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A call to action: The controversy of and rationale for competency-based medical education

Eric S. Holmboe[a], Jonathan Sherbino[b], Robert Englander[c], Linda Snell[d,e] and Jason R. Frank[e,f]; on behalf of the ICBME Collaborators

[a]Accreditation Council for Graduate Medical Education, Chicago, IL, USA; [b]Division of Emergency Medicine, Department of Medicine, McMaster University, Hamilton, Canada; [c]School of Medicine, University of Minnesota, Minneapolis, MN, USA; [d]Centre for Medical and Department of General Internal Medicine, McGill University, Montreal, Quebec, Canada; [e]Royal College of Physicians and Surgeons of Canada, Ottawa, Canada; [f]Department of Emergency Medicine, University of Ottawa, Ottawa, Canada

ABSTRACT

Although medical education has enjoyed many successes over the last century, there is a recognition that health care is too often unsafe and of poor quality. Errors in diagnosis and treatment, communication breakdowns, poor care coordination, inappropriate use of tests and procedures, and dysfunctional collaboration harm patients and families around the world. These issues reflect on our current model of medical education and raise the question: Are physicians being adequately prepared for twenty-first century practice? Multiple reports have concluded the answer is "no." Concurrent with this concern is an increasing interest in competency-based medical education (CBME) as an approach to help reform medical education. The principles of CBME are grounded in providing better and safer care. As interest in CBME has increased, so have criticisms of the movement. This article summarizes and addresses objections and challenges related to CBME. These can provide valuable feedback to improve CBME implementation and avoid pitfalls. We strongly believe medical education reform should not be reduced to an "either/or" approach, but should blend theories and approaches to suit the needs and resources of the populations served. The incorporation of milestones and entrustable professional activities within existing competency frameworks speaks to the dynamic evolution of CBME, which should not be viewed as a fixed doctrine, but rather as a set of evolving concepts, principles, tools, and approaches that can enable important reforms in medical education that, in turn, enable the best outcomes for patients.

Background

Mary is a 75-year-old woman with heart disease and recurrent lung cancer. She has made it clear that she doesn't want additional cancer therapy, but after presenting with shortness of breath and being diagnosed with bronchitis, she complies with several courses of antibiotics prescribed by three different physicians. Unfortunately, Mary feels worse. She feels more tired and has to stop frequently to catch her breath. She is very frustrated with her oncologist and primary care physician, who she says "just aren't listening to me – and they don't seem to talk to each other." Finally, the primary care physician orders a chest CT scan that shows her cancer has advanced with bulky mediastinal adenopathy. He refers Mary to a surgeon for an endobronchial biopsy to "guide possible palliative therapy." Since she has already declined further therapy for her cancer, Mary is confused about the need for the biopsy. After 8 weeks of multiple physician visits with three different physicians, she can barely get out of bed and has lost all appetite. Her elderly husband and children intervene independently and institute home hospice care. On initial hospice evaluation Mary is severely hypoxic and confused; oxygen and medications are ordered for comfort and to reduce the anxiety from her shortness of breath. Mary dies at home 7 days later. The biopsy was never performed, and none of her physicians were engaged in her hospice care.

A myriad of stories like Mary's lies behind the rise of competency-based medical education (CBME) (McGaghie et al. 1978; Frank et al. 2010a; Frenk et al. 2010). No single measure could capture all the deficiencies in Mary's care, which cut across multiple competency domains at the level of the individual physician, the team and the

Practice points

- Competency-based medical education (CBME) is an approach to and philosophy of designing the explicit progression of competence of health professionals to meet the needs of patients and the public.
- CBME is not and should not be viewed as a rigid set of rules and beliefs, but rather as an important collection of principles and approaches that are constantly evolving to meet the primary aim of achieving better outcomes for patients and learners.
- CBME does not have to be overly reductionist in assessment but, rather, should embrace informed judgment and synthesis based on a program of assessment.
- Time is a precious resource, not a proxy for competence in CBME programs.
- CBME-based reform is not an "either/or" choice between competing theories, but an amalgam of important theories and approaches to maximize the quality of medical education training.

CONTACT Eric Holmboe eholmboe@acgme.org ACGME, 401 North Michigan Avenue, Chicago, IL 60611, USA

system. Errors in diagnosis and treatment, communication breakdowns, poor care coordination, the inappropriate use of tests and procedures, and dysfunctional collaboration all amount to inadequate care for this patient in her particular situation.

