The critical role of infrastructure and organizational culture in implementing competency-based education and individualized pathways in undergraduate medical education

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ABSTRACT

In 2010, several key works in medical education predicted the changes necessary to train modern physicians to meet current and future challenges in health care, including the standardization of learning outcomes paired with individualized learning processes. The reframing of a medical expert as a flexible, adaptive team member and change agent, effective within a larger system and responsive to the community’s needs, requires a new approach to education: competency-based medical education (CBME). CBME is an outcomes-based developmental approach to ensuring each trainee’s readiness to advance through stages of training and continue to grow in unsupervised practice. Implementation of CBME with fidelity is a complex and challenging endeavor, demanding a fundamental shift in organizational culture and investment in appropriate infrastructure. This paper outlines how member schools of the American Medical Association Accelerating Change in Medical Education Consortium developed and implemented CBME, including common challenges and successes. Critical supporting factors include adoption of the master adaptive learner construct, longitudinal views of learner development, coaching, and a supportive learning environment.

KEYWORDS

Undergraduate medical education; competency-based medical education; UME; CBME; master adaptive learner; coaching; learning environment

Introduction

Medical education exists to serve the health care needs of patients and populations. However, despite rapid changes in biomedical science, population health, and health care systems, the structure of medical education remained largely uniform and steeped in tradition for over 100 years. Health care in the United States has failed to optimize the nation’s health, with issues such as poor-quality care, medical errors, health care disparities and health inequities, complex and burdensome systems, and escalating costs demonstrating important shortcomings in the health care delivery system (IOM 2001). New educational strategies are warranted to ensure physicians are better trained to meet the needs of society.

Sentinel works in medical education in 2010 forecasted the types of changes that would be needed to train modern physicians to meet current and future challenges in health care. The Lancet Commission on Education of Health Professionals for the 21st Century (Frenk et al. 2010). This group advocated for backward design (Wiggins and McTighe 1998) to align curricula and assessment programs to achieve desired educational outcomes across professions (Figure 1). Similar recommendations arose from an evidence-based report of medical education in the United States, commissioned by the Carnegie Foundation, which called for the standardiza-
tion of learning outcomes – clearly articulated in a developmental manner across the educational continuum – coupled with individualized learning processes (Cooke et al. 2010).

Of the Lancet Commission’s final proposed reforms, the first is:

Adoption of competency-based curricula that are responsive to rapidly changing needs rather than being dominated by static coursework. Competencies should be adapted to local contexts and be determined by national stakeholders while harnessing global knowledge and experiences. Simultaneously, the present gaps should be filled in the range of competencies that are required to deal with 21st-century challenges common to all countries—e.g., the response to global health security threats or the management of increasingly complex health systems. (Frenk et al. 2010)

Competency-based medical education (CBME) represents a fundamental shift from focusing on curricular time spent on certain topics or experiences to more explicitly emphasizing the outcomes of training (Harden 1999). By defining what knowledge, skills, and attitudes trainees must demonstrate to signify readiness to enter the next stages of training and eventual unsupervised practice and outlining how they will continue to expand their competence while in practice, CBME constitutes an outcomes-based approach to curricular design (Frank et al. 2010). The Lancet Commission highlighted three critical components of transformative medical education: (1) cultivation of skills in adaptive expertise and lifelong learning rather than rote memorization of medical knowledge; (2) achievement of a range of competencies for effective practice within interprofessional health care teams; and (3) application of sound educational models adapted to the local context (Frenk et al. 2010). Current realities of practice demand a reframing of a medical expert not as a solo ‘hero physician’ but rather as a flexible, adaptive team member and change agent, responsive to the community’s needs and effective within a larger system (Lesser et al. 2010). CBME approaches can accommodate such evolving expectations of physicians. Actualization of CBME should ensure trainee readiness for escalating care responsibilities and equip them to engage in lifelong learning throughout their continuing education in practice. Implementation, however, is arduous, as the Lancet Commission acknowledged:

No different than a century ago, educational reform is a long and difficult process that demands leadership and requires changing perspectives, work styles, and good relationships between all stakeholders. (Frenk et al. 2010)

In this manuscript, we outline shared lessons learned regarding the critical role of infrastructure and organizational culture in implementing CBME.

