The Milestones Guidebook:

Competency-Based Medical Education and Milestones Development

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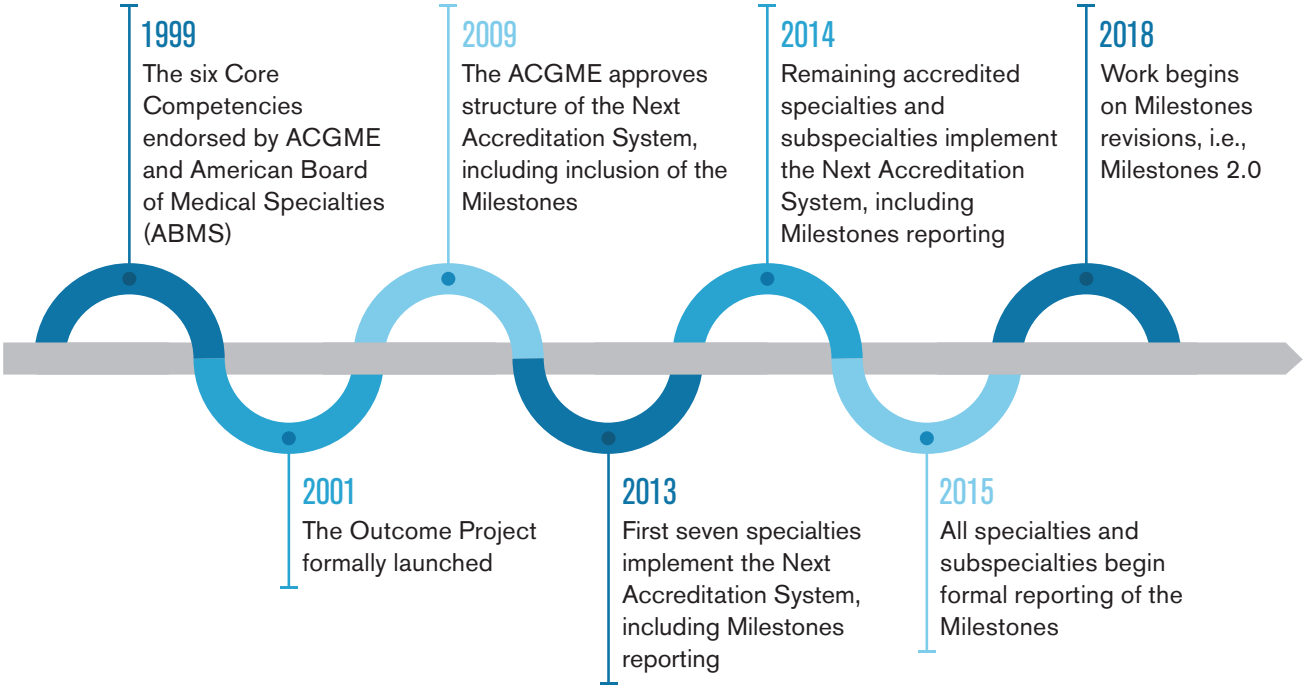
COMPETENCY-BASED MEDICAL EDUCATION

Introduction

This section provides an overview of competency-based medical education (CBME) and assessment as the foundation for the ACGME Milestones. It describes basic tenets of CBME as the foundation for the ACGME's accreditation model grounded in a continuous quality improvement and innovation philosophy (Nasca et al. 2012; Weiss et al. 2013) using the Core Competencies (Professionalism, Patient Care and Procedural Skills, Medical Knowledge, Practice-Based Learning and Improvement, Interpersonal and Communication Skills, Systems-Based Practice) and the Milestones as core components.

Key Dates in Development of the ACGME Milestones



Grounded in Competency-Based Education (CBE)

CBE is not a new concept; it represents a form of outcomes-based education. Harden and colleagues (1999) defined outcomes-based education as:

> *…an approach to education in which decisions about the curriculum are driven by the outcomes the learners should display by the end of the training program. In outcome-based education, product defines the process. The educational outcomes are clearly specified and decisions about the content and how it is organised [sic], the educational strategies, the teaching methods, the assessment procedures and the educational environment are made in the context of the stated learning outcomes. (Harden, Crosby, and Davis 1999, p. 8)*

In fields outside medical education, CBE has been called competency-based education and training (CBET). CBET had much of its genesis in the teacher education reform movement of the 1960s (Elam 1971). This interest was spurred by a US Office of Education National Center for Education research grant program in 1968 to 10 universities for development and implementation of new teacher training models that focused on student achievement (outcomes). From this early research and activity, interest in competency-based models within medical education began to grow. In 1971, Elam provided a series of principles and characteristics that continues to capture the essence of CBET.

Principles

- Competencies are role-derived (e.g., physician), specified in behavioral terms, and made public.
- Assessment criteria are competency-based and specify what constitutes mastery level of achievement.
- Assessment requires performance as the prime evidence but takes knowledge into account.
- Individual learners progress at rates dependent on demonstrated competence.
- The instructional program facilitates development and evaluation of the specific competencies.

Characteristics

- Learning is individualized.
- Feedback to the learner is essential.
- Emphasis is more on the exit criteria (i.e., outcomes) than on the admission criteria (i.e., selection).
- A systems approach is required to manage a training program.
- Training is modularized.
- Both the learner and the program are accountable.

The Foundation for CBME

In medical education, competency-based models were first promoted for wide use by McGaghie and colleagues (1978) as part of a report to the World Health Organization. In that report, the authors defined the goal of CBME:

> *The intended output of a competency-based programme [sic] is a health professional who can practise [sic] medicine at a defined level of proficiency, in accord with local conditions, to meet local needs. (McGaghie et al. 1978, 18*)

In the context of medicine, Carraccio and colleagues (2002) compared elements of the structure/process-based educational approach and the outcomes-based approach which have been adapted in the table below:

Structure/Process-based vs. Competency-based Educational Programs

Variable	Structure/Process	Competency-Based
Driving force for curriculum	Content: knowledge acquisition	Outcome: knowledge application
Driving force for process	Teacher	Learner
Path of learning	Hierarchical (Teacher→Student)	Non-hierarchical (Teacher↔Student)
Responsibility for content	Teacher	Student and Teacher
Goal of educational encounter	Knowledge acquisition	Knowledge application
Typical assessment tool	Single measure focused	Multiple measures
Assessment tool	Proxy	Authentic (mimics real tasks of profession)
Setting for evaluation	Removed (gestalt)	"In the trenches" (direct observation)
Evaluation	Norm-referenced	Criterion-referenced
Timing of assessment	Emphasis on summative	Emphasis on formative
Program completion	Fixed time	Variable time

Finally, Carraccio and colleagues (2002) also described a four-step process for implementing CBME: 1) identification of competencies (in the US, the six ACGME/ABMS General Competencies); 2) determination of competency components and performance levels (e.g., benchmarks and milestones); 3) competency evaluation; and 4) overall assessment of the implementation process.