In 1978, McGaghie et al. described a rationale for an approach to medical education founded on the acquisition of defined competencies. "The intended output of a competency-based program," they wrote, "is a health professional who can practice medicine at a defined level of proficiency, in accord with local conditions, to meet local needs" (McGaghie et al. 1978, p. 18). Roughly 10 years later, a doctor's strike in Ontario, Canada, would catalyze a public conversation about what patients should expect from their physicians (Neufeld et al. 1993, 1998). This ultimately led to the first iteration of the CanMEDS Roles by the Royal College of Physicians and Surgeons of Canada in 1996 (Frank et al. 1996; Frank 2005). Recognizing similar needs and issues, the Accreditation Council of Graduate Medical Education, the American Board of Medical Specialties, the Institute of Medicine, the General Medical Council of the United Kingdom, the Royal Australasian College of Surgeons, the Dutch College of Medical Specialties, and other national professional entities produced competency frameworks (Batalden et al. 2002; IOM 2003; ten Cate 2007; General Medical Council 2013; RACS 2015). These frameworks were created to address the growing recognition that health care was too often unsafe and of poor quality and that medical education systems were not producing physicians with the abilities needed to meet the complexities of modern practice. The era of solo practice was waning; the era of team-based care, rapidly evolving practices, quality reforms and patient-centeredness had arrived. The substantial gap between practice and education resulted in the realization among policy-makers worldwide that reforms in undergraduate, graduate and continuing medical education were urgently needed. Despite this impetus for reform, many would agree that while William Osler would not recognize the health care system of today, he would, sadly, still recognize the medical education system (Sherbino & Frank 2014).

Historians may look back at the last 5 years as transformative. In 2010, the International CBME Collaborators, a group of medical educators and leaders convened by the Royal College of Physicians and Surgeons of Canada, produced a series of articles on the history, concepts, and challenges to the implementation of CBME across the continuum of medical training (Campbell et al. 2010; Frank et al. 2010a, 2010b; Harris et al. 2010; Holmboe et al. 2010; Iobst et al. 2010). In the same year, another international group published a position paper in the *Lancet* on the need to accelerate transformation in medical education, grounded in the principles of CBME (Frenk et al. 2010); meanwhile, on the 100th anniversary of the Flexner report (Flexner 1910), the Carnegie Foundation released recommendations for medical education that embraced many of the key principles and goals of CBME (Cooke et al. 2010). A few years later, Ludmerer's *Let Me Heal* (2015) further codified calls for change. Since 2010, several medical education systems have adopted and implemented sweeping CBME-based changes across the medical education continuum on a national scale (Nasca et al. 2012; Frank et al. 2015).

Table 1. Fundamental characteristics of competency-based medical education.

1. Graduate outcomes in the form of achievement of predefined desired competencies are the goals of CBME initiatives. These are aligned with the roles graduates will play in the next stage of their careers.
2. These predefined competencies are derived from the needs of patients, learners, and institutions and are organized into a coherent guiding framework (e.g. CanMEDS 2015, ACGME Clinical Competencies).
3. Time is a resource for learning, not the basis of progression of competence (e.g. time spent on a ward is not the marker of achievement).
4. Teaching and learning experiences are sequenced to facilitate an explicitly defined progression of ability in stages.
5. Learning is tailored in some manner to each learner's progression.
6. Numerous direct observations and focused feedback contribute to effective learner development of expertise.
7. Assessment is planned, systematic, systemic, and integrative.

In essence, CBME as a philosophy and educational strategy has reached the stage of widespread implementation.

However, as the momentum of the CBME reforms has increased, so have criticisms of the movement. Given the growing number of CBME initiatives on a large-scale, the ICBME group was recently re-constituted and expanded to reflect on the critical forces driving and challenging change. The core lesson from early efforts to implement CBME is the realization that it is not, and should not be, a uniform or static ideology. Rather, it is an amalgam of principles and approaches that must constantly evolve to meet a primary aim: to achieve better health and health care for all through more effective medical education.

What is meant by "CBME"?

CBME is an approach to and philosophy of designing the explicit developmental progression of health care professionals to meet the needs of those they serve. Among its fundamental characteristics (see Table 1) is a shift in emphasis away from time-based programs based solely on exposure to experiences such as clinical rotations in favor of an emphasis on needs-based graduate *outcomes*, authenticity, and learner-centeredness (Frank et al. 2010b; Carraccio et al. 2016).

Criticisms of CBME

Table 2 outlines arguments for and against CBME. The criticisms of CBME can be loosely grouped into five themes: concerns about reductionism; lack of evidence; impact on existing systems; implementation challenges; and philosophical or ideological concerns. Before delving into the arguments in support of CBME, it is important to examine some of the thoughtful criticisms that have been brought forward.

Concerns about reductionism

One of the more unfortunate misconceptions about CBME is that it leaves little room for the "art" of medicine, for meaningful professional identity formation, and for the development of complex, higher-level competencies (Grant 1999; Huddle & Heudebert 2007). A common refrain is that not all that is measurable is meaningful, and not all that is meaningful is measurable. Others have labeled CBME a checklist or "tick-box" approach to medical education while

Table 2. Arguments for and against the CBME movement.

