

Quality Improvement

Competency-Based Cardiology Training: A Simple Approach to Improve Supervisor Completion of Entrustable Professional Activities

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ABSTRACT

Background: Adult cardiology residency programs formally transitioned to Competency by Design (CBD) in July 2021. CBD was designed to establish clear learning expectations and increase opportunities for coaching; however, cited challenges include inconsistent participation by staff, and variable timelines for receiving feedback. This project was designed to implement a simple intervention to improve expiry rates and completion timelines of entrustable professional activities (EPAs).

Methods: EPAs triggered by cardiology residents at Dalhousie University between July 1, 2020 and February 28, 2023 were reviewed. The intervention consisted of performance reviews, including a grand rounds presentation, along with a personalized data set distributed to each staff supervisor, with individual statistics compared to group averages. Outcomes include EPAs completed per resident-months, time to completion, and percentage of expired EPAs.

Results: At 12 months postintervention, the percentage of expired EPAs decreased from 35.0% to 21.5% (odds ratio 0.51, CI 0.33–0.79; $P = 0.03$), and the time to completion decreased from 7.3 ± 5.99 days to 5.0 ± 5.78 days (difference -2.31 , CI -3.55 to -1.07 ; $P < 0.001$). The number of EPAs completed per resident-months increased from 3.10 to 4.29 (rate difference 1.18; CI 0.64–1.72; $P < 0.001$), and the percentage of EPAs completed within the target time of 48 hours increased from 54.4% to 71.5% (OR 2.11, CI 1.27–3.50; $P = 0.004$).

Conclusions: Performance reviews in the form of a group presentation, along with the distribution of personalized data sets to supervisors, positively impacted EPA expiry rates, completion timelines, and completion rates, which helped facilitate the transition to CBD.

RÉSUMÉ

Contexte : Les programmes de résidence en cardiologie pour adultes sont officiellement passés à la Compétence par Conception (CPC) en juillet 2021. La CPC a été conçue pour établir des attentes claires en matière d'apprentissage et pour augmenter les possibilités d'encadrement; cependant, des défis tels que la participation incohérente du personnel et les délais variables pour l'obtention des rétroactions ont été soulevés. Ce projet a été conçu pour mettre en œuvre une intervention simple afin d'améliorer les taux d'expiration et les délais de réalisation des activités professionnelles fiables (APC).

Méthodes : Les APC déclenchées par les résidents en cardiologie de l'Université Dalhousie entre le 1^{er} juillet 2020 et le 28 février 2023 ont été examinées. L'intervention a consisté en des examens de performance, incluant une présentation lors d'une conférence générale, ainsi qu'un ensemble de données personnalisées distribué à chaque superviseur du personnel, avec des statistiques individuelles comparées aux moyennes du groupe. Les résultats comprennent les APC réalisées par mois-résidents, le temps de réalisation et le pourcentage d'APC expirées.

Résultats : Douze mois après l'intervention, le pourcentage d'APC expirées a diminué de 35,0% à 21,5 % (rapport des cotes [RC] 0,51, intervalle de confiance [IC] 0,33-0,79; $p = 0,03$), et le délai d'exécution a diminué de $7,3 \pm 5,99$ jours à $5,0 \pm 5,78$ jours (différence $-2,31$, IC $-3,55$ à $-1,07$; $p < 0,001$). Le nombre d'APC réalisées par mois-résident est passé de 3,10 à 4,29 (différence de taux 1,18, IC 0,64-1,72; $p < 0,001$), et le pourcentage d'APC réalisées dans le délai cible de 48 heures est passé de 54,4 % à 71,5 % (RC 2,11, IC 1,27-3,50; $p = 0,004$).

Conclusions : Les évaluations des performances sous la forme d'une présentation de groupe, accompagnées de la distribution d'ensembles de données personnalisées aux superviseurs, ont eu un impact positif sur les taux d'expiration des APC, les délais d'exécution et les taux d'exécution, ce qui a contribué à faciliter la transition à la CPC.

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See page 1252 for disclosure information.