Further Development of CBME

In 2010, a group of international educators worked to "modernize" the definition of CBME and lay out the theoretical rationale for a CBME system. This group defined CBME as:

> *…an outcomes-based approach to the design, implementation, assessment, and evaluation of a medical education program using an organizing framework of competencies. (Frank et.al. 2010, p. 641)*

Elaine Van Melle and colleagues (2019) outlined five core components for CBME along with their associated practices, principles, and conceptual frameworks as follows:

Core Components of CBME: An Organizing Framework

Core Components	Practice What the core component should look like in practice	Principle How the core component is supposed to work in practice	Competency-Based Why the core component should work according to theories, models, or best practices
Outcome competencies are required for practice and are clearly articulated	Required outcome competencies are based on a profile of graduate and/or practice-based abilities	Specifications of learning outcomes promotes focus and accountability	▪ Social accountability ▪ Outcome-based education ▪ Backwards design ▪ Job task analysis
Competencies and their developmental markers are sequenced progressively	Competencies are organized in a way that leads to a logical developmental sequence across the continuum of medical education	A sequential path supports the development of expertise	▪ Expertise theory ▪ Entrustable professional activities ▪ Surface and deep approaches to learning ▪ Mastery learning
Learning experiences facilitate the developmental acquisition of competencies	Learning takes place in settings that model practice, is flexible enough to accommodate variation in individual learner needs, and is self-directed	Learning through real-life experiences facilitates membership into the practice community and development of competencies	▪ Situated learning ▪ Deliberate practice ▪ Workplace based learning ▪ Professional identity formation
Teaching practices promote the developmental acquisition of competencies	Teaching is individualized to the learner, based on abilities required to progress to the next stage of learning	Development of competence is stimulated when learners are supported to learn at their own pace and stage	▪ Zone of proximal development ▪ Constructive friction ▪ Learner-centered apprenticeship ▪ Coaching theory ▪ Growth mindset
Assessment practices support and document the developmental acquisition of competencies	Learner progression is based on a systematic approach to decision making, including standards, data collection, interpretation, observation, and feedback	Programmatic assessment systems allow for valid and reliable decision making	▪ Programmatic assessment ▪ Formative assessment ▪ Learning analytics

Ten Cate (2015) also explained that the core components framework is grounded in a "growth" mindset which:

- forms the basis for significantly redesigning assessment practices, instructional methods and learning experiences (i.e., curriculum);
- focuses on promoting learner growth and development through frequent formative assessment (i.e., assessment for learning);
- provides rich feedback/coaching individualized to the learner and grounded in the desired competencies; and,
- provides rich and diverse learning experiences, steeped in clinical practice where learners can stay *as long as required*.

CBME and Systemic Medical Education

CBME explicitly recognizes that learners progress through the educational process at *different rates* within and across competencies. However, system constraints in US medical education create substantial challenges in designing flexible curricula to manage and effectively support this known variability in development among learners. In CBME, time is viewed as a *resource* and not an *intervention/measure*. Time is too often used as a proxy for competence. Shortening medical school education and GME is *not* the *primary* goal of CBME. Time should be used wisely and the amount of "training time" required should be based on outcomes. The core principles of CBME can still advance GME within "fixed" program lengths, designing outcomes-based flexibility within a residency/fellowship.

CBME requires robust assessment, especially ongoing, longitudinal assessment that enables faculty to determine the developmental progress of the learner more accurately, as well as to help the learner through frequent feedback, coaching, and adjustments to learning plans (Holmboe et al. 2010; Kogan and Holmboe 2013). This characteristic is consistent with multiple and important educational theories in expertise, deliberate practice, and mastery-based learning (Ericsson et al. 2007; McGaghie, et al. 2017; McGaghie, et al. 2014). In fact, CBME and its core components are grounded in multiple evidence-based educational theories and methods.

Understanding the principles of CBME forms the basis for answering the questions "Why the Milestones?" and "How the Milestones?" which, in turn, form the basis for assessment in GME. The remaining Guidebooks in this collection of resources will provide the reader with the answers to those questions along with detailed guidance as to how to develop an effective assessment system with a GME program. Those Guidebooks are:

- **Assessment Guidebook**
- **The Milestones Implementation Guidebook**
- **The Milestones Guidebook for Residents and Fellows**
- **Clinical Competency Committee Guidebook**

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MILESTONES DEVELOPMENT

Milestones represent a significant point in development.
They can enable residents and fellows as well as the program to determine individual trajectories of professional development in narrative terms.

Why Milestones?

In general terms, a milestone is a significant point in development toward achieving a desired outcome. In GME, the Milestones are a response to a number of critical needs. Most importantly, the Milestones are designed to help all residencies and fellowships produce highly competent physicians to meet 21st century public health care needs. Programs have often struggled to operationalize the six Core Competencies since their introduction in 1999 (Batalden et al. 2002). The Milestones, along with the related concept of entrustable professional activities (EPAs), provide descriptive language that can facilitate a deeper, shared understanding within and among programs regarding competency outcomes of interest within and across disciplines. (For further information on competency-based medical education, see "Competency-Based Medical Education," p. 3) the Milestones also enable the movement away from an overreliance on high-stakes medical knowledge testing and use of numeric rating scales on evaluation forms which faculty members have historically found very difficult to use effectively. In addition, the Milestones can serve as a guide and "item bank" to create more meaningful assessments and, as learners' gaps are identified, they provide the ability to offer individualized coaching to help learners progress to the next level. Finally, the Milestones provide a critical framework for Clinical Competency Committee (CCC) deliberations and judgments.