Supporting arguments	Criticisms
Quality and safety concerns • Patients not receiving evidence-based care • Overwhelming evidence of unacceptable variation in care • Poor communication skills among health care professionals • Suboptimal teamwork • Overuse and misuse of tests and procedures • Lack of patient-centeredness • Little improvement in rates of diagnostic error • Poor performance on the triple aims of better health, efficient per capita cost, and optimal quality and safety Inertia in the current medical education system Despite compelling evidence that: • Current training provides inadequate preparation for practice • Current training does not ensure graduates have all desired abilities (ad hoc model of medical education) • Educators fail to fail learners who have not attained the desired abilities • Assessment programs and systems are inadequate • Lifelong learning programs and activities are inadequate • Transitions in phases of the current continuum are difficult Core UME and GME models have shown very little change for decades. The need for accountability in medical education systems CBME offers: • Better stewardship of public funding • Fulfillment of the social contract and moral obligations • Transparency and accountability CBME is part of the solution because it • Is explicit in calling attention to what the public and patients need (i.e. it is more patient-centered) • Has helped to empower patients and the public • Is supported by multiple theories (e.g. progression of competence/expertise) • Defines desired abilities, not just knowledge • Defines stepwise paths • Emphasizes assessment for learning • Reconceptualizes time as a resource • Is more learner-centered • Is grounded in measurement science • Can be implemented to be fluid, dynamic, and adaptable to meet changing conditions in health care delivery • Places limits on how much variation in teaching and assessment is acceptable	Reductionism versus holism tensions • CBME is too reductionist • The CBME approach is unable to balance and integrate reductionism and holism • It is impossible to explicitly define everything that is important in being a health professional • CBME reduces everything to a checklist of competencies Time and impact on existing systems • Current systems cannot readily change to time-variable based training • CBME cannot meet the service needs of training institutions • CBME cannot be embedded in poorly performing health care systems Evaluation and implementation challenges • If implemented with the same rigidity as current time-based models, CBME likely will fail • CBME cannot be "locked in" as a static concept • Attempts at implementation have been flawed or ineffective and non-iterative • Faculty are too busy to implement CBME • Work-based assessments not up to the task • Faculty are unable to make the transition because variability and idiosyncrasy continue to rule • Sufficient institutional resources for implementation are lacking Lack of evidence There is no psychometric or other evidence that CBME achieves better results than current training CMBE should not be instituted until there is evidence of its effectiveness Philosophical/ideological concerns CBME is: • Misguided • A professional power grab • Confusing • Prone to the same old problems as current training • Failing to promote excellence

others have argued meaningful differences between competencies cannot be measured (Talbot 2004; Huddle & Heudebert 2007; Lurie et al. 2009; Glass 2014). In reality, CBME seeks to maintain a holistic approach to physician competence at the same time as it appropriately parses competence into elements that can be taught and assessed. To make sense of a competency, we often need to explicitly break it down into meaningful components. This is an essential element of effective feedback even for experts, as Atul Gawande wonderfully highlighted in describing his experience of having a former mentor watch him operate. As Gawande noted, "one twenty-minute discussion gave me more to consider and work on than I'd had in the past five years" (Gawande 2011). The feedback he received was highly specific and granular (reductionist), although it had the "holistic" goal of improving the outcomes of his surgeries. Work by Ericsson, Pusic and others provides further support for the idea that highly granular feedback is needed by all learners (Ericsson 2007; Pusic et al. 2011; Cook et al. 2013).

At the same time, CBME relies heavily on informed judgment and synthesis. This is the primary rationale for including clinical competency committees in the new medical accreditation system in the United States (Nasca et al. 2012; Andolsek et al. 2015). Methods to enhance informed judgment are needed to help medical educators, especially clinical faculty and program leaders, develop shared mental models of what the desired outcomes of training should look like and to enable the use of group processes to make entrustment decisions (Andolsek et al. 2015; Hauer et al. 2015). We also know that criterion-based approaches, such as milestones and entrustable professional activities (EPAs), currently being used in a number of countries, are challenging to implement in educational programs (Swing 2007; ten Cate & Scheele 2007; Philibert et al. 2014; Tekian et al. 2015; ten Cate et al. 2016). Although some variation is to be expected – all faculty have idiosyncrasies, biases, and cognitive limitations (Govaerts et al. 2011; Yeates et al. 2013; Gingerich 2015) – the degree of acceptable variation in assessment should be "bounded" (Kogan et al. 2014; Gingerich 2015). For too long the medical education system has seen unfettered variation as a good thing, to the detriment of patients and trainees (Kogan et al. 2014; Lau et al. 2015). Holism and reductionism both have a place in medical education; the issue is when and how to apply these interconnected philosophies appropriately.

Lack of evidence for CBME

Some have pointed to the lack of evidence for the CBME approach, especially regarding the lack of traditional psychometric validity and reliability evidence. (Norman et al. 2014; Dewan et al. 2015). Related to the psychometric argument is the concern that work-based assessments, critical

to the CBME model, are simply not up to the task of producing statistically justified high-stakes decisions (Norman et al. 2014; Tekian et al. 2015). However, psychometric assessment instruments have long suffered from numerous limitations, and faculty have also struggled with the concept of criterion-referenced versus norm-referenced approaches to the assessment (Kogan & Holmboe 2013; Gingerich 2015). In addition, the amount of sampling required to "sign off" on every competency needed for independent practice (assuming this is even necessary; it is *not* endorsed by the CBME movement) can be daunting from a psychometric perspective (Norman et al. 2014).

