Competency Based Medical Education

A White Paper commissioned by the AFMC Board of Directors

Co-Authored by:

Andree Boucher – Universite de Montreal

Jason R Frank – University of Ottawa and Royal College of Physicians and Surgeons of Canada

Elaine Van Melle – Queens University and Royal College of Physicians and Surgeons of Canada

Ivy Oandasan- University of Toronto and College of Family Physicians of Canada

Claire Touchie – University of Ottawa and Medical Council of Canada

Contents

Competency-Based Medical Education is Here

Competency-based medical education is no longer merely an aspiration - it is an education innovation that is rapidly being adopted as a leading practice.

Within Canada, the evolution to competency-based medical education is well underway:

- ❖ The College of Family Physicians has effectively implemented a novel national Triple C Competency Based Curriculum
- ❖ Competence by Design (CBD), the Royal College's initiative to improve physician training and lifelong learning, is scheduled to officially launch at the residency level in two disciplines in July, 2017
- ❖ As an institution wide initiative, Queens University has embarked upon the implementation of CBME across all postgraduate medical education programs on July 1st, 2017.
- ❖ A set of pan-Canadian Entrustable Professional Activities (EPAs) for UGME have been adopted for UGME, through the collaborative effort of an AFMC working group, guiding the progressive roll out of competency- based education for the transition of the medical school graduate into residency education
- ❖ The planning process for Competency-Based Continuing Professional Development (CB CPD) for specialists was officially launched by the Royal College in January 2016 and a detailed plan for its articulation is presently in development.
- ❖ The Medical Council of Canada developed an examination blueprint reflective of the reality of medical practice and the health care needs of society, and plans to launch the new Qualifying Examinations based on this blueprint in Spring 2018

Internationally, the movement towards competency-based medical training has gained worldwide momentum. Alongside Canada, the United States, the Netherlands, and Australia, are leading the way and rapidly progressing in CBME innovation, while many other medical training programs from around the globe have recently started the transition. Appendix A provides an overview of the evolution of CBME and highlights some of the key international CBME activities that have emerged over the past half century. Whereas the individual design and approaches to implementation may be vary from program to program and across institutions, the underlying philosophy remains same for all – to produce physicians with the competencies and life-long learning skills required for meeting the ever-changing needs of the society in which they serve. To remain current and competitive, the Canadian medical schools are participating in new models to teach, assess, evaluate and produce scholarship in CBME.

Like many other changes in medicine such as problem-based learning (PBL), the shift to competency-based medical education may have internal challenges for widespread uptake but even in the course of the last three years, CBME has become the new norm. The implementation of competency-based medical education provides an opportunity for Canada to maintain its leadership position in medical education and to produce physicians that will best serve the Canadian public and beyond. The key facets of CBME can be described as "flexible, socially accountable, measureable and evidence-based."

The Canadian CBME innovation represents the most significant disruption in medical education since Flexner.

> *"CBME is a new frontier. There is no roadmap for success; we must chart our own path. But we have all the tools we need to succeed: engaged faculty and learners, curricular guidance from our certifying colleges, and significant local expertise in education innovation and research. If we all work together, we can lead the way in bringing CBME to life. We owe it to our patients. We owe it to our communities. We owe it to our learners"*
>
> *Dr. Chris Watling, MD, PhD: Associate Dean, Postgraduate Medical Education, Schulich Medicine & Dentistry*

This White paper was commissioned after the Open Board session in April 2016 of the AFMC Board where concerns were raised about the utility and rationale for a move to CBME. The purpose of this paper is to provide a brief overview of:

❖ The rationale for competency based medicine
❖ CBME in the context of the current curriculum
❖ National CBME progress to date, and
❖ Considerations for next steps for AFMC

The CBME White paper working group was comprised of Andree Boucher, Jason Frank, Elaine Van Melle, Ivy Oandasan, Claire Touchie and Sarita Verma with support from Lisa Gorman and Stacey Brzezina. The Group expresses many thanks to the Royal College for their in-kind contribution to the development of this paper.