The American Medical Association Accelerating Change in Medical Education Consortium

The American Medical Association (AMA) recognized a malalignment between physician education and the realities of practice, demonstrated by concerns related to medical error, high costs of care, and prevalence of burnout among providers (Skochelak and Stack 2017). To spur needed changes to medical education to better meet the needs of patients and populations, the AMA launched the Accelerating Change in Medical Education initiative in 2013. Through a competitive process, initial grants were awarded to eleven U.S. medical schools, and funding was extended in 2016 to an additional twenty-one U.S. schools. The AMA convened these schools to create the Accelerating Change in Medical Education Consortium, providing an unprecedented opportunity for cross-institutional partnerships to implement and disseminate groundbreaking ideas. The consortium has since grown and extended to include graduate medical education (GME). This article focuses on activities related to CBME in UME during the consortium’s first five years among the original 32 schools; the final paper of this supplement discusses the continuation of these efforts into GME.

One core objective of the initiative was to promote new methods for teaching and assessing key competencies for medical students and fostering methods to create more flexible, individualized learning pathways. Recognizing that CBME is a complex intervention heavily dependent upon context and institutional culture, the AMA acknowledged that local solutions would be necessary to support this objective. There was no expectation for a standardized implementation across consortium sites. In this manuscript, we describe how different schools participating in the AMA’s consortium implemented broad curricular and structural innovations to support CBME and reflect upon the collective lessons learned as members shared successes and struggles in the process.

In 2019, Van Melle and colleagues proposed a core components framework for evaluating the fidelity of CBME implementation (Van Melle et al., International Competency-Based Medical Education Collaborators 2019). The five components entail clearly articulated outcome competencies with a sequenced progression of developmental steps, such as milestones to characterize the graded development of competence. Tailored learning experiences, not only in the classroom but also in the workplace, are paired with competency-focused instruction so that authentic learning takes place with the needed teaching, coaching, and role modeling from more experienced providers. Programmatic assessment is the coordinated approach to gathering and synthesizing learner assessment
data, typically coupled with group review and decision making so that learners are assessed using a variety of tools to ensure their achievement of the expected progressive development of competence (van der Vleuten et al. 2012; Lockyer et al., ICBME Collaborators 2017). In a CBME system that achieves these components, learners can progress at different rates. As such, time becomes a curricular resource rather than the defining structure of medical education (Frank et al. 2010; Lucey et al. 2018). Although this core components framework was not yet published when the consortium schools embarked on their efforts, the components provide a useful lens to review the implementation they accomplished.

### Implementing CBME at consortium institutions

Consortium institutions tackled the challenge of implementation with varied approaches, sharing lessons learned along the way. The degree to which core components of CBME have been achieved varies significantly among member institutions. In reviewing the objectives described in the initial grant proposals from the 32 member institutions, 16 specifically mentioned CBME as an outcome for their grant, and 14 mentioned individualized pathways; only one explicitly named programmatic assessment as a goal, and three sought to create time-variable systems. Common programmatic changes actually accomplished across consortium institutions included making competency expectations more explicit and broadening opportunities for competency development via more active learning formats and early meaningful clinical roles, consistent with recommendations of the Lancet Commission. To define outcomes and assess learner progression, consortium schools applied existing and novel frameworks. Many aligned with U.S. national frameworks such as the Accreditation Council for Graduate Medical Education Milestones Project (ACGME 2021) and the Association of American Medical Colleges Core Entrustable Professional Activities (EPAs) for Entering Residency (AAMC 2021). Many institutions implemented explicit assessments of readiness for internship to strengthen the evidence that each learner attained desired competencies. A few sites were able to accomplish even deeper implementation of CBME, with programmatic competency assessment, data-driven learner portfolios, time-variable progression, and flexible individualized learning plans.

### Exemplars in implementing CBME

A few consortium institutions were able to implement CBME for all of their students. These sites undertook a comprehensive overhaul of programming to apply a CBME approach to their entire student population over all the years of training. Table 1 elaborates how these sites accomplished elements of the core components framework, actualizing the ‘reform position’ (Van Melle et al., International Competency-Based Medical Education Collaborators 2019) that focuses on ‘flexible, individually tailored programs that can adapt to variable rates of competence attainment’ (Hodges 2010).