What Are the Milestones?

The Milestones describe the performance levels that residents and fellows are expected to demonstrate for skills, knowledge, and behaviors in the six Core Competency domains (i.e., Patient Care, Medical Knowledge, Systems-Based Practice, Practice-Based Learning and Improvement, Professionalism, and Interpersonal and Communication Skills). As portrayed in the figure below, the Milestones lay out a framework of observable behaviors and other attributes associated with a resident's or fellow's development. They provide narrative descriptors of the Competencies and their associated subcompetencies along a developmental continuum with varying degrees of granularity.

General Description of Milestone Levels Related to Stage of Education

Competency: Subcompetency				
Level 1	Level 2	Level 3	Level 4	Level 5
Novice Resident/Fellow Brand new to the specialty	Advanced Beginner Resident/Fellow Performs some tasks with limited autonomy	Competent Resident/Fellow Performs common tasks with autonomy	Proficient Resident/Fellow Target for graduation (not a requirement)	Expert Resident/Fellow Exceeds graduation expectations

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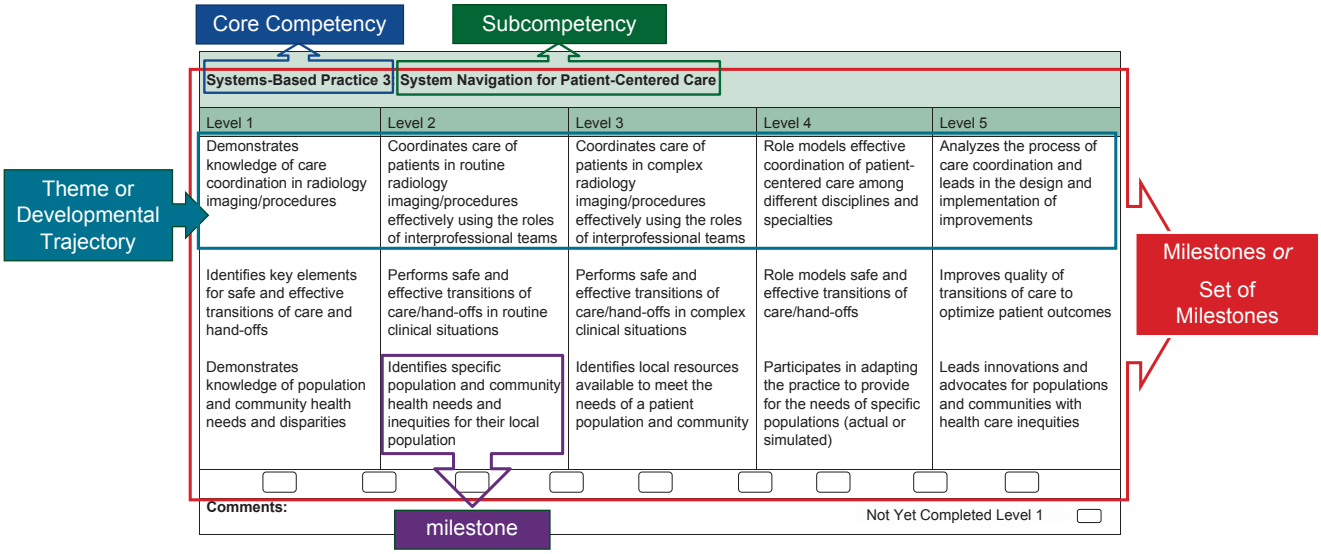
The Milestones are based on the concept of stages of professional development; in GME, they are specifically designed to be criterion-based and agnostic to the actual post-graduate year (PGY) of the resident or fellow. Programs, therefore, should judge each resident or fellow based on their actual level of performance as described in the Milestones, not in relation to peers or others. The figure below provides a description of the general anatomy of a milestone.

Basic Anatomy of a Milestone



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 Development Trajectory	Skill, knowledge, or behavior that progresses from novice to advanced beginner to competent to proficient to expert
milestone	Significant point in development along a developmental trajectory

The Milestones describe the learning trajectory within a subcompetency that demonstrates how a resident or fellow progresses in performing as a novice learner in a specialty or subspecialty, to proficiency, and, eventually, expertise in unsupervised practice. The Milestones are different from many other assessments because they provide an opportunity for the learner to demonstrate attainment of aspirational levels of the subcompetency, and just as importantly, to allow for a shared understanding of the expectations for the learner and the members of the faculty. The Milestones can provide a framework that offers a degree of assurance for all GME programs that graduating residents and fellows across the US have attained a high level of competence.

How Were Milestones 2.0 Developed?

Work Group Formation

Each Milestones Work Group was composed of representatives that included: an appointed member(s) of the relevant ACGME Review Committee; the ABMS through the individual certification boards; the American Osteopathic Association (AOA); and specialty-specific program directors' groups. Each Work Group also included up to five members selected through a "Call for Volunteers," at least one resident and/or fellow, and a public member. Each group was diverse and included representation from various sizes and types of programs (e.g., academic medical centers, rural hospitals, military hospitals), subspecialty representation (e.g., neurologic surgery with representation for each of the eight primary subspecialties), and time-in-practice (e.g.,

junior and senior faculty members, program directors). For specialties into which medical school graduates enter directly (e.g., internal medicine, surgery), representatives from the Association of American Medical Colleges (AAMC) and American Association of Colleges of Osteopathic Medicine (AACOM) were included to ensure a more realistic expectation of the competence demonstrated by incoming residents.

Harmonized Milestones

A group of Harmonized Milestones was developed for the Core Competencies of Interpersonal and Communication Skills, Practice-Based Learning and Improvement, Professionalism, and Systems-Based Practice (Edgar, Roberts, and Holmboe 2018). These Milestones were developed by four interdisciplinary, interprofessional groups and distributed for public comment. The intent was to develop a common set of subcompetencies that allow each specialty to tailor the language to fit its distinct needs. For example, in the subcompetency of Patient- and Family-Centered Communication, the specific outcomes for internal medicine, surgery, and pathology vary based on the needs of the specialty.