The Next Steps for consideration by the AFMC are summarized as follows:

1. The Association of Faculties of Medicine should endorse Competency-Based Medical Education as a unique innovation in medical education and recognize Canada as one of the world leaders in the field
2. As Competency-Based Medical Education implementation progresses, medical schools should explore and benefit from opportunities to produce scholarship and engage in activities for sharing best practices
3. In preparation for the migration to CBME, AFMC should encourage familiarization with CBME through available resources and promote adoption of enabling tactics for enhanced CBME implementation.

Keeping Pace in the 21st Century

Throughout the 20th century, the scope of the health care system has expanded. Emerging societal needs (such as an aging population), advancements in medical care & knowledge, as well as increasing patient expectations require us to focus on social accountability. In light of these changing demands,

evidence suggests that the current structure of medical training is no longer sufficient in preparing physicians for practice in the 21st century (Frenk et al, 2010). In 2000, the Institute of Medicine published "To Err is Human" followed by two subsequent reports (IOM, 2001; 2015). The essence of these reports is that most people will suffer from adverse events and diagnostic errors in their lifetime and that many of these are preventable. Similar studies have been reported from Canada and the United Kingdom (Baker et al., 2004; Shaw et al., 2005).   Despite 15 years of evidence that patient-safety is an issue, the present educational system fails to adequately prepare trainees for these issues. Moreover, the increased need to produce highly-skilled, specialist practitioners to keep up with the ever-increasing advancements in medical care has shifted the focus of training inwards and has created what has been described as a "physician-centered approach" rather than "a community- and patient-centred approach" (Meilli and Buchman, 2013). In order to remain socially accountable as a profession, the shift must once again turn outwards.

As a self-regulating profession, medical educators have the responsibility to provide training that produces competent graduates and is accountable to the public, patients and their families. CBME offers an approach to training that honours this responsibility.

In comparison to traditional approaches to medical education that are expert-driven, and internally produced, CBME provides a method of organizing medical education that is learner-centred and oriented around population and health care system needs (Iobst et al., 2010). CBME works to first identify the desired outcomes of medical training (i.e., the competencies physicians will require for future practice), and then works backwards to design a curriculum that outlines tailored training experiences and focused instruction that will facilitate the achievement of these outcomes, and assessment strategies that promise greater accountability in progression and entrustment decisions. This approach recognizes that time-spent learning is not always a surrogate marker of competence and that the time required to progress and acquire competence will vary across learners. CBME provides a description of the expected end-product i.e. a physician at the end of training; measures whether the outcome expected is actually achieved; and helps to identify learners in difficulty early, offering opportunities for enabling achievement (Saucier et al., 2012).

CBME in the context of the current curriculum: Describing the change

The current system of medical education is primarily organized to provide learner exposure to specific content. Described as a structure- and process-based system, the focus is on all learners acquiring specific knowledge within the same fixed timeframe. In this system, teachers tend to be responsible for determining the content which can vary from program to program. In competency-based medical education however, competencies required for practice form the central component of all curricula. Described as an outcome-based curriculum, the competencies are derived from an assessment of societal needs for healthcare. These competencies are organized in a way that promotes a sequential path through the program. All other curricular components – instructional methods, learning experiences and assessment practices - are aligned to support individual learner progression.

The approach to competency-based education has been further put into practice through a Core Components Framework shared by the Royal College in its Competence by Design initiative, and which

aligns with the CFPC's Triple C. The core components of a CBME curriculum are described in [Appendix B](#) and are based on the following five elements.

- o **Framework**: An outcomes competency framework where competencies required for practice are clearly articulated and are identified based on societal needs
- o **Progression:** Competencies and their developmental markers are sequenced progressively in a way that supports a learner's progression from novice to master clinician
- o **Tailored experiences**: Learning experiences that resemble the practice environment facilitate the development of competencies and are flexible enough to accommodate variation in individual rates of progression
- o **Competency- focused instruction**: Teaching practices (especially observing and coaching behaviours) promote the developmental acquisition of competencies and emphasize learning through experience and application as well as knowledge acquisition
- o **Programmatic assessment**: Assessment practices support and document the developmental acquisition of competencies and emphasize workplace-based observation as well as meaningful feedback.

It is important to note that these core components should be consistent across all residency programs within a medical school. Therefore all residency programs in Canada support the same CBME principles.