Other consortium schools applied CBME strategies to support special tracks involving limited numbers of students. Both the University of California (UC), Davis, School of Medicine and the Ohio University Heritage College of Osteopathic Medicine offered accelerated pathways into primary care and applied CBME strategies to ensure students attained satisfactory learning outcomes despite a shortened timeline of training. At UC Davis, each student works with a dedicated clinician mentor and coach to translate classroom learning into everyday clinical practice skills. The program uses EPAs to assess the competence and determine appropriate advancement. Ohio Heritage developed a new osteopathic competency-based program in which students must achieve didactic and clinical milestones that are not fixed in a specific timeframe. Advancement is based solely on the attainment of competencies determined by the objective assessment, not by the number of years in the program.

### Collaborative work of the consortium to support fidelity in implementation

As consortium institutions delved into the hard work of CBME implementation, teams recognized that attaining fidelity would truly require a transformation. CBME is a complex intervention that is highly context-dependent. The success of a CBME program relies heavily upon infrastructure to ensure that graduates are supported and assessed on their progress toward achievement of expected competencies (Holmboe et al. 2010). McGaghie and colleagues cautioned in 1978 that ‘implementation of such a system demands a substantial redefinition of faculty and student roles and responsibilities’ (McGaghie et al. 1978). The consortium provided a venue for schools engaged in the work of transformation to discuss shared challenges and barriers encountered along the way. Transparency among members regarding common struggles, coupled with a systemic orientation of the consortium’s work, informed institutional approaches to change management that address people, workflows, technology, and culture. Culture change to support CBME entails not only acceptance by faculty and students but also leadership committed to a widespread institutional shift from a focus on achievement to a focus on growth and lifelong learning (Alman et al. 2013). Although schools implemented CBME independently, collaborative efforts emerged around key elements of infrastructure that were deemed necessary to support fidelity of implementation.

The following areas reflect the collective efforts of consortium members across institutions to support fidelity in implementation of CBME.

### The master adaptive learner model

CBME relies on learners who are actively engaged in their own education. Though gaining admission to medical school requires significant academic success, that success is rarely of a self-directed and self-regulated nature that is required throughout one’s career as a physician (Sandars and Cleary 2011). Students must shift from a performance orientation, in which they strive to appear competent and achieve extrinsic rewards such as scores, grades, and medical school admission to a mastery orientation in which they learn for the sake of developing competency and
Table 1. Implementation of CBME at exemplar sites aligned with the core components framework.