Meeting Structure

Each Work Group met in person and/or virtually to complete the development process, which incorporated a review of published documents, including the Program Requirements, certification blueprints, competency statements, shared curricula, and other literature. Each group also reviewed national data that had been reported to ACGME and results from a program director survey regarding the Milestones, as available. Before identifying the subcompetencies, groups created a shared mental model around the educational frameworks used to develop the Milestones. These elements were taken into consideration while selecting the subcompetencies for Milestones 2.0. The discussion of what knowledge, skills, and attitudes would be most important was enthusiastic and complete. In many cases, the groups were able to select the most important topics for patient care and medical knowledge within a few hours. In some cases, the decision regarding which subcompetencies were most important took more than one full meeting due to the need to dissect the specialty and determine what was considered core to its identity; the work of development subsequently started after that that determination was made.

Supplemental Guide

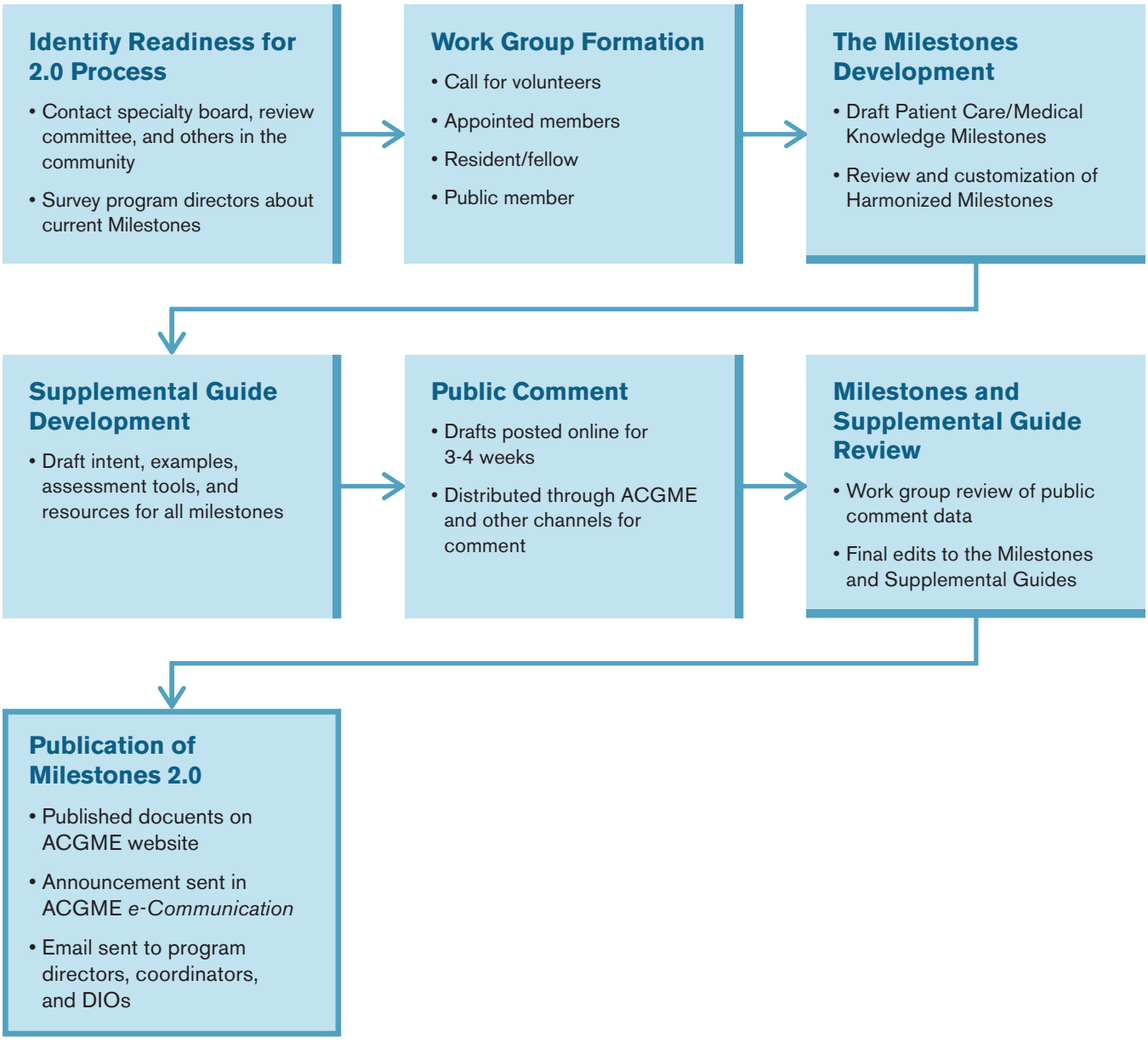
After several rounds of editing, a Supplemental Guide was created to help programs gain better insight into the overall intent of the subcompetency, to provide examples for each level, to suggest potential assessment methods, and to create a list of resources. Ideally, using these materials, programs can create a shared mental model of what a resident or fellow would demonstrate at each level in that context. Both the specific assessment tool and curriculum mapping can be added as well. A list of resources related to the many components of Milestones is included at the end of the Supplemental Guide. The Supplemental Guide is available in both PDF and Microsoft Word formats on the specialty pages of the ACGME website.

GME Community Input

A Milestones Set and Supplemental Guide for each specialty were made available for public comment on the ACGME website after they were drafted. Emails were sent to the specialty program directors and coordinators, and to the designated institutional officials (DIOs), with links to the drafted Milestones and Supplemental Guides. Those who received the emails were asked to share the information with faculty members, residents, and fellows. Program director organizations were also asked to share information through their various channels of communication (e.g., listservs, emails). Those responding to the call for public comment were asked about the Milestones and the Supplemental Guide. The Work Groups used

the feedback to edit and finalize the documents. Some specialties found that drafts of Milestone Sets that had been considered either duplicative or too elementary could be useful in an appendix as a remediation or learning tool; these tools are sometimes referred to as "non-reportable milestones."

Milestones 2.0 Development Process



Using the Milestones

The table below summarizes the purpose and function of the Milestones according to constituency and/or stakeholder.