Context plays an important role in the implementation of CBME. Implementation will look different based upon the local context. Under the component of programmatic assessment, some programs may use academic advisors and others may not. In addition, under tailored experiences, some programs may implement a fully longitudinal curriculum, other programs may use block rotations and some may use a combination of the two. The critical element is that no matter how the curriculum is designed it must ensure that learners are provided opportunities to learn the competencies expected and are assessed on an ongoing basis for progressive achievement of competence during training. The components provided in [Appendix B](#) highlight the essential principles that guide the development of CBME. Implementation, however, is determined by what is feasible and available in local contexts.

CBME within Canada

As previously mentioned, Canada is well underway in the design, implementation and evaluation of competency-based approaches to physician training and lifelong learning.   Recognizing that CBME is not a prescriptive approach but rather an overarching guiding framework, CBME has been implemented across different specialties, at varying paces with unprecedented collaboration between accrediting colleges, across specialty programs, within university departments, within hospital and other clinical training sites and with excellent learner, faculty, and researcher involvement.   The table below provides a sample of how CBME is being implemented in Canada.

Table 1 – National CBME activities

University	FM - Triple C Launched 2011	Competence by Design - programs launching in July 2017	Local Innovations
University of British Columbia	√	Anesthesiology Otolaryngology- Head and Neck Surgery	
University of Calgary	√	Anesthesiology Otolaryngology- Head and Neck Surgery	• 1st FM Residency Program that fully implemented CBME across all its urban teaching sites in one year (2012) (need to check this date)
University of Alberta	√	Anesthesiology Otolaryngology- Head and Neck Surgery	• FM Residency program implementation of Competency Based Assessment (CBAS) electronic system for all Residents
University of Saskatchewan	√	Anesthesiology	
University of Manitoba	√	Anesthesiology Otolaryngology- Head and Neck Surgery	
Northern Ontario School of Medicine	√	Anesthesiology	
University of Western Ontario	√	Anesthesiology Otolaryngology- Head and Neck Surgery	
McMaster University	√	Anesthesiology Otolaryngology- Head and Neck Surgery	• EM residency program developed and implemented McMAP- a competency-based assessment program
University of Toronto	√	Anesthesiology Otolaryngology- Head and Neck Surgery	• Orthopedic Surgery - transitioned into a competency-based curriculum following a pilot project initiated in 2009 • Psychiatry – PGY1 transition

University	FM - Triple C Launched 2011	Competence by Design - programs launching in July 2017	Local Innovations
			- program to use competency-based medical education initiated in 2015 (FIRE) - Family Medicine introduces formative serial knowledge testing throughout the program
Queen's University	√	Anesthesiology	- All Postgraduate specialty residency programs to fully transition to CBME by July 1st, 2017
University of Ottawa	√	Anesthesiology Otolaryngology- Head and Neck Surgery	- Anesthesiology – competency-based training program initiated in 2015 (FIRE)
Memorial University of Newfoundland	√	Anesthesiology	- NunaFM Residency Program in Nunavut made possible with CBME design - Using an EPA assessment program in clerkship
McGill University	√	Anesthesiology Otolaryngology- Head and Neck Surgery	
Université de Montréal	√	Anesthesiology Otolaryngology- Head and Neck Surgery	
Université de Sherbrooke	√	Anesthesiology Otolaryngology- Head and Neck Surgery	- UGME program is launching their new 2017 curriculum with a competency-based framework and programmatic assessment in September 2017
Université Laval	√	Anesthesiology Otolaryngology- Head and Neck Surgery	
Dalhousie	√	Anesthesiology Otolaryngology- Head and Neck Surgery	- Anesthesiology – competency-based training initiated in 2015 (FIRE) - Annapolis Valley FM Residency Program offers 3 year integrated Emergency Medicine Residency Program with CBME Design

Managing the Transition to CBME

Using outcomes-based approaches, the CFPC and the Royal College are committed to the evaluation of short-term and long-term outcomes of their respective initiatives, which includes close, on-going monitoring to consider impact on learners, faculty, and the health system in general.