| Core components | Vanderbilt University School of Medicine | Oregon Health & Science University School of Medicine | University of Michigan Medical School | University of California, San Francisco, School of Medicine |
|-----------------|----------------------------------------|------------------------------------------------------|--------------------------------------|-------------------------------------------------------------|
| Outcome competencies | Institutionally-created UME competencies aligned with ACGME framework (Lomis et al. 2017) plus AAMC Core EPAs | Institutionally-created UME competencies aligned with ACGME framework plus AAMC Core EPAs | Eight Institutionally – created UME competency domains aligned with ACGME framework + 2 additional domains (leadership, teamwork, & interprofessionalism; critical thinking & discovery) for a total of 31 competencies | Seven UME competencies aligned with the 6 competencies in the ACGME framework plus interprofessional collaboration |
| Sequested progression | Competencies are allocated and tracked across courses and years of training Greater focus on EPAs in the post-clerkship phase | Competencies are allocated and tracked across courses and years of training EPA achievement tracked only in clinical phase | Focus on 4 competency domains during first preclinical year (MK, PC, Comm, Prof); other competencies assessed in clerkship and post-clerkship years. | Competencies have 35 milestones for the 3 phases of the curriculum: curriculum and assessment activities are mapped to the milestones |
| Tailored learning experiences | Evidence-driven digital portfolio Structured individualized coaching program Student-led individualized learning plans, with scheduling flexibility in post-clerkship phase (years 3 & 4) | Students have great flexibility in timing and choice of clerkships Each student assigned to academic coach who provides guidance based on student performance | Three years of workplace-based learning (clinical) Post-clerkship competency committee reviews competency development and provides guidance to learners and their coaches/advisers (Keeley et al. 2019) Individualized development plans and coaches | Each student has a faculty coach for the entire curriculum; students and coaches have 8 progress and planning meetings to review progress in student dashboard and discuss student’s individual SMART goals for learning planning |
| Competency-focused instruction | All courses and clerkships have learning objectives and assessments mapped to competencies New course structures created to emphasize differing competency needs | All courses and clerkships have learning objectives and assessments mapped to competencies | All courses and clerkships have learning objectives and assessments mapped to competencies | All courses and clerkships have learning objectives and assessments mapped to competencies |
| Programmatic assessment | All courses assess in standardized competency language and provide frequent formative and fully transparent feedback Individual competency development is tracked and informs progression independently of course grades Aggregate competency outcomes for cohorts of students inform curricular and assessment improvements | All courses and clerkships have a standardized assessment framework based on competencies Aggregate competency outcomes for cohorts of students inform curricular and assessment improvements | Learners are assessed primarily based on competencies using a number of assessment strategies Competency committee reviews learner data in dashboard and makes determination of competency progression (Monrad et al. 2019) | All assessments are centrally coordinated (Hauer et al. 2018) Multiple competency-focused assessment tools are used longitudinally Group decision making is required for course and clerkship grading and overall progress |
| Time variable approaches | Graduation is not variable; however variable use of time in the post-clerkship phase based on individual’s competency development | Time-variable progression as well as graduation A few students have begun GME training – 2 months; early and early graduation is increasingly common | Graduation is not variable; however variable use of time in post-clerkship phase based on individual’s competency development | Time variability allowed for exams and in required medicine sub-internship |

* the Van Melle model does not name time-variability as a core component
improving to achieve individual goals and optimal function within larger teams and systems (Dweck 1986; Pintrich et al. 2003). Explaining to accomplished students that they need to learn how to learn is a challenge. This tension led members of the consortium to collaborate in articulating the construct of the Master Adaptive Learner (Cutrer et al. 2017). This model pushes beyond the Dreyfus model of routine expertise (Dreyfus et al. 1986) to strive for adaptive expertise. Iterative cycles of assessing, adapting, planning, and learning support individualized, developmental competency progression and illustrate more clearly how such development may vary within an individual across different domains of competency. These steps are analogous to efforts in health system quality improvement, reminiscent of the ‘plan, do, study, act’ approach (Deming 1986). This parallel helps learners to embrace a growth orientation within a system that is also growing and adapting, presenting continual individual self-improvement as matching continual quality improvement of systems. To further advance the implementation of the Master Adaptive Learner model, members of the consortium collaborated to publish an instructor focused guide on training future clinicians to develop adaptive skills (Cutrer et al. 2019).

Coaching
The expectation in CBME for tailored learning experiences requires a structured process to gather and review assessment evidence, understand gaps, and identify needed experiences. Though the focus of coaching in medicine can vary (Lovell 2018), a coach in a CBME program guides a learner in the context of a longitudinal relationship through the process of reviewing performance ratings, creating learning goals, planning strategies to achieve goals, and reflecting on personal and professional development (Deiorio et al. 2016). Evidence that people in general, and perhaps physicians in particular, are not effective at self-assessment argues that explicit training and evidence about one’s performance to promote informed self-assessment are necessary to support a developmental approach to competency (Davis et al. 2006; Sargeant et al. 2010). Schools prioritizing the cultivation of a mastery orientation toward learning and adaptive expertise have created coaching programs of varying forms to foster students’ skills in evidence-driven self-assessment that in turn inform the design of individualized learning pathways. As expected from existing literature (Kruger and Dunning 1999), high performing students often under-rated their own performance and lower performing students sometimes exhibited over-confidence. Coaches can assist in calibration; one consortium member school demonstrated that repeated sessions involving the student and coach discussing the interpretation of performance feedback led to increasing concordance between students’ self-assessments and coaches’ review of performance. To advance the utilization of coaching in medical education, consortium members collaborated to create a faculty guidebook and a companion guide for learners (Deiorio and Hammond 2017; Wolff et al. 2019). The consortium has also offered multiple faculty development workshops in coaching.

