

REVIEW ARTICLE

MEDICAL EDUCATION

Competency-Based Medical Education
at the Front Lines of Patient CareDawn Cooper, Ph.D.,¹ and Eric S. Holmboe, M.D.²

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PATIENTS, HEALTH CARE PROFESSIONALS, AND COMMUNITIES INCREASINGLY recognize the urgent need to achieve the quintuple goal of improved population health, health equity, better patient health care, better support for health care professionals, and reduced health care costs.^{1,2} Yet too many physicians enter the workforce lacking basic clinical and procedural skills³⁻⁶ and insufficiently prepared to work in teams, manage information, and participate in quality improvement.⁴⁻⁶ These gaps, along with the maldistribution of practicing clinicians, especially in primary care, have led many to conclude that the medical education system — rightly viewed as an essential partner in addressing the challenges facing the health care delivery system⁴ — is failing to fulfill its social contract to meet the health and health care needs of patients, populations, and communities.⁵⁻⁷ The evidence for maintaining the current traditional, time-based approach to medical education (i.e., a fixed time from matriculation to graduation) is rapidly disappearing. In fact, current evidence suggests that this traditional model has not been effectively preparing learners and that we are at a crisis point that requires a paradigm change.^{8,9}

In this article, we argue in favor of a promising paradigm for training physicians: competency-based medical education (CBME).¹⁰ CBME takes an outcomes-based approach in training learners to become physicians who are prepared for practice and is fundamentally oriented toward ensuring that graduates can do what is expected of them at the end of a training period. We limit our review to the process and challenges of implementing CBME at the training-program level while acknowledging that numerous other factors influence realization of the full potential of CBME.

We discuss the ongoing challenges with traditional time-based training models and the solutions offered through CBME, and we pay particular attention to the roles of program leaders, clinician-educators, and trainees on the front lines of education and clinical care because health care and medical education are deeply human and highly consequential activities.¹¹ These human actors are most important in producing desired outcomes for patients and trainees alike. No doubt, the transition to CBME is challenging for many reasons, yet maintaining a physician education system that fails to consistently produce competent physicians because change is hard reflects fundamentally flawed logic. We provide arguments for continued, collective work toward CBME despite its current challenges.

THE DIFFERENCE BETWEEN TRADITIONAL MEDICAL
EDUCATION AND CBME

The initial impetus for the CBME movement was the desire to address specific concerns about the varying abilities of graduates from traditional medical educa-

KEY POINTS

COMPETENCY-BASED MEDICAL EDUCATION

- The program design and approaches of current medical education consistently produce unwanted variation in educational outcomes among trainees across the continuum. Maintaining the current system will not lead to needed improvements.
- Competency-based medical education (CBME) is an outcomes-focused model that aligns training goals with patient and societal health care needs and promotes the journey to mastery among trainees.
- Competency frameworks are essential in supporting shared mental models (i.e., shared understanding) and implementing CBME at the undergraduate and graduate stages of training.
- Frontline clinician–educators are essential partners in CBME. They need institutional support and longitudinal faculty development focused on teaching the competencies and acquiring the skills required for assessment, feedback, and coaching.
- Learners should be viewed as educational and clinical care partners actively involved in CBME programs. Principles of coproduction with faculty should be used to support their professional development and provide high-quality health care.
- Program and institutional leaders need to develop and implement policies that support CBME and innovation.

tion training programs.^{3-6,8,12} The fixed, time-based training that characterizes traditional medical education — 4 years in undergraduate medical education and 3 years in graduate medical education for generalist specialties in the United States — assumes that all trainees are ready to transition at the end of these predefined training periods.^{10,12,13} Confronting this assumption, the CBME model defines and targets specific assessable educational outcomes and recognizes that trainees may have different developmental trajectories (Fig. 1 and Table S1 in the Supplementary Appendix, available with the full text of this article at NEJM.org).¹²⁻¹⁷ In doing so, CBME promises greater accountability for trainee preparedness, time-based flexibility in supporting trainees to achieve required outcomes, and trainee centeredness in designing pathways without compromising standards of competency.^{12,18} Instead of producing graduates who are variably prepared to care for patients and families,⁵ CBME aligns training with societal needs^{13,15} and aims to ensure that all graduates possess the necessary knowledge, skills, and professional behaviors (i.e., abilities) to achieve the quintuple goal of improved population health, health equity, better patient care, better support for health care professionals, and reduced health care costs.^{2,16}