The Triple C Curriculum of CFCP is now implemented throughout the 17 Family Medicine programs in Canada. Appendix C provides CFPC's Triple C logic model and highlights the short term and long-term outcomes of Triple C that are actively being monitored.   Using the CFPC's Triple C program evaluation data compiled to date, some key lessons have emerged:

- ❖ It is possible to implement CBME across all 17 FM Residency Programs within a relatively short period of time (2011-2016) and measure changes across programs
- ❖ The use of a flexible approach to the implementation of Triple C was valued among residency program directors allowing for a period of innovation in applying CBME within their local contexts. However, some programs had hoped for slightly more guidance by the CFPC.
- ❖ Costs related to implementation have been asymmetrical across and within residency programs. All have recognized the substantial increase in administrative and resource costs. Due to already approved expansion of new Family Medicine training sites during Triple C's implementation period, many programs were able creatively use the funding to support the changes.
- ❖ The implementation of Triple C is showing some signs of successful early identification of struggling students in residency programs using programmatic assessment processes with helpful remediation. At the University of Alberta, residents encountering difficulty were significantly more likely to be identified by the program and offered learning support or remediation. (Ross et al., 2016)
- ❖ Key cautions are emphasized for establishing ongoing communication as CBME is implemented within and across residency programs; with the PG deans; with clinical environments that may be affected due to service delivery changes; and with regional health authorities. Where change is created too quickly or with a lack of communication with stakeholders, challenges arise.
- ❖ The use of the program evaluation plan is providing data to help support and course correct changes that have been affected by the implementation of Triple C. This includes a plan to better define how the CFPC defines "comprehensive" and "centred in Family Medicine" as two of the 3 C's that guide curriculum development.

The Royal College is committed to an iterative, adaptive approach to CBD implementation, and through the progressive roll-out and gradual adoption of CBD by specialty and subspecialty programs, lessons learned from early experiences will help shape and inform future iterations.

Learning from the experiences of others involves forming partnerships and collaborations with local, national and international organizations – both formal and informal in nature.   A number of organizations and programs have engaged in a variety of projects and transformations premised upon

CBME, and because many of these projects are situated at different stages of implementation, each experience offers rich data to help guide future CBME development.

The initial findings from early CBME adopters can provide guidance on what schools can do to prepare for CBME implementation. Table 2 offers some enabling tactics for CBME implementation that draw upon some of these early experiences.

Next Steps for consideration by the AFMC

1. AFMC should endorse CBME as a unique innovation in medical education and recognize Canada as one of the world leaders in the field
2. As CBME implementation progresses, medical schools should explore and benefit from opportunities to produce scholarship and engage in activities for sharing best practices
3. In preparation for the migration to CBME, AFMC should encourage familiarization with CBME through available resources (Appendix D) and promote adoption of enabling tactics for enhanced CBME implementation (Table 2)

Table 2 – Enabling tactics for enhanced CBME implementation

Coordinate and Communicate
❖ Understand and communicate the rationale for CBME (become equipped with an elevator speech) ❖ Develop a strong communication strategy both internally and externally ❖ Leverage Faculty Development resources across all medical schools to provide a coordinating hub that supports CBME program implementation by both the CFPC and the Royal College ❖ Strengthen opportunities between UGME and PGME within medical schools to examine what is being taught within the medical school curriculum and what is needed as a baseline for PGME residency programs. Ensure that gaps can be addressed through learning opportunities at the end of medical school or beginning of residency through "boot camps" enhancing transitions and supporting readiness to begin training in residencies. ❖ Work with the Colleges to find ways to survey residents post completion of residency in order to garner data to help with improving CBME implementation and consider the implementation of CBME approaches to assessment in UGME.
Promote and Support
❖ Become an advocate of CBME and promote engagement ❖ Develop a network of local CBME champions ❖ Support faculty development programs to enable the new skill acquisition required by faculty to assess and coach learners in a CBME manner ❖ Ensure the appropriate infrastructure is in place to support the transition to CBME (i.e. restructuring of clinics and ward to allow for direct observation, assessment and feedback, appropriate electronic platform to support ePortfolio technology) ❖ Ensure there is clarity around roles and responsibilities ❖ Support faculty to learn with and from each other during the ongoing implementation of CBME to capitalize on expertise within local contexts. ❖ Consider the needs of residency programs for remediation programs to help learners who may be in difficulty.
Encourage acceptance, engagement and adaptability
❖ Foster acceptance in the community (encourage open-mindedness and promote a culture of change) ❖ Take on an iterative approach to implementation and be prepared to make adjustments along the way ❖ Systematize ways in which residents, faculty, administrators can provide feedback on implementation of CBME. ❖ Explore options for change in length of training (either shortened or lengthened) because of CBME and funding impact. ❖ Involve and engage residents, faculty, and program administration alike ❖ *Just start! It is easier to change the course of a moving subject than of one that stands still (Isaac Newton)* ❖ *Empathy drives change – put your soul into it!* Marian Mourits, MD, PhD