The learning environment
Consortium members recognized the tremendous impact of the learning environment on the implementation of CBME. A Learning Environment Study across consortium institutions (Skochelak et al. 2016) subsequently led to the description of individual and institutional drivers of the medical school educational environment (Gruppen and Stansfield 2016). That study demonstrated differences among institutions in student perceptions of the learning environment, but even more striking was the significant individual variance in experience within a given institution, which highlights the need to be mindful of the diversity of learners in addressing environmental issues. A conceptual framework for describing the learning environment outlined by Gruppen and colleagues includes both a psychosocial dimension and a material dimension. Members of the consortium shared strategies to address the interplay of the personal, social, physical, and virtual spaces and organizational factors in supporting optimal learning (Gruppen et al. 2019).

CBME demands a true developmental approach, which creates a level of vulnerability for learners that must be acknowledged. Shifting from a performance orientation to a mastery orientation requires the learner to expose areas needing further development (Savatsky et al. 2020). Although uncomfortable for many, this same behavior is necessary in the clinical realm to support safe and effective care. Schools attaining deeper implementation of CBME articulated this rationale to students and focused on empowering them to take charge of their own development.

To move from traditional assessment of learning to emphasize assessment for learning (van der Vleuten et al. 2012), the institutional culture must gain students’ trust. Explicit training for students about programmatic assessment approaches and the longitudinal view of development proved essential. Role modeling was helpful as well; students responded best when supervising residents and faculty members openly reflected on their own gaps and learning needs. Edmonson demonstrates that learning is most effective when a student experiences a combination of psychological safety, motivation, and accountability (Edmonson 2018). To realize the vision of CBME, students must perceive a safe environment (Tsuei et al. 2019).

The issue of a safe learning environment has proved critical in faculty development as well. Faculty assessors found a criterion-based approach challenging since they have historically compared students at a given level of training for the purpose of grade assignments and ranking rather than reporting on their progress toward ultimate competency for graduation. In reality, that traditional normative approach has been found fraught with structural biases and creates educational inequities with significant downstream consequences (Hauer and Lucey 2019; Teherani 2018). Many assessors expressed concern that their ratings of student performance were ‘lower’ in the context of CBME — even if developmentally appropriate — and that this would harm students’ ability to secure a residency position in their desired clinical discipline. Some faculty found the educational lingo around competencies, milestones, and EPAs overly complex (Dath and lobst 2010; Holmboe et al. 2011). One approach to faculty development was to tier faculty training by the ‘need to know’. Demonstrating how data dashboards aid in formulating a longitudinal view of each
student’s performance and explaining that competency committees monitor trends in performance over time and across settings helped frontline assessors (those faculty members and residents supervising learners in the clinical environment) understand that any single rating from them would not harm a student. Coaches assisting learners to engage in a developmental mindset and faculty members serving on competency committees needed a deeper, more nuanced understanding of the institution’s programmatic assessment process.

**Monitoring longitudinal progress**

Investment in educational informatics is critical to support programmatic assessment (Thoma et al. 2020). Competency develops across courses and over time; thus, centralized mechanisms to track progress are required. Data capture, organization, and visualization tools are necessary to make performance evidence interpretable and actionable (Boscardin et al. 2018). Consortium members shared key features of developing informatics platforms and challenges encountered (Santen et al. 2020). Although competency milestones rely on narrative descriptors, a common pitfall of dashboards noted in implementation was conversion of narratives to numeric data for reporting and display. This practice is harmful in two ways. Numeric data provides no feedback to help a student move, for example, from level 2 to level 3 on a scale; one needs the wording of competencies and milestones to understand what specific behaviors lead to growth. Numeric representation also creates the illusion that criterion-based ratings represent continuous data, although in reality, they are discrete descriptors. The frequency with which, and importantly the contexts in which, a student receives one rating or another is more helpful to educational planning than an ‘average’ score. Most programs went through repeated iterations of their dashboard designs to best support meaningful interpretation. Further, some schools incorporated narratives associated with student performance in clerkships to ground decisions on student progression and competency achievement. Members of the consortium collaborated to articulate critical technology needs in support of transformation (Stuart and Triola 2015; Spickard et al. 2016).