Constituency and/or Stakeholder	Purpose/Function
Residents and Fellows	▪ Provide a descriptive roadmap for education and training ▪ Increase transparency of performance requirements ▪ Encourage informed self-assessment and self-directed learning ▪ Facilitate better feedback to learner ▪ Encourage self-directed feedback-seeking behaviors
Residency and Fellowship Programs	▪ Guide curriculum and assessment tool development ▪ Provide meaningful framework for CCCs (e.g., help create shared mental model) ▪ Provide more explicit expectations of residents and fellows ▪ Support better systems of assessment ▪ Enhance opportunity for early identification of under-performers ▪ Enhance occasions to identify advanced learners to offer them innovative educational opportunities
ACGME	▪ Accreditation – promote continuous improvement of programs through annual aggregated specialty Milestones data/performance ▪ Public accountability – report at an aggregated national level on learner Competency outcomes ▪ Community of practice - develop cadre of educators focused on evaluation and research, with emphasis on continuous improvement
Certification Boards	▪ Enable research to improve certification processes

The Milestones — Not Rotation Evaluations

The Milestones used for reporting to the ACGME were never intended to serve as regular assessment tools such as end-of-rotation evaluations. The Milestones, and specifically the subcompetencies, do not contain sufficient detail or levels of performance on a developmental trajectory to facilitate an accurate determination of the knowledge, skills, or abilities of an individual learner over a short period of time. The Milestones are, however, designed to guide a synthetic judgment of progress at least twice a year. Utilizing language from the Milestones may be helpful as part of a mapping exercise to determine which Competencies are best covered in specific rotations and curricular experiences. The Milestones can also be used for guided self-assessment and reflection by a resident/fellow in preparation for feedback sessions and in creating individual learning plans. Residents and fellows should also use the Milestones self-assessment in a guided feedback conversation with a faculty advisor, mentor, or program director. Residents and fellows should not judge themselves on the Milestones in isolation. Feedback on the Milestones is most effective when it is performed in dialogue between a learner and faculty advisor. The Milestones can also be useful in faculty development. They can help faculty members recognize their expectations of learners' performance, more explicitly assess the trajectory of skill progression in their specialty and discern how best to assess a learner's performance.

The Milestones — Not Complete Curricula

For program directors, curriculum planners, and CCCs to use the Milestones correctly, they must remember that the Milestones are not inclusive of the broader curriculum, and that limiting assessments only to the Milestones could leave many topics without proper and essential assessment and evaluation. The Milestones represent, instead, the essential core of a discipline; programs, therefore, will need to use good judgment to fill

in the gaps in curriculum and assessment that are identified when the Milestones are assessed. Even for those specialties that developed more general subcompetencies, the understanding was that the Milestones would not cover all areas essential to the unsupervised practice of medicine.

Implementing the Milestones Effectively

While there is still much to learn, early research regarding milestone development and implementation, combined with solid educational theory provides some useful guidance for GME programs. While an entire Guidebook is devoted to **implementing the Milestones**, some **practical tips for residents, fellows, and program leadership** are summarized below:

Residents and Fellows

- Share and discuss the pertinent Milestones Set with residents/fellows when they begin their program. This practice helps them gain a shared understanding of the goals of the program, expectations for their performance/competence, and the usefulness of the Milestones in their education.
- Share **The Milestones Guidebook for Residents and Fellows** at the beginning of the program.
- Direct residents/fellows to complete individualized learning plans by working with faculty member advisors and/or mentors, using the Milestones as a significant tool in their formation.
- Consider having residents/fellows complete a self-assessment of their performance based on the Milestones with a trusted advisor, so they can compare and contrast their progress to the CCC judgments of their performance based on the Milestones every six months.
- Enable residents/fellows to seek out assessment (i.e., self-directed assessment seeking), especially direct observation, from faculty members.

Faculty Members

- Share and discuss the pertinent Milestones Set with faculty members as a group at the beginning of the academic year (at a minimum). This activity helps faculty members develop and use a shared understanding of the goals of the Milestones.
- Observe, observe, observe! Faculty members' observation of key competencies is essential to effective feedback, coaching, and professional development of residents/fellows.
- Embed observation in "what faculty members do" – clinic precepting, procedures, bedside rounds, discharge planning, joining part of an admission, etc.
- Participate in faculty development around the Milestones, assessment and observation, and feedback as core educator skills.
- Help faculty members understand where program assessment methods/tools map to the pertinent Milestones. This practice will help clarify faculty members' role in the program and assessment of the residents/fellows.

The emphasis on continuous program improvement in ACGME accreditation and use of the Milestones has substantially affected the role and nature of work for program directors and other program leaders. Program directors represent the essential hub of the program. Institutions should actively support professional development for program leaders. The program director, associate program director, and program coordinator

roles are vitally important to the overall medical education enterprise, having profound and lasting influence on learners and patient outcomes. As such, program leaders require ongoing professional development around the key roles and tasks required of them. Key tasks for program leadership are summarized below:

Program Leadership

1. Conduct a crosswalk of the curriculum with the specialty Milestones and Supplemental Guide to ensure that learners have sufficient experience. Program leaders in collaboration with medical educators should review the educational objectives and purpose of a rotation and map the essential subcompetencies with the objectives, purpose, and goals of the rotation to develop a shared mental model of Milestones. For example:

Milestones	Curriculum Mapping (i.e., which rotation objectives meet this Milestone)	Assessment Tool/Method
Patient Care 1	Outpatient rotations	Direct observation tool; multisource feedback
Medical Knowledge 2	Inpatient rotations	Assessment of case-based discussion; journal club participation; assessment of presentation

2. Develop a program of assessment that aligns with the Milestones and functions as an integrated, holistic package; assessment activities should tightly align with the actual education and/or training activity.
3. Identify and address gaps in assessment strategies to ensure meaningful and authentic Milestones judgments.
4. Conduct ongoing program evaluation to assess what is working, for whom, in what circumstances, and why. Do not hesitate to discontinue activities or tools that are not working. Consider the Milestones to be part of a continuous quality improvement process for education; logic models, the Kirkpatrick Model, and other approaches to program evaluation can be very helpful. If the program has access to an education department or expertise, program leaders are encouraged to collaborate with these individuals to explore what the best program evaluation strategy would be for their programs.
5. Provide ongoing faculty development, especially around assessment. While workshops are clearly helpful, they are not sufficient., Program leaders should think of ways the program can build “small aliquots” of faculty development into section or department meetings, grand rounds, CCC meetings, etc.; taking only 15 minutes on a regular basis to review several subcompetencies and their milestones, review and rate a short video tape performance, etc., can be very valuable.
6. Build a team. Program directors cannot manage this process in a vacuum. Building a team that has deeper understanding of the Milestones and basic educational and assessment methods and theory is crucial. Most specialties now have active program director associations or groups that provide excellent resources and training. It is equally important to reach across specialty boundaries; much good work is happening within institutions of which other specialties in the same institutions are unaware. Program directors should check with the their DIOs and graduate medical education committees (GMECs) to keep abreast of educational developments within their own Sponsoring Institutions.
7. Explore the functionality of the local electronic residency/fellowship management system with respect to linking items on assessment tools and methods to the Milestones to aid in curriculum review.