References

Baker GR, Norton, PG, Flintoft V, Blais R, Brown A, Cox J, et al. 2004. The Canadian Adverse Events Study: the incidence of adverse effects among hospital patients in Canada. CMAJ. 170: 1678-1686.

Frenk J, Chen L, Bhutta ZA, Cohen J, Crisp N, Evans T, Fineberg H, Garcia P, 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.

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.

Institute of Medicine, Committee on Quality of Health Care in America. Kohn LT, Corrigan JM, Donaldson MS, editors. To err is human: building a safer health care system. Washington: National Academy Press; 2000.

Institute of Medicine, Committee on Quality of Health Care in America. 2001. Crossing the quality chasms: a new health system for the 21st century. Washington: National Academy Press.

Meilli R, Buchman, S. 2013. Social accountability: at the heart of family medicine. Canadian Family Physician. 59: 335-336Ross S, Svystun O, Donoff M, Humphries P, Schipper S. 2016. Trends in resident rotation flags before and after implementation of the Competency-Based Achievement System. Can Fam Phys 62 (Suppl. 1) S25

Saucier, D, Shaw E, Kerr J, Konkin J, Oandasan I, Organek A, Parsons E, Tannenbaum D, Walsh A. 2012. Competency-based curriculum for family medicine. Can Fam Physician. 58: 707-708

Shaw R, Drever F, Hughes H, Osborn S, Williams S. 2005. Adverse events and near miss reporting in the NHS. Qual Saf Health Care. 14: 279-283

Appendix A: The Evolution of Competency-Based Medical Education across the Globe

Competency-based medical education was first introduced into the medical community in 1978 when the World Health Organization delivered a report promoting the worldwide adoption of CBME. Since that time, further reports have been released around the world discussing the need for change in medical education and offering solutions and strategies that resonate with a competency-based approach.   Over the past two and half decades, the concept of competency-based medical education has come to fruition as CBME frameworks have been developed, projects piloted, and CBME programs implemented around the world. The figure below provides an overview of the evolution of CBME and includes some of the key international activities that have been initiated over last five decades (references are provided in Table x).

