demonstrated progressively by residents and fellows from the beginning of their education through graduation to unsupervised practice within their specialties."[2] The committee used current resident curricula,[3] ACGME Program Requirements for PM&R, certification examination outlines, and literature reviews as the basis for their work. Through an iterative process, they produced PM&R specific subcompetencies. The Milestones were organized under the six core competencies, with multiple subcompetencies created for all except MK and numbered accordingly (ie, PC 1–7, MK 1, SBP1–3, PBL 1–3, PROF1–3, and ICS 1–2). The structure and scoring of each subcompetency was based on a five-level framework (Figs. 1, 2).[4] Level 1 represented the skills and functionality of a beginning resident, levels 2 and 3 were marked as intermediate steps, and level 4 represented a graduating resident. Level 5 described the aspirational goals of a resident who went above and beyond the normal expectations of a graduating senior.[5] Importantly, it was not the intention that the Milestone levels would correspond to the year of training. Rather, the Milestones were designed to enable the learner and the faculty of the training program to form a shared

Milestone Description: Template				
Level 1	Level 2	Level 3	Level 4	Level 5
What are the expectations for a beginning resident?	What are the milestones for a resident who has advanced over entry, but is performing at a lower level than expected at mid-residency?	What are the key developmental milestones mid-residency? What should they be able to do well in the realm of the specialty at this point?	What does a graduating resident look like? What additional knowledge, skills & attitudes have they obtained? Are they ready for certification?	Stretch Goals – Exceeds expectations
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐				
Comments:				

FIGURE 1. Milestone template describing the outline for how a Milestone progresses from level 1 (a beginning resident) to level 5 (aspirational resident with skills past that of the average graduating resident).

mental model for the expected trajectory of competency development over time. Level 4 Milestones were designed as a graduation target, with the expectation that a senior resident would achieve a level 4 on a "substantial" number of the Milestones by the time of graduation. However, it was expected that decisions regarding advancement from one level of training to the next, and decisions pertaining to readiness to practice would be based upon multiple sources of data (eg, 360 assessments, Resident Observation and Competency Assessment [ROCA's], Objective Structured Clinical Examination [OSCE's], examination scores). It was also understood that an individual resident might move up or down levels within the subcompetencies as they progressed through different rotations for a wide assortment of reasons (including the possible sign of a struggling resident). For example, a trainee might demonstrate different levels of competence and autonomy with PC in different clinical settings or as a result of variable faculty feedback and encouragement. In addition, depending on the structure of the training program, previously demonstrated gains in procedural skills might be lost without frequent repetition. In other cases, a resident might demonstrate behavioral changes or lapses in PROF over a period of time related to stress or life changes.

The initial draft of the Milestones document was then presented for residency program directors. Comments and suggestions were tabulated, and modifications to the Milestones were made with these in mind. Once finalized, the PM&R Milestones 1.0[6] were then disseminated to programs by the ACGME. Under NAS, each program was instructed to form a clinical competency committee (CCC), which would review the Milestone data (as well as additional sources of relevant information) for each PM&R resident within the program semiannually. The results of the CCC review were then shared with the program director, who used the report as a basis for decision making regarding advancement of each resident to the next level of training, readiness



Definitions	
Milestones or Set of Milestones	Describes performance levels residents and fellows are expected to demonstrate for skills, knowledge, and behaviors in the six Core Competency domains
Core Competency	One of the six domains of educational and clinical knowledge, skills, and attitudes that physicians must develop for independent and autonomous practice of a specialty or subspecialty.
Subcompetency	A specific content area that incorporates skills, knowledge, and/or behaviors under one of the Core Competencies
Theme or Developmental Trajectory	Skill, knowledge, or behavior that progresses from Novice to Advanced Beginner, to Competent to Proficient to Expert Resident
milestone	Significant point in development along a developmental trajectory

FIGURE 2. Example of a Milestone with graphical and descriptive definitions of the different components that make up a Milestone.

for graduation, and/or (if appropriate) need for intervention or remediation. The Milestone data were then reported to the ACGME through an electronic database to allow for a national report and further research efforts.

LIMITATIONS OF THE INITIAL MILESTONES

It is important to note that the ACGME anticipated that there would be Milestone revisions over time based on feedback from stakeholders and evolution of technology and clinical practice. The initial plan was for all Milestones to be reviewed and updated every 3–5 yrs. In late 2018, the ACGME surveyed PM&R program directors and coordinators about the PC and MK subcompetencies using their level of agreement with the following statements:

1. This Milestone set represents a realistic progression of knowledge, skills, and behaviors.
2. This Milestone set discriminates between meaningful levels of competency.
3. This Milestone set should be edited.
4. This Milestone set should be deleted.
5. Additional content should be embedded in this Milestone set.
6. I am able to evaluate my resident's skills on this Milestone set.