Educational handovers between courses and phases in an undergraduate medical education (UME) curriculum were deemed by consortium schools as necessary to support a developmental, sequenced learning progression. In a historical ‘performance mindset’ (Dweck 1986), some institutions have discouraged communication across courses due to concerns about anticipatory bias regarding a student’s performance, and many students would prefer to enter each course with a clean slate. However, a mastery orientation relies upon trends in individual performance across courses and settings to identify developmental needs enabling a more purposeful use of time as a resource for learning. Consortium schools that focused on longitudinal development found that individualized learning plans could often be executed within any given course or rotation in which the student was already engaged by focusing attention to specific competencies. In some cases, students could be directed toward targeted experiences as appropriate. Supporting a continuum of learner development across the transition of UME to GME requires similar support and trust. Several consortium members participated in pilots of communication of competency development near the time of graduation (Schiller et al. 2018). Consortium member Oregon Health & Science University School of Medicine (OHSU) implemented a process of communication after students have been matched that provides the receiving GME program an update on student competency achievement prior to the start of residency. One of the consortium’s annual conferences devoted several sessions to this topic, resulting in a collaborative publication regarding key elements of an envisioned post-selection UME-GME handover process to engage learners in a continuum of growth (Morgan et al. 2020).

**Bringing it all together**

Members of the consortium collaborated to describe the intersection of CBME, master adaptive learning, coaching, and the learning environment, as represented in Figure 2. Centered around iterative cycles of master adaptive learning, CBME provides guidance regarding desired learning outcomes and generates evidence of progress over time. Coaches support the learner’s advancement through each cycle and provide social support that positions the learner for increasing self-direction. The learning environment must offer appropriate physical and virtual spaces and tools for mastery learning and must validate mastery orientation at an organizational level.

This integration of models is now being promoted in the consortium’s faculty development programs on coaching.

**Prioritizing time for competency development**

Because CBME treats time as a resource for learning rather than a measure of learning and development progresses in a time-variable manner, creating flexibility in timelines is a critical element to support fidelity of implementation. The traditional Flexnerian model of medical education in the U.S., with two years of basic science training followed by two years of clinical work, has a rigidity that artificially separates development in these two spheres. Incorporating active learning modalities and clinical opportunities starting in the first year of the medical school enables students to begin developing the full breadth of competency domains much earlier. It is important to make this connection clear to students – that their knowledge learning is for application with patients and their behavior in their educational teams is a precursor to their behavior on clinical teams; the classroom is a safe space to practice all the domains. Successful CBME programs incorporate meaningful clinical roles from the first year to better integrate students’ learning across competencies.

An external barrier in the U.S. that essentially robs students of time for development has been a heavy emphasis on the scores on the United States Medical Licensing Examination (USMLE) Step 1 examination (which aims to assess whether medical school students or graduates can apply important concepts of the foundational sciences fundamental to the practice of medicine) in selecting students for residency positions. Use of this metric has driven students to de-prioritize other domains of competency until that exam has been taken. It is likely that high-stakes exams in other countries have similar impacts. Students experience anxiety when changes in curriculum and assessment are perceived to
create a risk to performance on licensing examinations or competitiveness for residency selection (Yengo-Kahn et al. 2017). Some consortium schools piloted a shift in timing, encouraging students to take this examination after completing their core clerkships to emphasize the integrated nature of developing knowledge and clinical skill sets; students at these schools attained higher scores (Daniel et al. 2017; Jurich et al. 2019). A consortium conference in 2018, which included representatives of the USMLE, highlighted concerns about the impact of Step 1 scoring on competency development. This helped to spur InCUS, a stakeholder conference in 2019 (USMLE 2019), jointly sponsored by the AMA, the Association of American Medical Colleges (AAMC), the Educational Commission for Foreign Medical Graduates (ECFMG), and the USMLE parent organizations, the Federation of State Medical Boards and the National Board of Medical Examiners (USMLE2019). There was consensus among participants that use of scores on this examination as a screening metric is only one of many problems associated with the current process of selection for residency in the U.S., however, this did result in plans to transition reporting from a 3-digit score to a pass/fail model starting in 2022. Hopefully, that transition will effectively recapture time for development across all competency domains early in students’ experiences.