Figure 1 – Timeline of CBME advancements

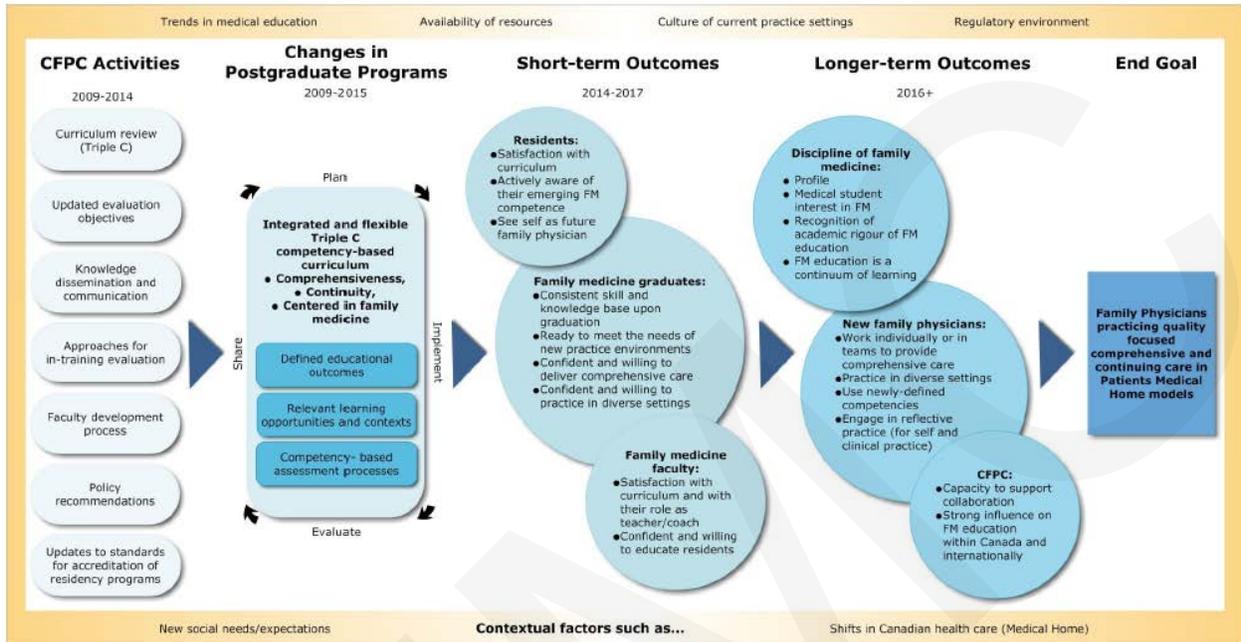|	References for activities/developments listed in Figure 1
1	McGaghie WC, Miller GE, Sajid AW, Telder TV, Lipson L. 1978. Competency-based curriculum development in medical education: an introduction. Public Health Papers No. 68. Geneva: World Health Organization; [cited 2017 Feb 6]. Available from: http://apps.who.int/iris/bitstream/10665/39703/1/WHO_PHP_68.pdf
2	Anderson MB, Cohen JJ, Hallock JE, Kassbaum DG, Turnbull J, Whitcomb ME. 1998. Report I: Learning objectives for medical student eductation. Guidelines for medical schools. Washington: Association of American Medical Colleges; [cited 2017 Feb 5]. Available from: https://members.aamc.org/eweb/upload/Learning%20Objectives%20for%20Medical%20Student%20Educ%20Report%20I.pdf
3	Neufeld VR, Maudsley RF, Pickering RJ, Walters BC, Turnbull JT, Spasoff RA, Hollomby DJ, Lavigne KJ. 1993. Demand-side medical education: educating future physicians for Ontario. CMAJ. 148:1471–1477.
4	Abrahamson S, Beaty HN, Bryan GA, Carver S, Friedman CP, Morahan PS, Reich C, Rosse C, Seidel HM. 1992. ACME-TRI report. Educating medical students: assessing change in medical education. The road to implementation. Washington: Association of Medical Colleges; [cited 2017 Feb 3]. Available from: http://files.eric.ed.gov/fulltext/ED354818.pdf
5	Anderson MB, Cohen JJ, Hallock JE, Kassbaum DG, Turnbull J, Whitcomb ME. 1998. Report I: Learning objectives for medical student eductation. Guidelines for medical schools. Washington: Association of American Medical Colleges; [cited 2017 Feb 5]. Available from:
6	Maudsley RF, Augustine JR, Embil JM, Dandavino A, DesGrosseilliers JP, Goldsand G, Mikhael NZ, Taylor BR, Junrbull J, VanBoxel J, et al. 1996. Report of the Task Force to Review Fundamental Issues in Specialty Education. Final report. Ottawa: Royal College of Physicians and Surgeons of Canada
7	Frank J, 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
8	Defining competence for the purpose of certification by the College of Family Physicians of Canada: The evaluation objectives in family medicine. Report of the Working Group on the Certification Process. Mississauga (ON): College of Family Physicians of Canada
9	Harden RM. 1999. AMEE guide no. 14: Outcome-based education: Part 1 – An introduction to outcome-based education. Med Teach. 21(1):7–14
10	Swing SR. 2007. The ACGME outcome project: retrospective and prospective. Med Teach. 29:648–654
11	Carraccio C, Wolfsthal SD, Englander R, Ferentz K, Martin C. 2002. Shifting paradigms: from Flexner to competencies. Acad Med. 77:361–367
12	ten Cate O. 2005. Entrustability of professional activities and competency-based training. Med Educ. 39:1176–1177
13	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: Ottawa
14	Medical Teacher
15	Ferguson P, Caverzagie K, Nousiainen M, International CBME Collaborators. 2017. Changing the culture of medical training: an important step toward the implementation of competency-based medical education. Med TeachTannenbaum D, Kerr J, Konkin J, Organek A, Parsons E, Saucier D, et al. 2011.
16	General Medical Council. 2009. Tomorrow's Doctors: Outcomes and standards for