Systems implementing CBME, with its greater focus on the needs of the patient, population and system, have encountered significant challenges when they apply conventional psychometric methods (Schuwirth & van der Vleuten 2011; Cook et al. 2015; Hodges 2015;). This experience has sharpened the focus on work-based assessment and prompted a return to narrative and group process as part of a *program and system* of assessment (Holmboe et al. 2006; Holmboe et al. 2010; van der Vleuten et al. 2012; Hodges 2015). However, we are not suggesting that we simply "throw out psychometrics." The psychometric paradigm has served the medical education enterprise well and will continue to do so into the future, but in the longer term systems will need assessment approaches that account for uncertainty and complexity. For example, one of the criticisms of script concordance testing is the lack of a psychometric theory to deal with the embedded uncertainty in the testing process (Lineberry et al. 2013). Yet any clinician will tell you that he or she spends a significant proportion of every work day in the land of uncertain choices and tradeoffs.

In the twentieth century, the individual was the primary frame of reference for high-stakes assessment; in the twenty-first century, it's the health care team. Competent health care providers do not work in isolation and can no longer (if they ever could) carry all necessary knowledge and skills in their head (Lingard 2009; Del Fiol et al. 2014; Ludmerer 2015). We have entered the interprofessional, technology-supported century of medicine (Chesluk & Holmboe 2010; IPEC 2011). The psychometric paradigm is ill-suited for interprofessional, complex care, and it struggles with issues such as context, distributed cognition within interprofessional teams, and the use of technological aids such as clinical decision support. The question before us is where and how psychometrics fits into a complex system to help educators and policy-makers make good decisions about advancing learners and maintaining the workforce. It is interesting that the two countries that rely most heavily on high-stakes standardized testing (the United States and Canada) have consistently ranked at the bottom of overall medical-care quality reports by the Organization for Economic Co-operation and Development (OECD) and the World Health Organization (WHO); perhaps it is no surprise that CBME has taken a strong hold in both countries (Mossialos et al. 2015).

Making the most of time: impact on existing systems

Few issues engender more passion in medical education reform than the role of time. Two major challenges account for this. The first is the uncomfortable reality that many teaching institutions have become overly dependent on learners to deliver care services, which means that variable rates of progression through a program can create havoc with respect to learners' availability to meet service needs (Ludmerer 2015). Also, certain graduate medical education (GME) financing systems, such as those in the United States and Canada, are time-based (Eden et al. 2014).

The second challenge is that time is used as a proxy measure of competence. Time is an indirect measure of experience. The duration of training has been refined, mostly unconsciously, to enable an adequate quantitative experience. However, it is unreasonable to assume that such a crude metric can ensure competence, or that all learners will progress at the same rate. This is not to say that time and quantity are irrelevant: recently, ten Cate outlined the "false dichotomy" that has crept into debates concerning time-based versus competency-based learning, noting that learners need a certain amount of time and experience to achieve the desired outcomes (ten Cate 2015). That being said, the major problem with the current model of education is that time has been used as an organizing *framework*, when it should be viewed as *resource* to manage wisely (Frank et al. 2010b).

For example, Bernabeo et al. (Bernabeo et al. 2011) looked at the impact of educational transitions, (i.e. moving from rotation to rotation) among a group of internal medicine residents. The results were sobering. Residents and non-physician health care professionals reported multiple problems with these transitions, including the challenge for learners to acclimate within new clinical microsystems, the failure of faculty to appreciate the dysfunction occurring during acclimation on their service, and the harm experienced by admitted patients during the process. By centering programs on clinical and educational outcomes, CBME seeks to address these negative consequences of time-based frameworks for learning and patient care. (Batalden et al. 2002; Batalden & Davidoff 2007; Holmboe & Batalden 2015).

Evaluation and implementation challenges

Almost no one disputes that implementing CBME-based programs is challenging, or that today's contexts of medical education and clinical practice are fraught with complexity. However, medical education can draw lessons from implementation science (McGaghie 2011) and complex program evaluation models (Pawson & Tilley 1997; Craig et al. 2008; Mayne 2011). Evaluation of programmatic change will have to recognize that the work of revising, refining, and improving our medical curricula and assessment approaches is never done. Research and evaluation models that recognize complexity must also embrace the notion that context matters a great deal and cannot be effectively addressed through the randomization associated with traditional biomedical research methods. To be sure, evaluation of CBME in a longitudinal, iterative process is essential and is a responsibility of all organizations implementing medical education reform.

Philosophical and ideological concerns

For some critics, CBME is radical, untested, and unnecessary. Others have pointed to political pressure to use CBME

not only to produce more competent physicians but also to do so in less time (Whitehead et al. 2011). This has led to doubts about the educational or societal benefit of CBME innovations and concerns about the ability to determine whether someone is ready for unsupervised practice early (Huddle & Heudebert 2007; Norman et al. 2014). The irony is that there isn't much evidence to support the traditional systems that have been in place for over a century. There is, however, abundant evidence that the status quo isn't serving us well (IOM 2003; Di Francesco et al. 2005; Cooke et al. 2010; Crosson et al. 2011; Eden et al. 2014; Ludmerer 2015). Some have noted that we shouldn't implement CBME reforms until they have been fully proven (Dewan et al. 2015). There are several problems with this argument. First, the rapid and ongoing changes in health care science and delivery demand more flexibility and a "continuous quality improvement" mindset for medical education. Second, policy-makers are demanding transformative change in light of the uneven quality and safety of current health care, cost pressures, the aging of populations, emerging diseases, and the advent of personalized medicine.