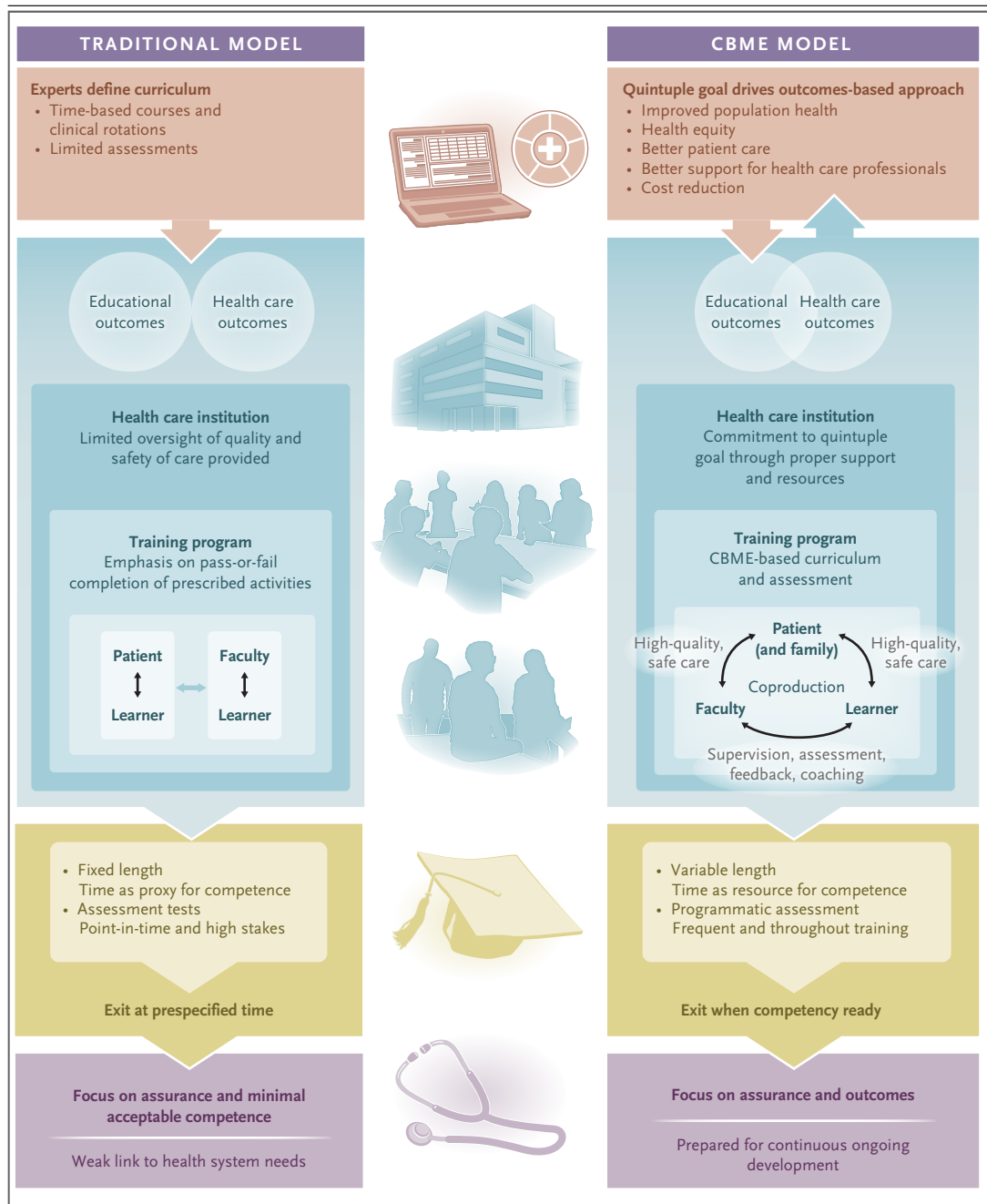
CBME clearly defines the expected outcomes of a training program and uses trainee assessment approaches that prioritize direct observation and align assessment with the workplace tasks necessary to ensure safe and effective clinical care of patients.¹⁹⁻²² These assessment methods

are tightly linked to monitoring trainees' progress on required activities during a training period in order to support judgments about trainee development and promotion to the next career phase (Table S2).^{20,21,23,24}

Early evidence suggests that this new approach to assessment is better than the traditional approach. Multifaceted programmatic assessment systems can identify students and residents in difficulty earlier and improve how learners' abilities are addressed.²⁵⁻²⁷ For example, a cohort study involving 458 Canadian family medicine residents who had been trained before or after the introduction of CBME showed that frequent formative feedback in the CBME program provided opportunities for early course correction, which resulted in an overall decrease in the number of residents with flagged deficiencies in performance or professionalism when the time came to make a decision about promotion.^{25,28} This study also showed that residents who were facing challenges were supported, and the deficiencies noted during previous periods did not occur on subsequent rotations. Transitioning to CBME requires time, resources, and faculty development, but better educational outcomes lead to higher-quality and safer health care in the long run.^{29,30}

ROLES AND RESPONSIBILITIES OF EDUCATORS AND TRAINEES IN CBME

CBME requires a coordinated and programmatic approach to the development and delivery of training opportunities and shared responsibility for



trainee progression. Below we outline the essential roles of program leaders, clinician–educators, and trainees in CBME, from program-specific patient care activities (curriculum committee) to observation and documentation of trainees' care of patients (bedside clinician–educators) to the development of learning plans (program direc-

tors and trainees) to assessment of competency to advance to the next level of training (clinical competency committee) (Fig. 2). To support the development of competency concurrently with clinical experiences, these essential roles and responsibilities are highly interactive and learner progression is often nonlinear.

