Competency-based training: Canadian cardiothoracic surgery

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Competency-based surgical training has long been innate to our training paradigm. In 1999, The American Board of Medical Specialties and Accreditation Council for Graduate Medical Education (ACGME) jointly approved 6 core competences aimed at providing a framework for developmental areas important for physicians in training, later launched as part of the Outcomes Project in 2001.1 The competencies innate to this framework included patient care and procedural skills, medical knowledge, professionalism, systems-based practice, interpersonal and communication skills, and practice-based learning and improvement.1,2 Relative to cardiothoracic surgery training, a working group was formed in January of 2012 by the American Board of Thoracic Surgery and ACGME, and represented all areas of adult cardiac, general thoracic, and congenital heart surgery. The completed Thoracic Surgery Milestones were first presented to the Thoracic Surgery Directors Association in 2013, and the Thoracic Surgery Milestones 2.0 was activated in July 2021; residency programs have now uploaded Milestones 2.0 data and evaluations twice.3,4 Although the United States has established themselves as experts in competency-based training, Canada has taken a similar yet more latent approach that is presented herein as all Canadian Residency training has converged on competency-based medical education.

The Canadian Perspective of Competency-Based Education

In Canada, training is different than in the United States, in that the Royal College of Surgeons and Physicians of Canada (Royal College) sets the standards for program accreditation, residency training, examinations, and the maintenance of certifications for all 69 medical and surgical specialties. The Royal College is an independent, not-for-profit, charitable educational organization that is governed by a Council of Fellow members and public members. The Royal College accredits the 17 Canadian medical schools and the residency training programs therein. Inherent to the curriculum and accreditation standards set by the Royal College is the CanMEDS Competency Framework, which was developed in 1996 and has consistently outlined the competencies expected of all physicians in Canada and has been adopted, with or without modification, by many jurisdictions.4,5 Although Canada’s medical education system is seen as exceptional as our US counterparts, there have been perceived gaps and challenges within models or training. With increased public accountability and literature supporting the potential for residents to graduate with gaps in readiness to practice, a new paradigm was thought to be needed.6-9 Envisioning the need for change started in approximately 2007, whereby the vision was to change the typical 5-year time-based training programs to an entirely competency-based medical education model.6,8 At the request of some innovative medical educators and guided by the Canadian Medical Schools, the Royal College initiated a project entitled “Fundamental Innovations in Residency Education,” which was launched and created in 2008 to sunset the time-based curriculum and develop an entirely new competency-based curriculum and training paradigm referred to as “Competence by Design” (CBD).6,8
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training program was the first to implement a cohort of residents to undertake CBD training and shortly thereafter moved the entire program to CBD in 2008. Early adopters, through the leadership of Dr Richard Reznick and a team of superb educators, were seen at Queen’s University in Kingston, Ontario, whereby 29 training programs adopted CBD uniformly.

As other disciplines started to indicate interest in adopting CBD, the Royal College’s governing Council directed a mechanism to adopt CBD in all 69 recognized specialties and to be developed and delivered through the 17 Medical Schools in Canada. This saw the formal launch of the CBD initiative in 2013. The Royal College has enjoyed a tremendous ability to develop and scale such innovative curriculum programs such as CBD across all specialty disciplines. The core principles of CBD include establishing clear phases of training: transition to discipline, foundation, core, and transition to practice. The transition between phases is deliberately based on demonstration of competence in stage-related milestones bundled into Entrustable Professional Activities (EPAs). These EPAs are observed by faculty and recorded by the trainee, and provide real-time feedback; Competence Committees within each residency program review the progress of residents in the CBD program. There are currently 34 EPAs in Cardiac Surgery, and those for Thoracic Surgery are under development. Given the magnitude of transitioning 69 disciplines, a deliberate stepwise introduction over several years was required. The completion of CBD implementation will be in 2025; because many of the programs are still newly converted to CBD, there is yet to be evidence of flexibility of training. Facilitated faculty development workshops are held for every discipline converting to CBD; the EPAs for each discipline are established by a group of specialty-specific peers and are referred to as the “Royal College Specialty Committees.”