Tensions and reconceptualization are a normal part of scientific progress, as we know from Thomas Kuhn's seminal work, *The Structure of Scientific Revolutions* (Kuhn 1962). Tensions arise when existing paradigms can no longer explain new findings or provide meaningful solutions to the changing conditions. In many ways, CBME has forced medical education systems to confront difficult truths regarding quality and safety, thereby forcing a reexamination of established approaches, such as psychometric-driven assessment approaches and time-based programs. Questions from the public and from policy-makers, as to how to improve medical education to better meet the public's needs, are legitimate. The important point is to use criticisms of CBME as useful feedback to improve implementation and avoid pitfalls, but not as an excuse to maintain an unsatisfactory status quo. Bridging the quality and safety gap with improvements in medical education should be the focus moving forward, and appropriate stewardship of public resources in preparing health professionals is a legitimate public policy concern (Weinberger 2011).

Why the strong and continued global interest in CBME?

Why does CBME continue to grow as a global movement despite the criticisms that have been leveled at it? History would suggest that inertia alone might be enough to block innovation. The question brings us back to where we started: the primary goal of medical education is to prepare a health professions workforce that can meet the needs of patients and populations (McGaghie et al. 1978; IOM 2003; Frenk et al. 2010; Eva et al. 2013; Carraccio et al. 2016). This is much more than just being "transparent" about what medical training should contain (Norman et al. 2014). Ironically, much of the criticism of CBME makes scant mention of the quality and safety issues currently plaguing health care, often taking a traditional, physician-centric view of medical training despite abundant evidence that traditional approaches are not meeting current needs. In fact, the word "patient" rarely appears in a number of commonly referenced criticisms of CBME.

Longitudinal data from the OECD and WHO continue to highlight the consequences of dysfunctional health care and persistent deficiencies across the globe (Mossialos et al. 2015). Many countries are confronting the challenge to the capacity of their health care systems posed by the accelerated aging of their population. At the same time, countries in Africa and the Near East are struggling mightily with shortages of skilled health care workers for all age sectors, as was tragically exemplified in the recent Ebola outbreak. Finally, there is a growing concern among many nations about escalating health care costs, most strikingly in the United States (Weinberger 2011; Mossialos et al. 2015). The most recent US Institute of Medicine report highlighted the urgent need for innovation to the structures, locations, and processes of GME (Eden et al. 2014). The focus on outcomes in CBME, while unquestionably difficult, better aligns the missions of medical education and health care delivery. Given this underlying state of concern regarding medical education systems around the world, how can we leverage CBME and the associated criticisms to move educational transformation forward?

A tipping point in implementation?

Medical education reform should not boil down to an "either/or" choice between competing theories; rather, it should blend theories and approaches to optimize the quality of training. In fact, CBME already represents an amalgam of theories and exemplifies the dictum that no single theory will be sufficient for something as complex as training a health care professional for twenty-first century practice (Frank et al. 2010b). For example, the rise of constructivist, socio-cultural, and newer cognitive theories are actually helping to move CBME implementation forward (Lingard 2009; Durning & Artino 2011; Gingerich et al. 2014; Durning et al. 2015; Gingerich 2015). There are no hard and fast "rules" of CBME that should prevent an educational program from applying multiple theoretical perspectives to design, implementation, and evaluation.

Ironically, the strength of the outcomes approach is its inherent recognition of the need to incorporate new theories as they emerge and mature to continually improve training programs. Implementing CBME-based models will always be an iterative, dynamic process (Pawson & Tilley 1997; van der Vleuten & Schuwirth 2005; Nasca et al. 2012). In CBME, outcomes are paramount, while the tactics used to achieve them are chosen from the best available. We are now entering a new phase of CBME implementation, perhaps best highlighted by the deliberate use of milestones and EPAs in a number of national medical education frameworks that did not exist at the beginning of the competency movement. This is one healthy sign that the CBME approach is in fact learning and adapting.

Conclusions

CBME is evolving to meet health care and educational system needs; rather than a fixed doctrine, it is a set of concepts, principles, tools, and approaches that can enable transformation. CBME must be implemented wisely, with

keen attention to context. For many countries, such as Canada, Singapore, and the United States, hybrid models of training are being implemented because of logistical and financial constraints, so that the principles and tools of CBME are being applied within fixed-time models. CBME embraces continuous quality improvement through iterative learning cycles to better learn what works, for whom, in what circumstances, and why.

Implemented effectively and dynamically, CBME can help all training programs do better for the patients and populations they serve. For future Marys, it will mean the delivery of patient-centered care by an effective interprofessional team that makes accurate diagnoses, maximizes meaningful engagement in life-and-death decisions, coordinates care, and attends to comfort and the needs of family members. We must also recognize that, as some of the criticisms of CBME reflect, change is hard because it is mostly about loss: loss of identity and loss of tremendous personal investment in traditional models of medical education (Heifetz & Linsky 2002). Ironically, CBME can help to "bring back" many things that we should embrace – most notably bedside rounds, direct observation, and faculty judgment – but in a more rigorous and systematic manner. Mary would have welcomed a more coherent and attentive health professions team during her clinic visits or at her bedside, helping her to make important decisions. Medical education programs must produce graduates who are prepared to provide the high-quality twenty-first century care that all patients deserve.