Lessons Learned About the Milestones

ACGME Milestones staff members regularly attend program director and society meetings, as well as visit Sponsoring Institutions. These encounters enable high-level conversations on the benefits and challenges of the Milestones and have helped drive the changes in Milestones 2.0. Along with other more systematic and rigorous research, these conversations have provided clear signals from the community and have helped to guide next steps in development by identifying benefits and challenges associated with implementing the Milestones.

Perceived Benefits of the Milestones

The Milestones can improve resident/fellow education by:

- providing CCCs with better feedback for residents/fellows;
- catalyzing feedback for residents/fellows (e.g., for many, use of the Milestones can be the first time they have received formal feedback);
- providing useful language for assessment and feedback;
- assisting faculty members with developing of a shared mental model of competence;
- helping program leadership to identify curricular gaps;
- facilitating improved assessment through mapping onto curricular activities;
- facilitating earlier identification of residents and fellows in difficulty;
- providing CCCs with a useful mechanism to work with residents and fellows in difficulty;
- facilitating faculty development;
- providing a continuous quality improvement systemic educational philosophy; and,
- Allowing for more generalizability of education research on assessment in GME by providing a common framework for discussion

Challenges with Implementing the Milestones

Use of the Milestones can involve some challenges:

- Time and resources (e.g., the burden of data entry) – "relative value units (RVUs) always win"
- Synthesizing multiple assessments into a CCC single development judgment
- Misalignment of assessment forms and scales with judgments based on the Milestones
- Lack of assessment methods and tools
- Use of the Milestones as a rotation evaluation form (i.e., problem of cognitive load)
- Need for faculty development
- Burden of assessment on faculty members
- Increasingly shorter faculty attending periods (e.g., one to two weeks) in a number of specialties provides insufficient faculty member exposure to perform adequate assessment

- Use of a five-level Milestone rubric for one-year fellowships
- Use of educational jargon and framing of language (select Milestone sets)

Use of the Milestones by the ACGME

The Milestones' primary purpose is to drive improvement in GME programs and enhance the resident and fellow educational experience. Milestones are not tools designed to negatively affect program accreditation. The Milestones are intended for formative purposes to help learners and programs improve educational, assessment, and accreditation processes. *Therefore, the Milestones data are not shared with the ACGME Review Committees. The Review Committees are made aware of program compliance with submission of the data. Residents' and fellows' performance on the Milestones, aggregated at the national level, are a source of specialty-specific data for the Review Committees to use in their continuous quality improvement efforts for facilitating improvements to program curricula and resident/fellow assessment.* The Milestones will also be used by the ACGME to demonstrate accountability of the effectiveness of GME within ACGME-accredited programs in meeting the needs of the public over time.

With the transition to Milestones 2.0 complete, the ACGME will continue to learn and improve from experience with the Milestones using several lines of inquiry that include its own research and evaluation activities, collaborative research and evaluation with other stakeholders, comments received through the Milestones mailbox (milestones@acgme.org), and ongoing outreach activities.

Data Security and Milestones

The ACGME is dedicated to protecting the data collected from programs and residents/fellows through the following efforts:

1. The ACGME uses state-of-the-art data security methods to ensure the safety of all data, including data related to the Milestones.
2. Review Committees do not review any identified individual resident or fellow Milestones data, but instead view Milestone data in aggregate, using the specialty as the unit of analysis for continuous quality improvement purposes.
3. From a legal standpoint, the ACGME is subject to the Illinois state peer review statutes. These statutes are tracked carefully and have successfully blocked discoverability of ACGME data.

How will the ACGME Continue to Evaluate the Milestones?

Longitudinal and iterative evaluation of the Milestones is essential in achieving the desired goals of the ACGME's accreditation model. Unlike traditional biomedical approaches to research, evaluation of the Milestones will require predominantly practice-based, action research utilizing principles of complex interventions and program evaluation (Campbell et al. 2007; Medical Research Council 2014; Pawson 2013; Pawson and Tilley 1997; Rogers 2011). Much has been learned since the initial implementation of the Milestones in 2013.

An advantage of using the Milestones, compared to some other assessment tools currently used by individual programs, is that assessment data is collected on thousands of residents and fellows that makes it possible to establish their reliability and validity on a national scale. This approach has enabled important validity research on a national scale. The Messick framework outlined below is a useful framework in understanding validity (Cook and Beckman 2006):

Content	The assessment instrument items completely and appropriately represent the construct being assessed
Response process	The relationship between the intended construct and the thought processes of subjects or observers (e.g., have the observers been trained?)
Internal structure	Acceptable reliability and factor structure of the assessment
Relations to other variables	Examining correlations with scores from another instrument assessing the same construct (e.g., medical knowledge, clinical skills)
Consequences (intended users)	How scores are used affects how the assessment instrument is used and how the data is interpreted

One principle of validity frameworks is that validity is an argument which requires ongoing refinement and investigation. Therefore, the ACGME's commitment to ongoing evaluation of the Milestones necessitates their revision and refinement over time, building from the "on-the-ground" experience of programs and rigorous research and evaluations.

ACGME has assembled a Program Evaluation Advisory Group to identify and direct the next steps in maintenance and assessment of the Milestones. Volunteers with experience in milestones development are joined by program evaluation experts and Milestones staff to begin the assessment of the development process and implementation. The group met in May 2023 to build a shared mental model of the process and begin discussions on major areas for evaluation. The program evaluation will use a principles-focused process and is expected to be completed in 2025 with recommendations for next steps in the Milestones evolution.