Feedback was also obtained from interviews with CCC's, ACGME led focus groups (including program directors, program coordinators, CCC members, residents, and other educators) and the Milestones summit. A consistent thread throughout much of this feedback had to do with complexity of the Milestones. Assessors described difficulty in applying the Milestones consistently to residents on different rotations. There were significant differences noted in the Milestones of similar specialties, making

TABLE 1. Timeline of events: Milestones 1.0–2.0

2015	PM&R Milestones 1.0 Released
2016	Multidisciplinary workgroups convened for harmonized Milestones for SBP, PBLI, PROF, ICS
	Harmonized Milestones developed and submitted for stakeholder feedback
	ACGME Milestones Summit convened
2017	Harmonized Milestones submitted for public comment and further refined
2018	Survey of PMR Program Directors and Coordinators about PC and MK Milestones
	PM&R Milestones 2.0 workgroup convened to revise PC and MK Milestones and adapt harmonized SBP, PBLI, PROF and ICS Milestones for PM&R context
2019	Draft PM&R Milestones 2.0 developed and submitted for public comment
	PM&R Supplement Guide drafted by PM&R Milestones 2.0 workgroup
2020	Stakeholder feedback on PM&R Milestones 2.0 and implementation timeline from the Association of Academic Physiatrists Residency and Fellowship Program Directors Council
2021	Anticipated release of PM&R Milestones 2.0 effective July 2021
2022	Anticipated first reporting of PM&R Milestones 2.0 due in January 2022

TABLE 2. Table of PM&R Milestone 2.0 subcompetencies

PC	PC-1 (Physiatric History)	PC-2 (Physical Examination)	PC-3 (Medical Management)	PC-4 (Procedural Skills: Injections for Tone and Movement)	PC-5 (Procedural Skills: Joint and Soft Tissue Injections)	PC-6 (Procedural Skills: Electrodiagnosis)	PC-7 (Assistive Technologies)	PC-8 (Rehabilitation Interventions)
MK	MK-1 Foundational principles of physiatric practice	MK-2 Clinical reasoning						
SBP	SBP-1 Patient safety	SBP-2 Quality improvement	SBP-3 System navigation for patient-centered care	SBP-4 Physician role in health care systems				
PBLI	PBLI-1 Evidence-based and informed practice	PBLI-2 Reflective practice and commitment to professional growth						
PROF	PROF-1 Ethical practice	PROF-2 Professional behaviors	PROF-3 Accountability	PROF-4 Patient care etiquette with patients of all abilities	PROF-5 Resident well-being and help-seeking			
ICS	ICS-1 Patient- and family-centered communication	ICS-2 Interprofessional and team communication	ICS-3 Communication within health care systems					

cross-specialty; evaluation and faculty education and involvement more difficult. Different interpretations among faculty led to inconsistent assessments of residents. Many respondents recommended editing the Milestones for "clarity" and requested examples illustrating how trainees would demonstrate achievement of each level of competence. Recommendations for consistent verbiage throughout all the Milestones were a regular comment. Better structure of the Milestones was recommended, noting that many threads within a given subcompetency did not have components for all levels of the Milestone and many that did were not lined up in a way to easily distinguish the progression from one level to the next.

HARMONIZED MILESTONES: FINDING COMMON GROUND

Another theme that was noted by the ACGME in their overall review of the first set of milestones was a wide variation among specialties in the non-PC and non-MK domains. Analysis by the ACGME team showed that across the 26 core specialties and the transitional year, there were more than 230 different ways of describing PROF, 171 for PBLI, 176 for ICS, and 122 for SBP.[7] In an effort to "harmonize" milestones for PROF, PBLI, ICS, and SBP, the ACGME gathered four separate working groups to take on the task of creating 2–3 subcompetencies in each of these core competencies that would be relevant to all specialties and subspecialties. Each group consisted of diverse faculty, subject experts, program directors, and interprofessional team members across the spectrum of specialties. Working drafts of these subcompetencies were then made available to more than 100 participants of the ACGME multispecialty Milestones summit in December 2016 for feedback, followed by revision by the original core working groups. At the end of this process in 2017, these "harmonized" milestones were submitted to the public for review and comment and then further refined by the respective workgroups for each of the four harmonized milestones.[8]