Figure 1 (facing page). Traditional Time-Based Medical Education as Compared with Competency-Based, Time-Variable Medical Education.

Traditional time-based programs rely heavily on a consensus-driven approach to the curriculum without sufficient attention to societal health care needs. Assessment of trainees is limited and infrequent. Although learners and faculty are nested within programs and institutions, they are loosely coupled, and patient care activities and outcomes are often viewed as separate from educational activities and outcomes. Competency-based medical education (CBME) aligns trainee needs with patient and community needs. By requiring learners to meet specific competencies before transitioning to the next level, CBME programs integrate educational and health care outcomes and ensure that every physician is capable of providing high-quality care. CBME involves interdependent care and educational activities (i.e., coproduction) among learners, clinician-educators, and patients. These triadic relationships are embedded within programs and institutions. Institutional and health system performance has a profound effect on both health care and educational outcomes that require strong support from the training program and institutional leaders.

PROGRAM LEADERS

Program directors and other education leaders have a crucial role in the implementation and success of CBME. They provide direction, resources, and support to clinician-educators and trainees.

Curriculum Design

CBME relies heavily on a well-designed competency framework that is built on identifiable and assessable developmental benchmarks (i.e., milestones) that must be met for a person to advance from one stage to another (Fig. 3A). For this framework to be effective, leaders must create shared mental models, have clear training expectations, and develop curricula and assessments aligned with the desired educational outcomes in a specific setting (e.g., general pediatrics vs. obstetrics).³¹⁻³³ To support the developmental progression of learning, these frameworks must incorporate detailed, stage-specific narrative description (i.e., milestones for expected abilities from the novice level to the early expert level) (Fig. 3B). When training programs consistently use an identifiable milestone framework, a developmental path becomes explicit, which encourages trainees to aim for mastery and pre-

pares them for lifelong learning, a core principle of CBME.^{30,33-35}

Program Implementation

Education leaders oversee the implementation of a CBME program. They are responsible for developing curricula and implementing programmatic assessment strategies that align assessment with workplace tasks, provide ongoing feedback, and advance equity in the learning environment and patient care. To be successful, education leaders must pay close attention to the development of a shared understanding and interpretation of competencies with frontline clinician-educators and trainees, which requires training and support for clinician-educators to effectively teach and assess trainees within a CBME framework. In the assessment of clinical reasoning, for example, the trainee who is considered to be a proficient learner ready for unsupervised practice effectively uses pattern recognition of clinical presentations for common conditions within the specialty but will still need to fall back on methodical, stepwise reasoning for managing new or complex medical problems. The proficient learner is also comfortable with evolving situations and can manage ambiguity and uncertainty.

Assessment of Trainee Progression

In CBME programs, faculty committees, known as clinical competency committees, help oversee trainee progression. Clinical competency committees and education leaders use multiple sources of assessment data, including workplace observations by clinician-educators, assignments, and standardized assessments, to make judgments about progress and provide feedback to trainees.^{19-21,36-40} Several studies have shown that reviews by clinical competency committees at specific time points during residency provide predictive information about the trajectories of individual residents, findings that suggest that milestone frameworks can provide a comprehensive road map for trainee development.^{29,33,41} For example, while reviewing a resident's performance, a clinical competency committee may find that assessments from faculty highlight suboptimal counseling skills with patients, and a multisource feedback assessment performed in an ambulatory clinic may show low ratings by nurses on interpersonal