	undergraduate medical education. Manchester (UK): General Medical Council; [cited 2017 Feb 6]. Available from: www.gmc-uk.org/Tomorrow_s_Doctors_1214.pdf_48905759.pdf
17	Triple C competency-based curriculum. Report of the Working Group on Postgraduate Curriculum Review – Part 1. Mississauga (ON): College of Family Physicians of Canada
18	Powell D, Aschenbrener C, Carraccio C. 2011. Pediatrics redesign project: a pilot implementing competency-based education across the continuum. Acad Med. 86:e13
19	Nasca TJ, Philibert I, Brigham T, Timothy C, Flynn TC. 2012. N Engl J Med. 366:1051–1056.
20	Frank JR, Snell L, Sherbino J, editors. 2015. CanMeds 2015 physician competency framework. Ottawa: Royal College of Physicians and Surgeons of Canada
21	Caccia N, Nakajima A, Scheele F, Kent N. 2015. Competency-based medical education: developing a framework for obstetrics and gynaecology. J Obstet Gynaecol Can. 37:1104–1112.
22	Stodel EJ, Wyand A, Crooks S, Moffet S, Chiu M, Hudson CC. 2015. Designing and implementing a competency-based training program for anesthesiology residents at the University of Ottawa. Anesthesiol Res Pract. 2015:713038.
23	Jurd S, de Beer W, Aimer M, Fletcher S, Halley E, Schapper C, Orkin M. 2015. Introducing a competency based fellowship programme for psychiatry in Australia and New Zealand. Australas Psychiatry. 23:699–705.
24	Carraccio C, Englander R, Gilhooly J, Mink R, Hofkosh D, Barone MA, Holmboe ES. 2017. Building a framework of entrustable professional activities, supported by competencies and milestones, to bridge the educational continuum. Acad Med. 92:324–330.
25	Carraccio C, Englander R, Van Melle E, ten Cate O, Lockyer J, Chan MK, Frank JR, Snell LS; International CBME Collaborators. 2016. Advancing competency-based medical education: a charter for clinician-educators. Acad Med. 91(5):645–9.
26	A 2016 world summit on CBME, held in conjunction with the AMEE conference, attracts over 200 participants from around the world.

Appendix B: Core Components of CBME - Van Melle's Framework

5 Core Components of CBME – An Organizing Framework				
AN OUTCOMES-BASED COMPETENCY FRAMEWORK: Competencies required for practice are clearly articulated.	**PROGRESSION:** Competencies and their developmental markers are sequenced progressively.	**TAILORED EXPERIENCES:** Learning experiences facilitate the developmental acquisition of competencies.	**COMPETENCY-FOCUSED INSTRUCTION:** Teaching practices promote the developmental acquisition of competencies.	**PROGRAMMATIC ASSESSMENT:** Assessment practices support & document the developmental acquisition of competencies.
Practice: Competencies required form the basis for the planning and delivery of all curricular events				
Competencies required for practice are articulated based on a profile of professional practice.	Competencies are organized in a way that leads to a smooth transition across the continuum of medical education.	Learning takes place longitudinally, in settings that model practice, is flexible enough to accommodate variation in individual learner needs, and is self-directed.	Teaching is individualized to the learner, based on what is required to progress to the next stage.	Learner progression is based on a systematic approach to decision-making including standards, data collection, interpretation, observation & feedback.
Principles: Given adequate preparation, unambiguous goals, sufficient learning resources and a flexible time schedule, students can with rare exception, achieve defined competencies. Curricular components working together create meaningful learning experiences				
Specification of learning outcomes promotes focus and accountability.	A sequential path supports the development of expertise.	Learning through real life experiences facilitates membership into the practice community & development of competencies.	Development of competence is stimulated when learners are supported to learn at their own pace and stage.	Programmatic assessment systems allow for valid and reliable decision making.
Conceptual Frameworks : Why the core component should work according to theories, models or best practices				
❖ Social Accountability ❖ Outcome-based Learning ❖ Backwards Design	❖ Novice to Expert ❖ Entrustable Professional Activities ❖ Surface & Deep Approaches to Learning	❖ Situated Learning ❖ Deliberate Practice ❖ Self-regulated Learning ❖ Professional Identity Development	❖ Zone of Proximal Development & Scaffolding ❖ Constructive Friction ❖ Learner-Centered Teaching ❖ Cognitive Apprenticeship	❖ Programmatic Assessment ❖ Formative Assessment