DEVELOPMENT OF THE PM&R MILESTONES 2.0

At this point, the ACGME recruited a new working group for the PM&R Milestones 2.0. Representatives from the previous working group and organizations were included. Additions were also made to include a public member and a representative of the American Osteopathic Board of Physical Medicine and Rehabilitation. A call for volunteers was also put out to the PM&R community at large to round out the 12-member working group. The PM&R Milestones working group met 3 times over the course of 2 yrs at the ACGME headquarters starting in late 2018, with additional conference calls as needed, as well as informal meetings at some of the national conferences. Significant editing and revision were also conducted between meetings with the use of shared electronic documents. Data from the 2018 survey of residency directors and coordinators were reviewed, as well as feedback from various other sources.[8] Each of the previous Milestones was reviewed by the working group for possible revision, combination, division, or removal. Major examples of this include the elimination of PC-3 (diagnostic evaluation) and the subsequent incorporation of portions of the old PC-3 into the new MK-2 (clinical reasoning) and the movement of PBLI-3 (quality improvement) from PBLI to SBP. In the case of procedural skills under PC, the working group decided to break the current two subcompetencies (PC-6 and PC-7) into three subcompetencies, adding spasticity-related procedures as a separate subcompetency in Milestones 2.0. The "harmonized" milestones were reviewed and revised minimally with the goal of staying close to the original format while still being relevant to the specialty of PM&R. Although major revisions of the "harmonized" milestones were minimized, the working group did decide to split PROF-1 (professional behavior and ethical practice) into two subcompetencies. Systems-based practice 1 (patient safety and quality improvement) was also split into two separate subcompetencies to help delineate two very different skill sets. Table 1 outlines the timeline of events between release of PM&R Milestones 1.0 to implementation of Milestones 2.0. Ultimately, a total of 24 subcompetencies were agreed upon, as can be seen in Table 2. A comparison of the major updates from Milestones 1.0 to Milestones 2.0 is briefly outlined in Table 3.

Once the primary subcompetencies were elaborated, teams of two to three working group members updated the subcompetencies to include threads with full progression from level 1 to level 5 where possible in an effort to improve readability and interpretation. Each team was also tasked with

TABLE 3. Comparison between PM&R Milestones 1.0 and 2.0

Category	Version 1.0	Version 2.0
Harmonized Milestones	Specialty specific milestones for all subcompetencies	Harmonized Milestones for PROF, PBLI, ICS, and SBP across all specialties (revised minimally for relevance to specialty)
Standardized language	Variation in language among subcompetencies	Standardized language among subcompetencies
Explanations and footnotes	Footnotes, headings, and subcompetency descriptions on all milestones	Milestones streamline for easier reading with all extra explanations moved to other documentation
No. subcompetencies	19 subcompetencies	24 subcompetencies
No. threads per subcompetency	Greater than 3 threads per subcompetency	Maximum of 3 threads per subcompetency
Consistency of levels across subcompetency thread	Many threads missing at various levels in subcompetencies	Concerted effort for most threads to follow from level 1–5
Supplemental guide	No supplemental guide	Supplemental guide
Examples for each level	No examples of levels 1 through 5 for each Milestone	Examples provided for levels 1 through 5 for each Milestone in the supplemental guide

Patient Care 5: Assistive Technologies including Prosthetics and Orthotics, Adaptive Equipment, Mobility Devices, Seating Systems, and Communication Technologies

Overall Intent: To generate a detailed prescription, in consultation with other professionals, for a full range of assistive technologies including justification and advocacy. taking into consideration the assessment of impairments, barriers, contraindications and comorbidities, and patient goals

Milestones	Examples
Level 1 *Describes assistive technologies and their indications*	• Explains the general indications for a cane after hip replacement surgery
Level 2 *Evaluates patient need for common assistive technologies based on impairments*	• Explains the specific indications for a cane in a patient with a Trendelenburg gait after hip replacement surgery • Justifies need for an ankle-foot orthosis to address foot drop
Level 3 *Evaluates patient need for a full range of assistive technologies based on impairments, taking into account barriers, contraindications, comorbidities, and input from other professionals*	• Responds to a physical therapist's concern about a patient's ability to safely navigate within his home and community after a hip replacement due to his cognitive impairment and difficulty with maintaining precautions; recommends a walker for within the home and a manual wheelchair for the community • Identifies the need for assistive technologies for a patient with severe expressive aphasia and visual impairment in collaboration with a speech pathologist
Level 4 *Generates a detailed prescription, in consultation with other professionals, for a full range of assistive technologies including justification and advocacy where needed*	• A young athlete with a transtibial amputation presents to the multidisciplinary prosthetic clinic for a high tech prosthesis that will allow her to continue to participate in her sport; in collaboration with the multidisciplinary team, generates a detailed prescription and documents the medical justification and advocates for the patient when the payor initially denies the prosthesis
Level 5 *Serves as a resource to other professionals for clinical problem solving and functional challenges related to assistive technology*	• Provides specific recommendations to realign the fit of a transtibial prosthesis for excessive lateral truncal shift when approached by a physical therapist for help
Assessment Models or Tools	• Chart review • Direct observation • Multisource feedback • Objective Structured Clinical Examination • Simulation • Written or oral examination
Curriculum Mapping	•
Notes or Resources	• Textbooks • Prosthetics and orthotics courses