Milestone Reports in the Accreditation Data System (ADS)

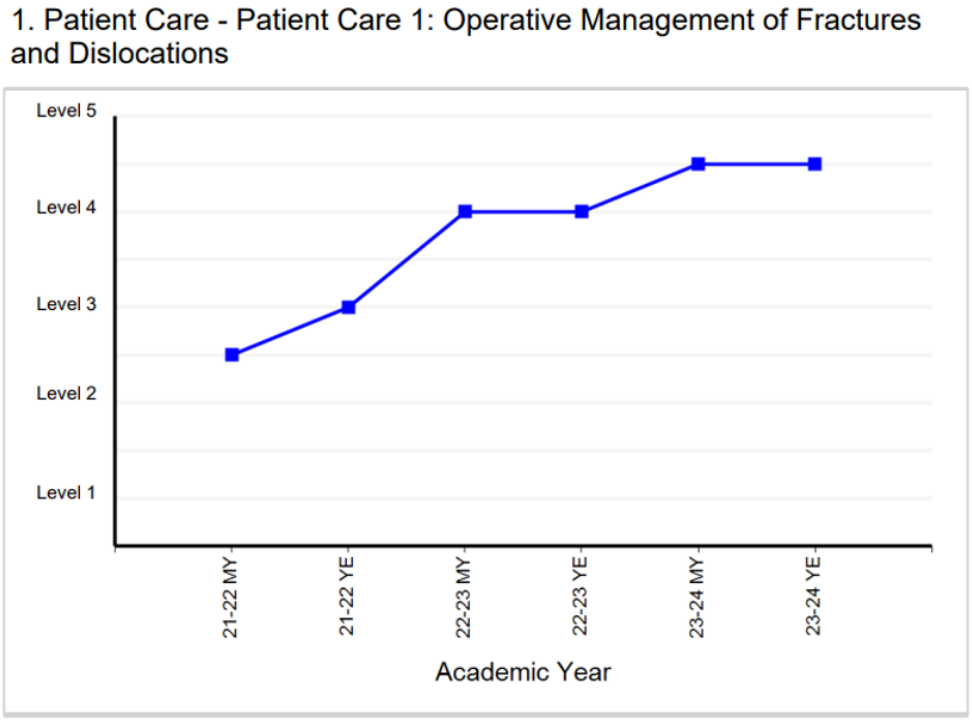
After a program submits its Milestones evaluations, several reports may be downloaded from ADS. Available reports include individual resident/fellow reports, program reports, and specialty reports.

Resident Reports

The resident/fellow reports can be used as part of the resident/fellow semiannual evaluation. A space is available for signatures at the program's discretion. It is not required that programs print these reports; the ACGME does not require any further action after Milestones data have been submitted. The individual detailed PDF documents of the reports are available 10-14 days after the close of the reporting window. The examples below represent a third-year orthopaedic surgery resident.

Report 1: Individual Milestone Trends

This report includes a graph showing the individual's progression for each subcompetency. The resident begins at Level 2.5 and steadily progresses to Level 4.5. The goal of the Milestones is to support professional development, and these "growth curves" can help programs assess whether a resident or fellow is on the appropriate trajectory (see Predictive Probability Tables, p.14 below).



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Report 2: Individual Milestone Summary

The Individual Milestone Summary report provides a snapshot of the individual's most recent evaluation for each subcompetency. The example below demonstrates that the resident effectively performs effectively in most Patient Care areas and is slightly higher in operative management of pediatric conditions and evaluation and management of the pediatric orthopedic patient.

Patient Care

	Not Yet Completed Level 1	Level 1		Level 2		Level 3		Level 4		Level 5	Not Yet Assessable
a). Patient Care 1: Operative Management of Fractures and Dislocations						●					
b). Patient Care 2: Operative Management of Soft Tissue Pathology						●					
c). Patient Care 3: Operative Management of Degenerative, Infectious, and Neoplastic Conditions						●					
d). Patient Care 4: Operative Management of Arthroscopically Treated Conditions						●					
e). Patient Care 5: Operative Management of Pediatric Conditions							●				
f). Patient Care 6: Evaluation and Management of the Adult Orthopaedic Patient						●					
g). Patient Care 7: Evaluation and Management of the Pediatric Orthopaedic Patient							●				

Report 3: Individual Milestone Evaluation

The Individual Milestone Evaluation report provides the text of the milestone level assigned for each subcompetency. When an individual's evaluation is between levels, the report includes text from both levels are displayed, with the higher of the two identifying that the resident has achieved certain, but not all of the requirements. In Patient Care 3 below, resident achievement is Level 4.

3 Patient Care	**Patient Care 3: Operative Management of Degenerative, Infectious, and Neoplastic Conditions**
Dr. ____ is at Level 4.	
Independently develops a surgical plan for complex procedures, including contingencies for complications.	
Independently performs core procedures; performs complex procedures, with assistance.	
Develops a plan for managing complex complications.	

Program and Specialty Reports

At the end of the academic year two reports, additional to those described above, are made available in ADS. Both reports are box plots with one demonstrating the results at the end of the academic year for the program, and the other demonstrating the results for the specialty. A key to understanding the box plots is included in the *Milestones National Report* published annually in the fall for the prior academic year. The *Milestones National Report* also includes other important data, including predictive probability values for evaluating whether a resident is on track to graduate below Level 4 for a specific subcompetency. All of the *Milestones National Reports* can be found on the Research and Reports page of the Milestones section of the ACGME website: **https://www.acgme.org/milestones/research/**.