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Glossary

Competency-based medical education: An outcomes-based approach to the design, implementation, assessment, and evaluation of medical education programs, using an organizing framework of competencies. (Frank et al. 2010b)

Notes on contributors

Eric S. Holmboe, MD, is a Senior Vice President for Milestone Development and Evaluation, Accreditation Council for Graduate Medical Education, USA.

Jonathan Sherbino, MD, is an Associate Professor in the Department of Medicine, McMaster University, and an Assistant Dean with Program for Education Research and Development, McMaster University, Canada.

Robert Englander, MD, is an Associate Dean for Undergraduate Medical Education, University of Minnesota School of Medicine, USA.

Linda Snell, MD, is a Professor of Medicine and Core Faculty member, Centre for Medical and Department of General Internal Medicine, McGill University, and a Senior Clinician Educator, Royal College of Physicians and Surgeons of Canada, Canada.

Jason R. Frank, MD, is the Director, Specialty Education, Strategy and Standards in the Office of Specialty Education at the Royal College of Physicians and Surgeons of Canada, and the Director of Educational Research & Development in the Department of Emergency Medicine, University of Ottawa, Canada.

References

Andolsek K, Padmore J, Hauer K, Holmboe ES. 2015. Clinical competency committees: a guidebook for programs. Chicago: Accreditation Council for Graduate Medical Education.

Batalden PB, Davidoff F. 2007. What is quality improvement and how can it transform healthcare? Qual Saf Health Care. 16:2–3.

Batalden PB, Leach D, Swing S, Dreyfus H, Dreyfus S. 2002. General competencies and accreditation in graduate medical education. Health Aff (Millwood). 21:103–111.

Bernabeo EC, Holtman MC, Ginsburg S, Rosenbaum JR, Holmboe ES. 2011. Lost in transition: the experience and impact of frequent changes in the inpatient learning environment. Acad Med. 86:591–598.

Campbell C, Silver I, Sherbino J, ten Cate O, Holmboe ES. 2010. Competency-based continuing professional development. Med Teach. 32:657–662.

Carraccio C, Englander R, Van Melle E, ten Cate O, Lockyer J, Chan MK, Frank JR, Snell LS. International Competency-Based Medical Education Collaborators. 2016. Advancing competency-based medical education: a charter for clinician-educators. Acad Med. 91:645–649.

Chesluk BJ, Holmboe ES. 2010. How teams work in primary care: an ethnographic perspective on teamwork in internal medicine practices. Health Aff (Millwood). 29:874–879.

Cook DA, Brydges R, Zendejas B, Hamstra SJ, Hatala R. 2013. Mastery learning for health professionals using technology-enhanced simulation: a systematic review and meta-analysis. Acad Med. 88:1178–1186.

Cook DA, Holmboe ES, Sorensen KJ, Berger RA, Wilkinson JM. 2015. Getting maintenance of certification to work: a grounded theory study of physicians' perceptions. JAMA Intern Med. 175:35–42.

Cooke M, Irby DM, O'Brien BC. 2010. Educating physicians: a call for reform of medical school and residency. San Francisco: Jossey-Bass.

Craig P, Dieppe P, Macintyre A, Michie S, Nazareth I, Petticrew M. 2008. Developing and evaluating complex interventions: new guidance. London: Medical Research Council.

Crosson FJ, Leu J, Roemer BM, Ross MN. 2011. Gaps in residency training should be addressed to better prepare doctors for a twenty-first-century delivery system. Health Aff (Millwood). 30:2412–2418.

Del Fiol G, Workman E, Gorman PN. 2014. Clinical questions raised by clinicians at the point of care: a systematic review. JAMA Intern Med. 174:710–718.

Dewan M, Manring J, Satish U. 2015. The new milestones: Do we need to take a step back to go a mile forward? Acad Psychiatry. 39:147–150.

Di Francesco L, Pistoria MJ, Auerbach AD, Nardino RJ, Holmboe ES. 2005. Internal medicine training in the inpatient setting. A review of published educational interventions. J Gen Intern Med. 20:1173–1180.

Durning SJ, Artino AR. 2011. Situativity theory: a perspective on how participants and the environment can interact: AMEE Guide no. 52. Med Teach. 33:188–199.

Durning SJ, Lubarsky S, Torre D, Dory V, Holmboe E. 2015. Considering "nonlinearity" across the continuum in medical education assessment: supporting theory, practice, and future research directions. J Cont Educ Health Prof. 35:232–243.

Eden J, Berwick D, Wilensky G, editors. 2014. Graduate medical education that meets the nation's health needs. Washington: National Academies Press.

Ericsson KA. 2007. An expert-performance perspective of research on medical expertise: the study of clinical performance. Med Educ. 41:1124–1130.

Eva K, Bordage G, Campbell C, Galbraith R, Ginsberg S, Holmboe E, Regehr G. 2013. Report to the Medical Council of Canada on current issues in health professional and health professional trainee assessment. Ottawa: Medical Council of Canada.