Launching a New Training Paradigm in Cardiac Surgery

Cardiac surgery began its CBD voyage in 2016 with a full launch for all new residents effective in 2019. At the beginning of this process, faculty surgeons and program directors were forced to recognize the current limitations of adult cardiac surgery training.7,10 There was an inherent pride among cardiac surgeons relative to the successful training of generations of cardiac surgeons using an apprentice-like model, but there was perhaps a failure to recognize the evolution of the educational world in competency-based education.11

To that end, cardiac surgery as a discipline faced several challenges in this CBD transition process, some of which were unique to the specialty. First, most surgeons were not familiar with the necessary evaluation process to make CBD successful. For many years previously, assessments involved summative evaluations that were highly biased and poorly reflected the necessary skill set of the trainees. They also failed to provide real-time feedback to allow for the evolution of surgical skill. Cardiac surgeons were not used to the concept of coaching and real-time feedback, which had been repeatedly proven to be successful in the acquisition of other skills such as in sports and music.

The sudden recognition of the challenge of competency-based assessment meant that cardiac surgeons had to embrace new models to help residents rapidly acquire the necessary skills that they could integrate into an operation.12 Simulation suddenly became a pressing need with every program in the country investing in stimulation surgical technology, such as high-fidelity anastomosis and valve implant models. Cardiac surgery also faced 2 other specialty-specific challenges. The first related to the lack of temporal heterogeneity in the cardiac operative repertoire. In general surgery training, EPAs can be structured to fit more closely complete patient care in certain patient pathologies. As the resident progresses, they acquire the ability to take on more significant complex challenges, such as liver or pancreatic resection or transplantation. Cardiac surgery is different, with the average operation lasting between 3 and 5 hours and a lack of small operations that allow the resident to gain a sense of awareness of their progression to the same degree. Therefore, cardiac surgeons have had to parse the operations, breaking them into specific sections that are integral to the larger goals until the resident becomes more senior.

The second challenge is related to the difficulties imposed by the nature of cardiac surgery whereby time equates to an ischemic organ. Cardiac surgeons recognized that other specialties embrace efficiency; however, the consequences of taking too long when the crossclamp is applied may be greater to the patient in cardiac surgery. Finally, cardiac surgery is often under a microscope in the public eye with public reporting. Most surgeons accept that crossclamp time is likely directly related to perioperative morbidity, and this can create a barrier to training.

Despite all these challenges, since its inception, there has been acceptance that CBD is achieving its goals in cardiac surgery. There has been a change in the mindset to embrace real-time feedback and coaching in the moment. Residents have expressed satisfaction with the measured progress and evolution of their skills. As expected, there has been some degree of evaluation fatigue from the trainers. It is likely that this will change, and, in fact, recording resident assessment will become a part of daily schedules. Currently, the first CBD resident learners are transitioning to practice. This will be a challenging process, and there is a national conversation to share ideas on how to best provide senior residents an experience consistent with what they would
face as junior staff such that they will be trusted colleagues the day after they finish their training.\textsuperscript{13,14}

**Transitioning From Time-Based to Competency-Based Training: Thoracic Surgery**

Thoracic surgery in Canada is a subspecialty; training occurs after achievement of certification in General Surgery or Cardiac Surgery. The transition to CBD curriculum has been part of ongoing discussions at the national level since 2016. This has included formal work planning at the level of the Thoracic Surgery Royal College National Specialty Committee, research on evaluative rubrics for key procedures, broad discussion regarding best metrics, and the selection of index procedures.\textsuperscript{12}

Various thoracic surgical units across Canada have proactively scrutinized the state of competency-based assessment tools and sought national consensus regarding the best elements to evaluate specific procedures.\textsuperscript{15-18} These scholarly efforts have served to catalyze discussions at Canadian Surgical meetings, thereby sensitizing all surgical educators to the coming curriculum changes.\textsuperscript{19} This broad and foundational work in thoracic surgical education has been invaluable in setting realistic, attainable, and correct milestones and assessment instruments. Thoracic surgery is planned to go live with CBD in 2024. Planning for CBD in any residency starts approximately 30 months before launch and involves preparation, design, building, and launch plans for this competence-based paradigm. The Royal College specialty committees, made up of experts in the said specialty, meet on a routine and frequent basis to define the EPAs, milestones, and overall evaluation framework within the CBD context. This work is further amplified by the program directors in each academic center and is informed by learners. Over the past decade, the Royal College has committed many educational resources for the transition as seen with the cardiothoracic surgery CBD implementation journey.