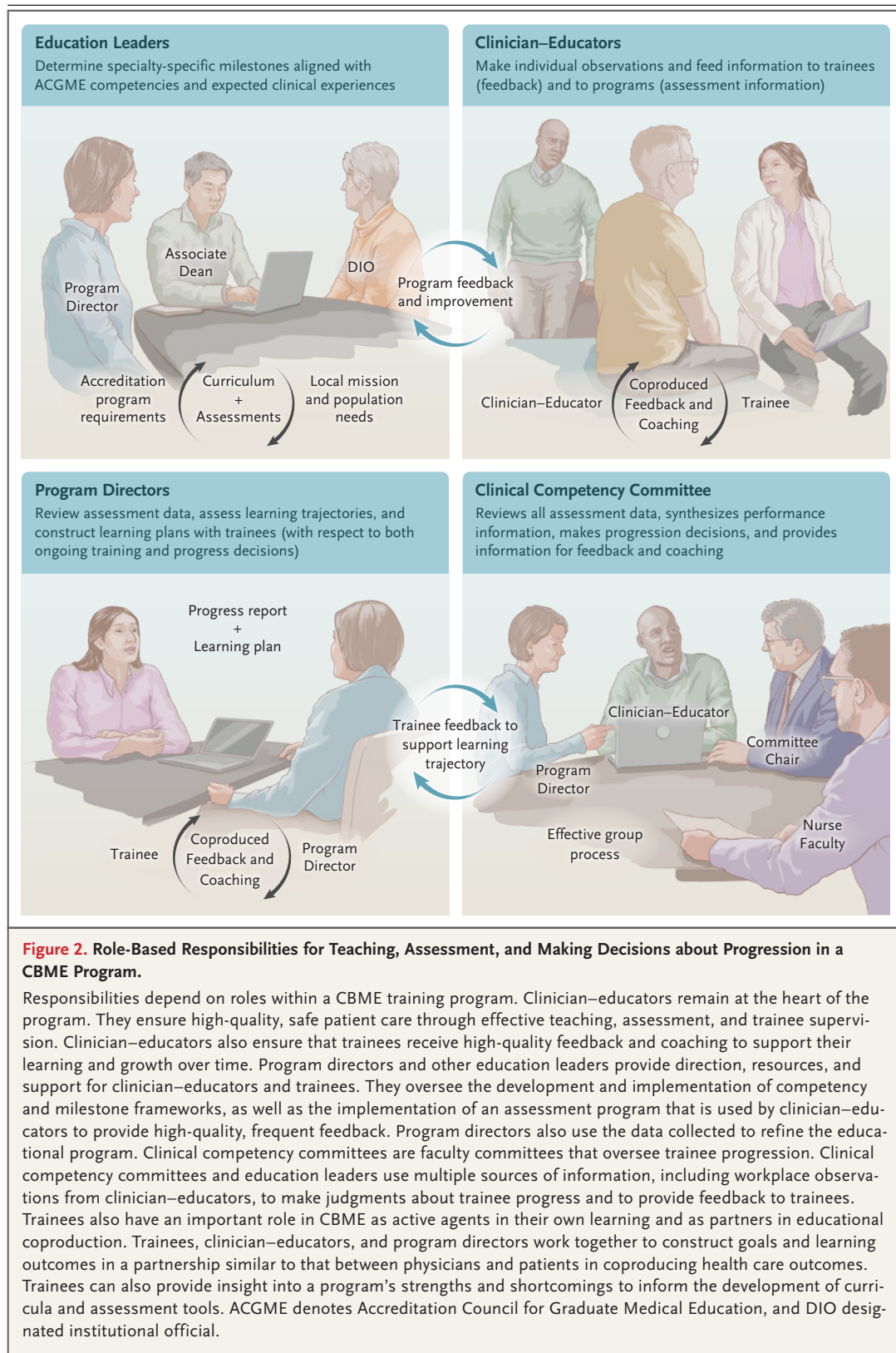


Figure 2. Role-Based Responsibilities for Teaching, Assessment, and Making Decisions about Progression in a CBME Program.

Responsibilities depend on roles within a CBME training program. Clinician-educators remain at the heart of the program. They ensure high-quality, safe patient care through effective teaching, assessment, and trainee supervision. Clinician-educators also ensure that trainees receive high-quality feedback and coaching to support their learning and growth over time. Program directors and other education leaders provide direction, resources, and support for clinician-educators and trainees. They oversee the development and implementation of competency and milestone frameworks, as well as the implementation of an assessment program that is used by clinician-educators to provide high-quality, frequent feedback. Program directors also use the data collected to refine the educational program. Clinical competency committees are faculty committees that oversee trainee progression. Clinical competency committees and education leaders use multiple sources of information, including workplace observations from clinician-educators, to make judgments about trainee progress and to provide feedback to trainees. Trainees also have an important role in CBME as active agents in their own learning and as partners in educational coproduction. Trainees, clinician-educators, and program directors work together to construct goals and learning outcomes in a partnership similar to that between physicians and patients in coproducing health care outcomes. Trainees can also provide insight into a program's strengths and shortcomings to inform the development of curricula and assessment tools. ACGME denotes Accreditation Council for Graduate Medical Education, and DIO designated institutional official.