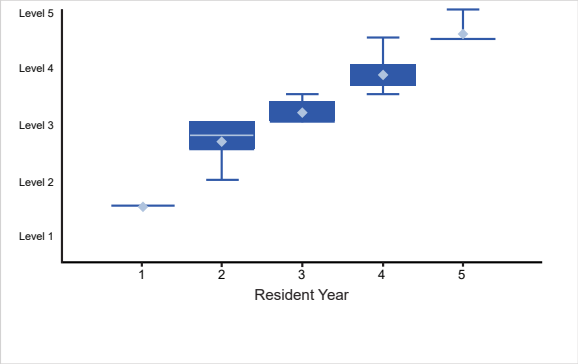
Program Report

Program Box Plot Report - Milestone Evaluation by Resident Year

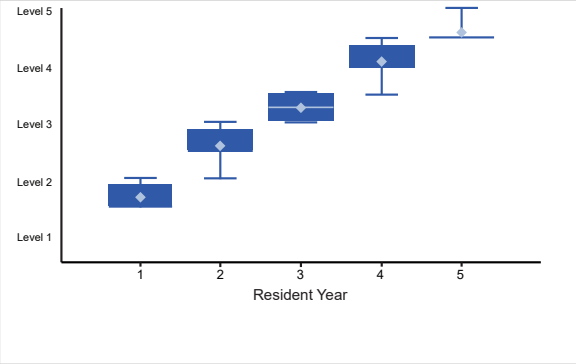
Program: _____ **- Orthopaedic Surgery**

Resident Year	1	2	3	4	5	Total Residents
# of Residents	6	6	6	6	6	30

1. Patient Care - Patient Care 1: Operative Management of Fractures and Dislocations



2. Patient Care - Patient Care 2: Operative Management of Soft Tissue Pathology



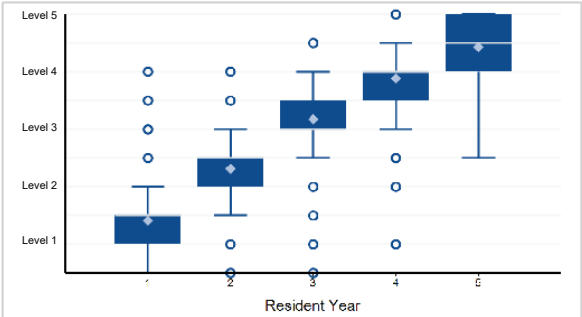
Specialty Report

Specialty Box Plot Report - Milestone Evaluation by Resident Year

Specialty: _____

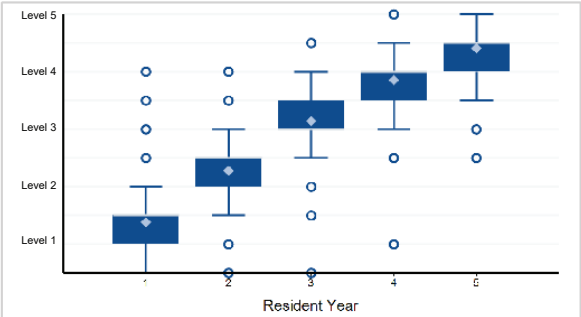
Resident Year	1	2	3	4	5	Total Residents
# of Residents	947	926	899	898	874	4,544

1. Patient Care - Patient Care 1: Operative Management of Fractures and Dislocations



Note: 19 of 4,544 residents have a status of "Not Yet Assessable" and are not included in the analysis.

2. Patient Care - Patient Care 2: Operative Management of Soft Tissue Pathology



Note: 67 of 4,544 residents have a status of "Not Yet Assessable" and are not included in the analysis.

Predictive Probability Value (PPV) Tables

The ACGME has begun providing predictive probability value (PPV) tables with the annual *Milestones National Report*. Program directors can now examine PPVs for program-level education and training which are provided by specialty following the box plots in the report. PPVs are provided to help program directors identify residents/fellows who may be struggling to match normative national data during each six-month block of the educational program.

PPV tables provide the probability (in percentage terms) that a resident/fellow at or below a certain Milestone rating (Level) would not achieve Level 4 at time of graduation. In the example shown below, all PPVs for the Family Medicine Patient Care Subcompetency #01 that could be calculated as of June each year are included in the table. For example, a resident receiving a Milestone rating of 2.0 or lower at the end of their second year in the program has a 62.7 percent probability (based on national data), of not achieving Level 4 in this subcompetency by the end of the three-year family medicine residency.

Figure 3: Family Medicine, Patient Care (PC) Subcompetency 1: Care of the Acutely Ill Patient

Subcompetency	Threshold	Yr1, Mid-Year	Yr1, Year-End	Yr2, Mid-Year	Yr2, Year-End	Yr3, Mid-Year
PC01 *Family Medicine*						
	≤ Lev 5.0					
	≤ Lev 4.5		19.1		19.4	
	≤ Lev 4.0		19.1	19.3	19.6	20.6
	≤ Lev 3.5	19.0	19.2	19.8	21.4	30.1
	≤ Lev 3.0	19.0	19.2	21.4	27.6	59.8
	≤ Lev 2.5	19.2	20.4	27.8	45.8	74.2
	≤ Lev 2.0	19.7	24.7	42.5	62.7	70.1
	≤ Lev 1.5	22.6	37.5	53.0	73.2	64.5
	≤ Lev 1.0	30.6	48.3	39.1	43.1	

The table in this example provides a matrix of all PPVs by Milestone rating threshold and Milestone review occasions for a single subcompetency for a single specialty. PPVs are provided to help programs identify residents/fellows who may be struggling to match normative national data during each six-month block of the educational program. PPVs thus can be used to support decisions for remediation or individualized learning plans. They also support the use of the Milestones as longitudinal assessment data to support professional development, feedback, coaching, and individualized learning plans.

Summary

The overarching goal of all GME programs is to produce graduates who can be trusted to provide the highest quality of care for the benefit of the public they serve. It is important to remember that the principal driver for a shift to an outcomes-based educational model has been recognition, both within and outside the medical education community, that rapid changes in health care delivery and science necessitated concomitant changes in medical education. The Milestones, combined with the ACGME requirement for CCCs, were developed to enable and accelerate the transformation to a competency-based system after a difficult early period of implementation. The success of the ACGME's current accreditation model and the Milestones will depend on ongoing collaboration among the end users (i.e., programs, faculty members, and learners), regulators like the ACGME and the certification boards, Sponsoring Institutions and organizations, researchers, and policy makers.

Resources/References

Annotated Bibliography of Research

The ACGME maintains a bibliography of research related to the Milestones and CCCs. The bibliography is updated annually and can be found at **https://www.acgme.org/milestones/research/**

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