Flexner A. 1910. Medical education in the United States and Canada: a report to the Carnegie Foundation for the Advancement of Teaching. New York: Carnegie Foundation for the Advancement of Teaching.

Frank JR, editor. 2005. The CanMEDS 2005 physician competency framework. Better standards. Better physicians. Better care. Ottawa: Royal College of Physicians and Surgeons of Canada.

Frank JR, Jabbour M, Tugwell P, Boyd D, Fréchette D, Labrosse J, MacFayden J, Marks M, Neufeld V, Polson A, et al. 1996. Skills for the new millennium: report of the societal needs working group. Ottawa: Royal College of Physicians and Surgeons of Canada.

Frank JR, Mungroo R, Ahmad Y, Wang M, De Rossi S, Horsley T. 2010a. Toward a definition of competency-based education in medicine: a systematic review of published definitions. Med Teach. 32:631–637.

Frank JR, Snell LS, ten Cate O, Holmboe ES, Carraccio C, Swing SR, Harris P, Glasgow NJ, Campbell C, Dath D, et al. 2010b. Competency-based medical education: theory to practice. Med Teach. 32:638–645.

Frank JR, Snell L, Sherbino J, editors. 2015. CanMEDS 2015 physician competency framework. Ottawa: Royal College of Physicians and Surgeons of Canada.

Frenk J, Chen L, Bhutta ZA, Cohen J, Crisp N, Evans T, Fineberg H, García PJ, Ke Y, Kelley P, et al. 2010. Health professionals for a new century: transforming education to strengthen health systems in an interdependent world. Lancet. 376:1923–1958.

Gawande A. 2011. Personal best. The New Yorker [Internet]. [cited 2015 Aug 11]. Available from: www.newyorker.com/magazine/2011/10/03/personal-best

General Medical Council. 2013. Good medical practice. Manchester: General Medical Council.

Gingerich A. 2015. What if the 'trust' in entrustable were a social judgement? Med Educ. 49:750–752.

Gingerich A, Kogan J, Yeates P, Govaerts M, Holmboe E. 2014. Seeing the 'black box' differently: assessor cognition from three research perspectives. Med Educ. 48:1055–1168.

Glass JM. 2014. Competency based training is a framework for incompetence. BMJ.. 348:g2909.

Govaerts MJB, Schuwirth L, van der Vleuten CP, Muijtjens AM. 2011. Workplace-based assessment: effects of rater expertise. Adv in Health Sci Educ. 16:151–165.

Grant J. 1999. The incapacitating effects of Competence: a critique. Adv Health Sci Educ Theory Pract. 4:271–277.

Harris P, Snell L, Talbot M, Harden RM. 2010. Competency-based medical education: implications for undergraduate programs. Med Teach. 32:646–650.

Hauer KE, Chesluk B, Iobst W, Holmboe ES, Baron RB, Boscardin CK, ten Cate O, O'Sullivan PS. 2015. Reviewing residents' competence: a qualitative study of the role of clinical competency committees in performance assessment. Acad Med. 90:1084–1092.

Heifetz RA, Linsky M. 2002. Leadership on the line: staying alive through the dangers of leading. Boston: Harvard Business School Publishing.

Hodges BD. 2015. Sea monsters & whirlpools: navigating between examination and reflection in medical education. Med Teach. 37:261–266.

Holmboe ES, Batalden P. 2015. Achieving the desired transformation: thoughts on next steps for outcomes-based medical education. Acad Med. 90:1215–1223.

Holmboe ES, Sherbino J, Long DM, Swing SR, Frank JR. International Competency-based Medical Education Collaborators. 2010. The role of assessment in competency-based medical education. Med Teach. 32:676–682.

Holmboe ES, Rodak W, Mills G, McFarlane MJ, Schultz HJ. 2006. Outcomes-based evaluation in resident education: creating systems and structured portfolios. Am J Med. 119:708–714.

Huddle TS, Heudebert GR. 2007. Taking apart the art: the risk of anatomizing clinical competence. Acad Med. 82:536–541.

Institute of Medicine (IOM). 2003. Health professions education: a bridge to quality. Washington: National Academies Press.

Interprofessional Education Collaborative Expert Panel (IPEC). 2011. Core competences for interprofessional collaborative practice. Washington: IPEC.

Iobst WF, Sherbino J, ten Cate O, Richardson DL, Dath D, Swing SR, Harris P, Mungroo R, Holmboe ES, Frank JR, et al. 2010. Competency-based medical education in postgraduate medical education. Med Teach. 32:651–656.

Kogan JR, Conforti LN, Iobst WF, Holmboe ES. 2014. Reconceptualizing variable rater assessments as both an educational and clinical care problem. Acad Med. 89:721–727.

Kogan JR, Holmboe ES. 2013. Realizing the promise and importance of performance-based assessment. Teach Learn Med. 25(Suppl 1): S68–S74.

Kuhn T. 1962. The structure of scientific revolutions. Chicago: Chicago University Press.

Lau BD, Streiff MB, Pronovost PJ, Haider AH, Efron DT, Haut ER. 2015. Attending physician performance measure scores and resident Physicians' Ordering Practices. JAMA Surg. 150:813–814.