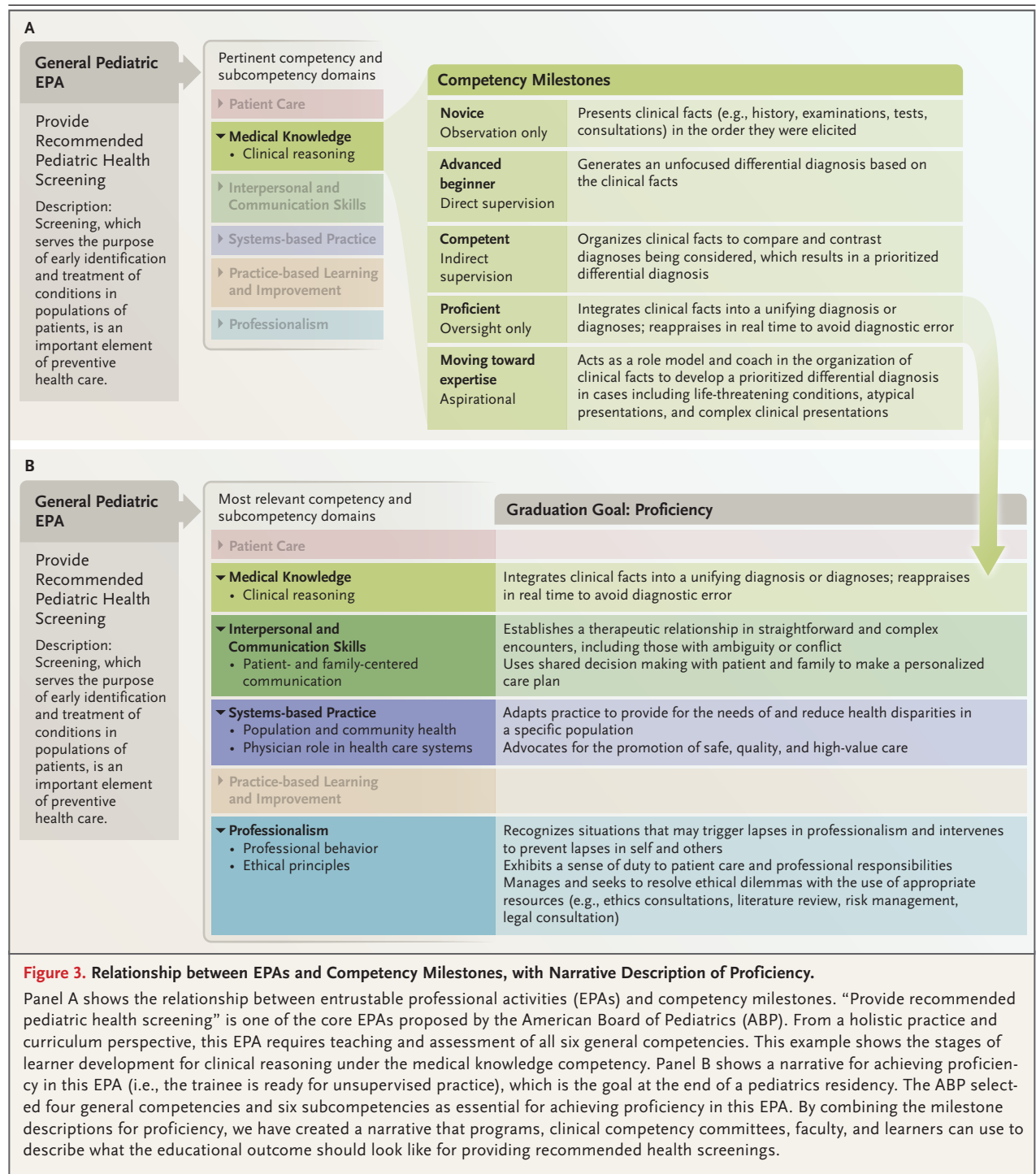


Figure 3. Relationship between EPAs and Competency Milestones, with Narrative Description of Proficiency.

Panel A shows the relationship between entrustable professional activities (EPAs) and competency milestones. “Provide recommended pediatric health screening” is one of the core EPAs proposed by the American Board of Pediatrics (ABP). From a holistic practice and curriculum perspective, this EPA requires teaching and assessment of all six general competencies. This example shows the stages of learner development for clinical reasoning under the medical knowledge competency. Panel B shows a narrative for achieving proficiency in this EPA (i.e., the trainee is ready for unsupervised practice), which is the goal at the end of a pediatrics residency. The ABP selected four general competencies and six subcompetencies as essential for achieving proficiency in this EPA. By combining the milestone descriptions for proficiency, we have created a narrative that programs, clinical competency committees, faculty, and learners can use to describe what the educational outcome should look like for providing recommended health screenings.

and team communication skills. These findings, in aggregate, should lead to further investigation by the program director or faculty coach to specify the deficiencies and develop an individualized learning plan with the resident.