Elaine Van Melle, PhD, Education Scientist, Royal College Physicians and Surgeons of Canada

Appendix C: Triple C Logic Model

Appendix D: CBME resources and literature

Organization/Collaborations	Resources/Links
Medical Council of Canada (MCC)	• Blueprint Project
The Association of Faculties of Medicine (AFMC)	• Entrustable Professional Activities for the Transition from Medical School to Residency • The Future of Medical Education in Canada (FMEC): A Collective Vision for MD Education
The College of Family Physicians of Canada (CFPC)	• Triple C Toolkit (Includes videos and tools) • Triple C Competency-Based Curriculum Document • Triple C Implementation Guide
The Royal College of Physicians and Surgeons of Canada (Royal College)	• About Competence by Design • CBD: Tools and Resources • Competence by Design: The Meantime Guide • CanMEDS 2015 • Competence by Design: Reshaping Canadian Medical Education (eBook)
CanMEDS Consortium	• CanMEDS Framework
Canadian Residency Accreditation Consortium (CanRAC)	• CanRAC Resources
International CBME websites/organizational resources	• International Competency-Based Medical Education (ICBME) Collaborators • ACGME - Milestones • AAMC - Core Entrustable Professional Activities for entering Residency
The August 2010 issue of *Medical Teacher* focused exclusively on the discussion of CBME and included the following papers	• Toward a definition of competency-based education in medicine: a systematic review of published definitions • CBME: Theory to practice • CBME: Implications for undergraduate programs • CBME in postgraduate medical education • Competency-based continuing professional development • Perspectives on competency-based medical education from the learning sciences • Medical competence: the interplay between individual ability and the health care environment • The role of assessment in competency-based medical education • The importance of faculty development in the transition to CBME • Identifying the policy implications of competency-based education

Other literature sources for consideration:

Boucher A, Ste-Marie LG, et coll. Pour un cursus d'études médicales axé sur les compétences: Cadre de formation, Décembre 2013, Les Presses du CPASS Cantillon P, Macdermott M. Does responsibility drive learning? Lessons from intern rotations in general practice. Med Teach 2008; 30: 254-259

Busing N, Harris K, MacLellan A,, Moineau G, Oandasan I, Rourke J, Saxena A., The Future of Postgraduate Medical Education in Canada. Acad Med 2015 Sep;90(9):1258-63

Oandasan I, Archibald D, Lawrence K, McEwan L, Ross S, Palacios M, Pakhari M, Slade S. Giving Curriculum Planners an Edge: Using Entrance Surveys To Design Family Medicine Education. Canadian Family Physician. 2015 61(4):e204-10

Slade S, Ross S, Lawrence K, Archibald D, MacKay M, Oandasan I. Extended family medicine training Measuring training flows at a time of substantial pedagogic change. Canadian Family Physician. 2016:62 vol 12: e749-e757.

Ten Cate O and Scheele F. Competency-Based Postgraduate Training: Can We Bridge the Gap between Theory and Clinical Practice? Acad Med 2007; 82:542-547

Ten Cate O. Nuts and Bolts of Entrustable Professionnel activities. J Grad Med Educ 2013;5:157–8.

Ten Cate O, Hart D, Ankel F, Busari J, Englander R, Glasgow N et al. Entrustment Decision Making in Clinical Training

Van Melle E, Gruppen L, Holmboe E, Flynn L, Oandasan I, Frank J. 2016. Using Contribution Analysis to Evaluate Competency-Based Medical Education Programs: It's All About Rigor in Thinking. Academic Medicine.