Surgical subspecialty trainees, such as those in thoracic surgery training, will have been exposed to CBD during their primary specialty training before entering thoracic training. Therefore, the essential components of a CBD curriculum will be familiar to them and they will have only known a CBD residency training environment. A recent survey of resident perspectives on CBD identified concerns with impacts of work relationships, the effect of CBD on work schedules, and the workload associated with evaluation.\textsuperscript{20} These concerns will be addressed in a manner that fosters and enhances residents’ trust and confidence in the system. Likewise, CBD will ensure that surgical educators have confidence in the validity of evaluation tools while managing worries about onerous increases in the associated workload. For individual thoracic surgery programs, the role of the Competency Committee, which is constituted by both faculty and residents, will be imperative to have ongoing evaluation of the residents and the faculty in this competency-based framework.\textsuperscript{10} The work of the competency committee is separate from the Royal College and is not part of the proceedings of the accreditation process. Successful implementation of CBD for Thoracic Surgery will be in 3 domains. The first domain would be that all parties (trainees, teaching staff, and the public) trust the new system as being an equitable and effective mechanism for evaluation of a safe and competent surgical practice. The second domain would be based in performance, where continued training duration and success in challenging certification exams would be preserved or enhanced. Finally, the new process would be sustainable and durable. It will be imperative that continuous quality improvement and learning health system approaches be applied to CBD to ensure that the appropriate structures and processes are in place.\textsuperscript{21}

**Is This the Best Way Forward for Our Specialties?**

CBD is a competency-based medical education model designed to work within the Canadian context. The Royal College and its specialty committees have always intended to oversee the design, implementation, assessment, and evaluation of each specialty program across Canada’s 17 medical universities, using CanMEDS 2015 as an organizing framework of competencies. In CBD, progression of competence occurs within a structured but flexible curriculum consisting of core learning components referred to as “EPAs.” Although this flexibility is theoretically inherent to CBD, the conversion of specialties is still fairly nascent and as such has yet to be truly realized. More specifically, in a competency-based approach, competencies required for practice form a framework and are accordingly organized into a progressive sequence. Within the Canadian context, Cardiac Surgery is ahead of Thoracic Surgery in its deployment, and we have the unique privilege of looking to the United States and seeing the progress of the ACGME competency-based training to help inform our journey.\textsuperscript{1,3} The cardiothoracic surgery educational community is small, and there is excellent sharing of challenges and opportunities in training across borders.\textsuperscript{22} Furthermore, there are a fair number of Canadians that train in ACGME-accredited programs, which are seen as fully equivalent, relative to Royal College exam eligibility. Therefore, the 2 systems, in an era of competency-based education are likely coming closer together. Ultimately, whether a resident trains in Canada or the United States, he/she is likely to experience competency-based education.

As of July 2022, Royal College–accredited training programs have converted to CBD training in approximately two-thirds of all specialties. The intent is to complete the conversion from time-based training to CBD training by 2025. Ongoing evaluation of the fidelity of implementation has been facilitated by the Royal College through surveys, program director workshops, and CBD evaluation summits. Additionally, the Royal College has partnered with national
Residency Associations to receive feedback and derive improvement strategies going forward. To date, there has not been any platform for engagement with the public or correlation with patient outcomes. The measurement may be imperfect, but it must continue to be intentional in its measurement strategy. What has been evident throughout this epic journey is that changes to the content and number of EPAs are necessary and that continuous quality improvement is imperative.23,24 As health care becomes more complicated, we need to be intentional to not overcomplicate our learning programs yet maintain high standards. A general sense of humility has been adopted in a change so fundamentally different as competency-based training, and in some instances, training design teams have had to go back to the drawing board.25 A recognition of unintended consequences including threats to faculty surgeon engagement due to the demands of assessment and issues stemming from the digital platforms used to record the assessments, a significant increase in administrative resources in offices overseeing surgical education, the lack of standardization, and local context and culture have had to be realized.25 However, there is a certain sense of optimism that comes with this transformation to competency-based training in cardiothoracic surgery. There is the very real expectation that residents will be well trained, highly adaptable, and able to meet the changes in health care in this era of change.

Conflict of Interest Statement
The authors reported no conflicts of interest. The Journal policy requires editors and reviewers to disclose conflicts of interest and to decline handling or reviewing manuscripts for which they may have a conflict of interest. The editors and reviewers of this article have disclosed no conflicts of interest.

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