For education leaders, analysis of the large volume of assessment data in a CBME program requires technological solutions and new strategies for decision making. Learning analytics (interpretation of a wide range of data to predict

future performance and identify potential issues) is an approach that can help programs identify trainees who are at risk for not achieving intended outcomes and support growth and development opportunities for all trainees.^{15,40,42,43} Several programs now use analytics to assess educational programming and refine existing assessment approaches.^{44,45} Some programs are also exploring the use of artificial intelligence and large language models to more holistically evaluate the corpus of assessment data at the individual and program levels.⁴⁴ Aggregated assessment data for individual trainees, combined with learning analytics, can improve program evaluation and help identify key gaps in curriculum and assessment approaches, which can lead to overall program improvement.

Continuous Improvement

Education leaders must regularly evaluate and refine the CBME program. Aggregated assessment information generated in the programs

can be used to monitor them and guide improvements through more rigorous program evaluation. Data showing that a substantial number of residents are not attaining the expected performance level in a component of the training program (e.g., developing an interdisciplinary management plan for common diagnoses) are probably more predictive of a curricular problem than of deficient trainee performance (Fig. 4).^{30,33,41,46,47}

CLINICIAN—EDUCATORS

Clinician—educators remain at the heart of any CBME program. First and foremost, clinician—educators must ensure that all patients receive high-quality, safe care through effective teaching, assessment, and supervision, while also ensuring that trainees receive high-quality feedback and coaching. The role of clinician—educators in CBME also requires an understanding of and proficiency in the general competencies being taught and assessed.

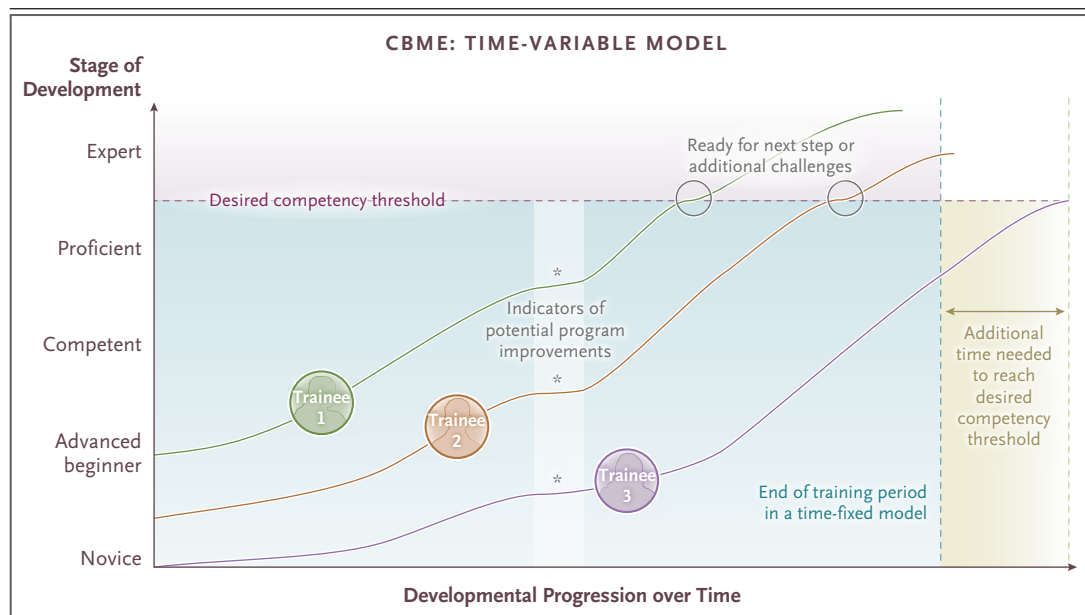


Figure 4. Support for Individual Learning Trajectories in CBME.

Learning curves for three trainees show the variable rates at which learners achieve competence, which highlights the need for time-variable education. In time-fixed programs, trainees transition with variable skill levels at the end of a defined training period, despite differences in individual learning trajectories. In the time-variable model, trainees transition when they have achieved the expected level of competence, an approach that ensures readiness to progress to the next level. The asterisks denote cohort-level milestone information, which identifies potential training program issues and highlights opportunities for improving education programs.

Use of Milestones to Facilitate Teaching and Learning

Clinician–educators facilitate the learning process in clinical settings. They can leverage the competency milestones to identify training gaps (e.g., a trainee has not yet had the opportunity to demonstrate a milestone) and monitor individual learning trajectories (e.g., a trainee is not progressing as expected). Clinician–educators can use the milestones to develop learning goals and individualized learning plans with trainees to ensure that learners know what is expected of them and can plan for improvements before transitioning to the next phase of training (Fig. 3).⁴⁸⁻⁵⁰