Lineberry M, Kreiter CD, Bordage G. 2013. Threats to validity in the use and interpretation of script concordance test scores. Med Educ. 47:1175–1183.

Lingard L. 2009. What we see and don't see when we look at 'competence': notes on a god term. Adv Health Sci Educ Theory Pract. 14:625–628.

Ludmerer K. 2015. Let me heal: the opportunity to preserve excellence in American medicine. New York: Oxford University Press.

Lurie SJ, Mooney CJ, Lyness JM. 2009. Measurement of the general competencies of the Accreditation Council for Graduate Medical Education: a systematic review. Acad Med. 84:301–309.

Mayne J. 2011. Contribution analysis: addressing cause and effect. Chapter 3 in: Forss K, Marra M, Schwartz R, editors. Evaluating the complex: attribution, contribution and beyond. New Brunswick (NJ): Transaction Publishers.

McGaghie WC. 2011. Implementation science: addressing complexity in medical education. Med Teach. 33:97–98.

McGaghie WC, Miller GE, Sajid AW, Telder TV, Lipson L. 1978. Competency-based curriculum development in medical education: an introduction. Public Health Papers No. 68. Geneva: World Health Organization.

Mossialos E, Wenzl M, Osborn R, Anderson C. 2015. International profiles of health care systems, 2014: Australia, Canada, Denmark, England, France, Germany, Italy, Japan, The Netherlands, New Zealand, Norway, Singapore, Sweden, Switzerland, and the United States. New York: Commonwealth Fund.

Nasca TJ, Philibert I, Brigham T, Flynn TC. 2012. The next GME accreditation system-rationale and benefits. N Engl J Med. 366:1051–1056.

Neufeld VR, Maudsley RF, Pickering RJ, Turnbull JM, Weston WW, Brown MG, Simpson JC. 1998. Educating future physicians for Ontario. Acad Med. 73:1133–1148.

Neufeld VR, Maudsley RF, Pickering RJ, Walters BC, Turnbull JM, Spasoff RA, Hollomby DJ, LaVigne KJ. 1993. Demand-side medical education: educating future physicians for Ontario. CMAJ. 148:1471–1477.

Norman G, Norcini J, Bordage G. 2014. Competency-based education: milestones or millstones? J Grad Med Educ. 6:1–6.

Pawson R, Tilley N. 1997. Realistic evaluation. London: Sage.

Philibert I, Brigham T, Edgar L, Swing S. 2014. Organization of the educational milestones for use in the assessment of educational outcomes. J Grad Med Educ. 6:177–182.

Pusic M, Pecaric M, Boutis K. 2011. How much practice is enough? Using learning curves to assess the deliberate practice of radiograph interpretation. Acad Med. 86:731–736.

Royal Australasian College of Surgeons (RACS). 2015. Nine RAC competencies. East Melbourne: RACS.

Schuwirth LW, Van der Vleuten CP. 2011. Programmatic assessment: from assessment of learning to assessment for learning. Med Teach. 33:478–485.

Sherbino J, Frank JR. 2014. @SirBill: the power of social media to transform medical education. Postgrad Med J. 90:545–546.

Swing SR. 2007. The ACGME outcome project: retrospective and prospective. Med Teach. 29:648–654.

Talbot M. 2004. Monkey see, monkey do: a critique of the competency model in graduate medical education. Med Educ. 38:587–592.

Tekian A, Hodges BD, Roberts TE, Schuwirth L, Norcini J. 2015. Assessing competencies using milestones along the way. Med Teach. 37:399–402.

ten Cate O. 2007. Medical education in the Netherlands. Med Teach. 29:752–757.

ten Cate O, Scheele F. 2007. Competency-based postgraduate training: can we bridge the gap between theory and clinical practice? Acad Med. 82:542–547.

ten Cate O. 2015. The false dichotomy of quality and quantity in the discourse around assessment in competency-based education. Adv Health Sci Educ Theory Pract. 20:835–838.

ten Cate O, Hart D, Ankel F, Busari J, Englander R, Glasgow N, Holmboe E, Iobst W, Lovell E, Snell LS, et al. 2016. Entrustment decision making in clinical training. Acad Med. 91:191–198.

van der Vleuten CPM, Schuwirth LWT. 2005. Assessing professional competence: from methods to programmes. Med Educ. 39:309–317.

van der Vleuten CP, Schuwirth LW, Driessen EW, Dijkstra J, Tigelaar D, Baartman LK, van Tartwijk J. 2012. A model for programmatic assessment fit for purpose. Med Teach. 34:205–3214.

Weinberger SE. 2011. Providing high-value, cost-conscious care: a critical seventh general competency for physicians. Ann Intern Med. 155:386–388.

Whitehead CR, Austin Z, Hodges BD. 2011. Flower power: the armoured expert in the CanMEDS competency framework? Adv Health Sci Educ Theory Pract. 16:681–694.

Yeates P, O'Neill P, Mann K, Eva K. 2013. Seeing the same thing differently: mechanisms that contribute to assessor differences in directly-observed performance assessments. Adv Health Sci Educ Theory Pract. 18:325–341.