Implementing time variable CBME in the United States faces another significant barrier related to the existing competitive process of selection for residency positions. Although processes of transition differ in other countries, similar pressures likely influence student behavior everywhere. Students feel pressured to assemble a competitive resume, which may paradoxically hamper development as learners feel compelled to prioritize looking good on paper over revealing their learning needs toward becoming a better physician. The competitive process for selection disrupts 3–6 months of educational time for each student, between completing multiple away ‘audition’ rotations in one’s desired specialty and devoting several months to interviews. Numerous concerns about this transition point were articulated during the InCUS conference, in which there was consensus that the current process is not serving any stakeholders well. The Coalition for Physician Accountability has recently charged a UME-GME Review Committee to examine the deleterious efforts of the current residency application and selection process (CPA 2021). It is notable that accelerated 3-year tracks typically seek exception from the formal U.S. matching process and guarantee participating students residency positions at the home institution; by avoiding time lost to the selection process, training time in these accelerated pathways effectively becomes only a few months less than the traditional pathway.

One strategy used by many consortium schools was to reduce the length of the pre-clerkship phase and position the core clerkships earlier in the students’ experience. Rather than completing core clerkships in June of the third year then hustling to complete a couple of advanced clinical rotations before submitting residency applications in September, students at these schools gain an additional 4–6 months for career exploration after the core clerkships and can focus on rounding out competency development before the application cycle begins. This structure provides more flexibility in the post-clerkship phase for individualized pathways driven by performance evidence and individual interests.

The single time point of transition into GME is an added challenge. On reflection, it does seem odd to have a system in which over 30,000 trainees transition simultaneously across the country; perhaps with better data, multiple standardized time points for transition could be implemented. Consortium schools that implemented robust CBME programs were able...
to identify a subset of students who were ready for the duties of internship at earlier time points in training. One school in the consortium, OHSU, did graduate these students early, reducing their tuition burden and even allowing some graduates to begin GME training within their own institution ahead of schedule (Mejicano and Bumsted 2018). Other schools did not graduate these candidates early because there was nowhere for them to go, and months of inactivity did not seem beneficial to sustaining performance. Loss of financial aid and loan repayment deferral for graduated students is also a risk. Those schools tried to provide advanced, value-added experiences within the home institution to promote ongoing growth. The upcoming work of the Coalition for Physician Accountability to explore changes to the UME to GME transition offers the opportunity to address challenges with the current selection process that would better support the continued learning trajectory valued in a CBME model. The AMA has taken on an advocacy role, encouraging systemic changes – such as multiple time points of transition across institutions from medical school into GME and from GME into fellowship or practice – to create a structure that supports full fidelity of implementation of CBME (Nousiainen et al. 2020).

Conclusion
Implementing CBME in UME is an immense and ongoing change process for individuals, systems, and cultures. The AMA consortium schools’ experiences highlight how each institution will encounter different challenges and opportunities in implementation, based on institutional mission, characteristics, readiness for change, and resources. Yet, there is benefit to collaboration around shared challenges and opportunities. Members of the consortium benefitted from a commitment to transparency in sharing struggles, lessons learned, and resources. Concrete examples of implementation strategies at specific institutions – some described in this manuscript – may help other schools considering implementation of CBME in UME. Rather than be intimidated and perhaps even paralyzed by the significant investments in faculty effort, informatics infrastructure, and culture change needed to implement CBME, some institutions might embrace an iterative approach while striving for transformative change (Borkan et al. 2018).

Maintaining transparency about the fidelity of implementation is necessary to understand outcomes; we cannot dismiss the conceptual value of CBME due to our challenges in bringing the construct to reality. Perceived immediate benefits of CBME based on the experience of consortium member institutions include the ability to identify and intervene with learners requiring more support as well as recognizing and enabling those ready to advance to greater responsibility for patient care. Ongoing improvements will include strengthening assessment processes and supporting a true continuum of development from UME to GME via the collective development of competency assessment frameworks and data management tools that are comparable and translatable across institutions. Institutions must continue to evaluate outcomes regarding the downstream performance of learners. Continued examination of the culture of medicine and advocacy for infrastructures and environments that truly support professional development across one’s career will be essential to realizing the full potential of CBME.

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