Enhanced Assessment and Feedback

In the CBME model, the focus is on direct observation of trainees and frequent and immediate feedback. In contrast to traditional models, in which summative assessments are provided at the end of rotations, in CBME, clinician–educators provide ongoing and specific narrative feedback that better supports learning and personal growth. To facilitate the work of focused feedback, some programs have implemented what are known as entrustable professional activities (EPAs).^{36,51-57} EPAs are designed to represent the routine professional activities of a physician; they should integrate relevant key competencies (i.e., abilities) needed to effectively perform a core patient care activity. Ten Cate and Taylor define an EPA as “a unit of professional practice that can be fully entrusted to a trainee, once [they have] demonstrated the necessary competence to execute this activity unsupervised. ‘Unit’ signifies a discrete task (e.g., ‘Managing patients with cataract’) or bundle of tasks (e.g., ‘Performing the procedures of internal medicine’ or ‘Managing an inpatient medical service’) and should be suitable for credentialing.”⁵⁷ Figure 3 provides an example of an EPA for pediatricians that is currently being used in the United States.

EPAs have gained traction because their focus on one or more specific observable clinical tasks aligns with direct patient care. They provide a more holistic approach to implementing curriculum and assessment programs by requiring that trainees be observed performing all specialty-specific EPAs. Instead of using traditional numerical scales, EPAs use entrustment-based scales to

communicate the amount of support or supervision a trainee requires for a particular clinical task.⁵⁴⁻⁵⁶ An entrustment scale indicates the clinician–educator’s assessment of how much supervision the trainee needs moving forward in performing a specific activity (e.g., counseling a patient about starting a new medication), which can range from direct supervision with the clinician–educator present in the examination room to no supervision. These new scales have gained widespread acceptance for workplace-based assessment because they readily align with the decisions clinician–educators make when granting trainees more autonomy.^{58,59}

We acknowledge that these newer approaches to assessment can be time-consuming and difficult, especially given the complex context of current systems of health care, increasing workloads, and physician reimbursement models. For frontline clinician–educators, programmatic assessment requires multiple observations of trainees, and although those observations are probably already occurring in the system, documenting them can still be burdensome for overworked clinician–educators. Supporting quality data collection from frontline clinician–educators requires technology that can facilitate capturing and integrating observations into the clinical workflow.⁶⁰

Progression Decisions

Perhaps one of the biggest changes for clinician–educators in a CBME model is the shift away from summative judgments about performance and readiness to progress. Individual clinician–educators should no longer make pass-or-fail decisions. Instead, because their time with trainees is often limited, they should focus on feeding rich descriptive information into the assessment system used by the program to guide decisions about a trainee’s developmental progress (Fig. 2).

Curriculum Development

Clinician–educators provide important feedback to program directors and other education leaders about what is working and where programs can address gaps in training. This feedback contributes to the design and implementation of CBME-aligned curricula.

Faculty Development

Given the emphasis on clinical coaching with workplace-based assessment and fulsome feedback, as well as the central role of the clinical competency committee, a strong approach to faculty development that facilitates meaningful change (at the individual and institutional levels) is required for CBME. A culture that fosters innovation and improvement is critical.^{37,39} Because clinician–educators are at the heart of CBME, they deserve support and recognition for their crucial roles and responsibilities. Improvement in program quality outcomes cannot occur without highly skilled clinician–educators.

TRAINEES

Trainees also have a crucial role in the implementation of CBME. Trainee voices are important when advocating for policy changes and resources at both the institutional and national levels.

Advantages for Trainees

CBME represents an important shift in medical training; it places trainees at the center of the learning process and emphasizes the development of the competencies necessary for high-quality clinical practice. First and foremost, CBME offers trainees clear expectations about learning outcomes, training opportunities that are aligned with assessment, enhanced feedback, and personalized learning.^{12,27,61} Each of these features improves transparency and provides learners with the opportunity to engage in self-assessment, set goals, and implement strategies for personal improvement. By focusing on essential patient care needs and everyday clinical activities, CBME aims to ensure that resident trainees are fully prepared to provide care without supervision on graduation, an approach that may offer opportunities for a shortened training period and reduced debt. The focus on direct observation and frequent feedback shifts the learner's mindset from performance to growth and deliberate practice, providing a much-needed framework for self-regulated learning and enhanced motivation.^{62,63}

Trainees as Coproducers in CBME

Trainees are context experts. Their personal understanding of the learning environment makes them key coproduction partners for CBME. Edu-

cational coproduction⁴⁸⁻⁵⁰ is the mutual construction of learning outcomes between trainee and teacher, which is similar to the partnership between physician and patient in coproducing health care outcomes^{49,50} (Fig. 2). Trainees can provide insight into the educational strengths and shortcomings of their programs to inform the development of both curricula and assessment tools. As supervisors of more junior learners, trainees bring insights to assessment and feedback approaches. Because CBME exposes learners to team-based care models, they train alongside professionals from various disciplines and can be partners in improving team-based care. Finally, coproduction fosters leadership and professionalism in trainees.¹⁸

**CHALLENGES IN IMPLEMENTING
THE COMPONENTS OF CBME**

Although CBME is rooted in sound educational science, implementation has proved challenging. CBME is a complex social systems intervention that has five core components: an outcomes-based competency framework, progressive sequencing in a medical education program, tailored learning experiences, competency-focused instruction and coaching, and programmatic assessment.⁶⁴⁻⁶⁶ For a CBME program to be competency-based and function as intended, all five components must be implemented.