FIGURE 3. Sample from supplemental guide showing the outline of how the supplemental guide will be setup. The supplemental guide gives examples at all levels of the Milestone to help with assessment of residents. It also makes recommendations of assessment models and tools that can be used to help assess this particular Milestone, and notes are resources that may be helpful.

minimizing the number of threads (rows within any given subcompetency) to a maximum of three. Each thread was further reviewed by the group as a whole at the in-person meetings, with incorporation of feedback and extensive real-time editing. The working draft was then submitted for public comment and further revised based on the public feedback. Input from the public review, as well as from the Association of Academic Physiatrists Residency and Fellowship Program Directors council, suggested that implementation should be delayed until the 2021–2022 academic year, with the first reporting due in January 2022. Given this input, as well as the impact of COVID-19 on many programs, the working group agreed that a later implementation date would be appropriate.

A STEP FORWARD: THE SUPPLEMENTAL GUIDE

One of the most conspicuous improvements from Milestones 1.0 to Milestones 2.0 can be found in the supplemental guide. In an effort to further streamline the Milestones, headings, Milestone descriptions, and footnotes were moved to the supplemental guide in response to feedback requesting a more concise Milestones format. In addition, the supplemental guide was written with the intention of providing real world examples of resident actions and abilities that would demonstrate achievement of each level of each thread within the Milestones. This request for examples was a consistent theme in Milestones feedback for virtually all specialties. For the "harmonized" competencies of PROF, PBLI, ICS, and SBP, the working group was provided with a supplemental guide template created by the multidisciplinary group that created the "harmonized" milestones. This template was then modified to add examples relevant to PM&R with specialty specific context and language. In addition, recommended assessment models and tools are provided with each Milestone, as well as some resources relevant to each specific subcompetency. An example of the supplemental guide can be seen in Figure 3. The examples in the supplemental guide were created to help increase understanding of the original intent of the Milestone levels, but with the understanding that each CCC/program will need to arrive at its own shared mental model for these new Milestones. The end of the supplemental guide also includes a "map" between Milestones 1.0 and 2.0. This will help the CCC identify the changes and facilitate the mapping of assessments to the new Milestones. The addition of the supplemental guide should help decrease variability between resident assessments and provide a good reference for faculty new to the Milestones system.

CONCLUSIONS

The PM&R Milestones 2.0 represent a step forward in the ACGME evaluation and assessment model. With data from the Milestones 1.0, along with input from the PM&R community, improvements to the system have increased readability and decreased complexity. The harmonized Milestones for PROF, PBLI, ICS, and SBP will help decrease variability across specialties in assessment and improve cross-departmental faculty development and training. Consistency in threads through subcompetencies should improve evaluators' ability to document a stepwise progression in their residents' achievement of skills and abilities. The new supplemental guide will serve as a practical reference for faculty, providing PM&R-specific examples for each level of each subcompetency, as well as suggested tools and resources to help with assessment. The working group hopes these modifications and additions will help in

competency assessment and looks forward to future revisions and improvements with the Milestones 3.0 in 3–5 yrs.

REFERENCES

1. Lurie SJ, Mooney CJ, Lyness JM: Measurement of the general competencies of the accreditation council for graduate medical education: a systematic review. *Acad Med* 2009;84:301–9
2. Accreditation Council for Graduate Medical Education: Milestones. Available at: https://www.acgme.org/What-We-Do/Accreditation/Milestones/Resources. Accessed June 11, 2020
3. Bockenek WL, Massagli TL, Swing SR, et al: The development of the physical medicine and rehabilitation milestones. *J Grad Med Educ* 2014;6(1 suppl 1):204–6
4. Holmboe ES, Edgar L, Hamstra S: *The Milestones Guidebook*. Chicago, IL, Accreditation Council for Graduate Medical Education, 2016. Available at: https://www.acgme.org/Portals/0/MilestonesGuidebook.pdf?ver=2016-05-31-113245-103. Accessed July 9, 2020
5. Nasca TJ, Philibert I, Brigham T, et al: The next GME accreditation system–rationale and benefits. *N Engl J Med* 2012;366:1051–6
6. *The Physical Medicine and Rehabilitation Milestone Project*. Chicago, IL, Accreditation Council for Graduate Education, 2015. Available at: https://www.acgme.org/Portals/0/PDFs/Milestones/PMRMilestones.pdf. Accessed June 12, 2020
7. Edgar L, Roberts S, Holmboe E: Milestones 2.0: a step forward. *J Grad Med Educ* 2018;10:367–9
8. Edgar L, Roberts S, Yaghmour NA, et al: Competency crosswalk: a multispecialty review of the Accreditation Council for Graduate Medical Education Milestones across four competency domains. *Acad Med* 2018;93:1035–41