Table S3 describes the five core components in more detail and provides examples of activities that can be coproduced by the trainee, the faculty, and the program. Some components of the CBME model have been easier to implement than others. Specifically, meaningful progress has been made with the use of competency milestones, EPAs, and programmatic assessment, as well as competency-focused instruction and coaching. However, implementation of progressive sequencing and tailored learning remains challenging.^{65,66}

**TIME AND CONTINUITY AS RESOURCES
FOR ACHIEVING OUTCOMES**

Key transition points along the continuum from undergraduate medical education to graduate medical education to continuing professional development represent important changes in expectations

of trainees. Yet these transitions also involve considerable fragmentation.⁶⁷⁻⁷⁰ Because the trajectory toward competence varies among trainees (Fig. 4), numerous transitions and fragmentation in the learning environments contribute to the challenges programs face when interpreting assessment information that fails to build on previous observations and fairly judge trainees' competence. Finally, without a shared educational vision and priorities in undergraduate medical education, graduate medical education, and continuing professional development, training environments are siloed, which makes transition points painful for trainees, supervisors, and patients.

Creating space to support the individual learning needs of trainees is challenging, given the rigid time-based curricular structures of most training programs. We need to transition from the current approach, which uses rotational blocks of time to organize clinical experiences, to a model that uses time as a resource for learning in order to better reflect the individual learning trajectories of trainees.^{46,71,72} For example, longitudinal rotations that permit greater continuity between physicians and patients, between clinician-educators and trainees, and between trainees and other health care team members have been shown to enhance relationships that are critical for effective learning, professional development, and high-quality patient care.^{17,73}

MAKING THE TRANSITION TO CBME

How training programs transition from the current rigid, time-fixed training paradigm to a CBME structure remains to be seen. We recognize that time-variable models affect the reliance of the health system on the health care services that trainees are expected to provide. For example, if a trainee moves from a given training module earlier than expected, a gap in patient care may result unless another trainee or other health care professional is immediately available to step into that role. Reorganizing such workplace processes will require coproduction and allocation of financial and material resources that support innovation.

To address some of these concerns, several novel time-variable models have been introduced in both Canada and the United States.

The Royal College of Physicians and Surgeons of Canada implemented the Competence by Design program,¹⁰ which is a hybrid approach to CBME. Trainees progress at different rates according to their abilities and developmental trajectories but must remain in the specialty program for the prescribed period. The time-variable component occurs within the program; trainees who achieve desired outcomes early can pursue specific areas of training when they are ready to do so. Time variability may also offer the advantage of allowing clinician-educators to devote more time to trainees who need additional coaching. Efforts to refine and evaluate the effectiveness of the Competence by Design approach are ongoing. In the United States, this model has been called "promotion in place," in which residents or fellows can be "promoted" to higher levels of responsibility beyond the graduate medical education requirements but do so within their training institution.^{74,75} Innovations such as promotion in place and Competence by Design provide options for personalizing training while maintaining current roles, responsibilities, and provision of care.

CONCLUSIONS

Although CBME is often perceived as resource-intensive, its true value should be considered as a return on investment from the perspective of patients and populations. Lack of trainee preparedness for increasing patient care responsibilities has costs for patients, training programs, and health systems, such as diagnostic and therapeutic errors and the delivery of suboptimal care. The education community should be asking what the costs are for not producing robust educational outcomes.

One of the strongest arguments for CBME is its foundational philosophy of longitudinal education that supports mastery of learning milestones and meets societal needs.^{14,28,62} The evidence for maintaining our traditional approaches to medical education is rapidly disappearing, and we argue that there is no going back. We cannot remain comfortable or complacent with the performance of the current medical education system; the need for change is too great. This does not mean that constructive criticism and scientific friction

are not important, but those who are critical of CBME have an obligation to provide alternatives to the inadequate current model. Sustaining the status quo is not a viable option. As we broaden our admissions criteria to enrich the physician community and better support community diversity, we owe our teachers and our trainees a system that is better designed to prepare trainees for future practice. It is time for a collective conversation to develop a shared mindset and a call to action among stakeholders. The need for

change is not only about improving education. It is a moral imperative to ensure that in every training environment, all patients under the care of trainees receive the highest-quality medical care.

Disclosure forms provided by the authors are available with the full text of this article at NEJM.org.

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