Competency by Design (CBD) is a recently launched initiative by the Royal College of Physicians and Surgeons of Canada to training programs nationwide. CBD combines a time-based and outcome-based approach to learning, to ensure physicians complete and graduate from training

programs with competencies deemed necessary to meet evolving healthcare needs.^{1,2} It is made up of a series of Entrustable Professional Activities (EPAs), which are organized into 4 distinct stages of training that a learner progresses through during their residency training.³⁻⁵

Adult cardiology residency training programs nationally made the formal transition to CBD in July 2021, with some programs launching earlier, including Dalhousie University who launched in July 2020. There are a total of 36 EPAs in the Adult Cardiology Residency Training Program, resulting in 157 observations that each resident must achieve successfully during their 3 years of training. Each EPA has its own unique set of learning objectives, written in the form of milestones, that are based on the CanMEDS framework.⁶

CBD was established to set clear learning expectations for trainees, increase opportunities for feedback, promote resident control of learning, and prevent gaps in knowledge.^{1,7} Cited benefits include more-frequent feedback and opportunities for direct observation, clarity around learning requirements, and easier identification of knowledge gaps.⁸

Many challenges to the implementation of CBD have been cited, including an increased administrative burden and cognitive load, due to the vast increase in number of formal assessments. Finding opportunities to complete EPA assessments requires a significant amount of time and effort in already busy and demanding residency programs.⁹ The increased number of assessments creates new roles and responsibilities for supervisors, without adequate training or resources, resulting in variable participation by staff and inconsistent completion of EPAs in a timely manner.^{10,11} In 2021, a CBD Resident Pulse Check Report revealed that only 37% of residents either strongly agreed or agreed that CBD implementation was going well within their program. There was also a reportedly significant negative impact on health and wellness for residents associated with CBD.^{8,12,13}

The goal of this project was to implement a simple intervention to improve expiry rates, completion timelines, and completion rates of EPAs, to facilitate the transition to CBD and offload the associated resident burden. The experience of CBD implementation has not been previously studied in a Canadian cardiology residency program.

Methods

EPAs triggered by cardiology residents at Dalhousie University from July 1, 2020 to February 28, 2023 were reviewed in the one45 software program (Acuity Insights, Vancouver, BC). Data including the number of EPAs triggered, completed, and expired, and the time to completion, were collected according to supervisor. Supervisors included cardiologist staff, fellows, senior cardiology residents, echocardiogram sonographers, and device clinic technicians. EPAs completed by staff cardiology supervisors were included in the study, and those completed by other supervisors, including sonographers, device clinic technicians, senior residents, and fellows, were excluded.

The intervention was a personalized data set distributed to each of the 36 cardiology staff supervisors in February 2022, via e-mail by the program director. Each e-mail contained individual statistics regarding the number of EPAs completed, percentage of EPAs expired, and average time to completion,

along with group averages for comparison (Supplemental Table S1). Group data also were presented at a departmental “grand rounds” in February 2022. At Dalhousie University, EPAs expire after 14 days; therefore, a completion time of 14 days was assigned to any EPA that had expired. The preintervention period was from July 1, 2020 to December 31, 2021, and the postintervention period was from March 1, 2022 to February 28, 2023.

The outcomes included number of EPAs completed per resident-months, time to completion, proportion of EPAs completed within the 48-hour target, and proportion of EPAs expiring at 6 and 12 months postintervention. The number of resident-months was calculated by summing the total number of rotations completed by cardiology residents enrolled in CBD at the Queen Elizabeth II Hospital Department of Cardiology, in Halifax, Nova Scotia. Rotations completed at external centres, and in departments outside of cardiology (ie, cardiac surgery) were excluded, as residents are not able to complete EPAs on these rotations.

Data from the one45 software program were exported into Excel (Microsoft, Redmond, WA). To account for clustering of the data by evaluator, generalized estimating equations with independent correlation structures were used to analyze the outcomes. The binary outcomes were modelled using logistic regression and are presented as odds ratios (95% confidence interval [CI]); the continuous outcomes were modelled using linear regression and are presented as differences (95% CI); and the rate outcomes were modelled using Poisson regression and are presented as rate differences (95% CI). The binary outcome of expired EPAs additionally was modelled in a multivariable model, adjusting for the number of EPAs triggered to the evaluator (whether < or > the median of 7 EPAs). A 2-sided *P* value of < 0.05 was the threshold for statistical significance. All analyses were performed using SAS statistical software, version 9.4 (SAS Institute, Cary, NC).

The research ethics board approval for this study was waived by the Nova Scotia Health Authority, as it was deemed to be a quality-improvement initiative.

Results

In the 2020-2021 academic year, 4 residents were enrolled in CBD, which increased to 7 in 2021-2022, and 11 in 2022-2023. There were a total of 36 attending cardiology staff, 4 fellows, 9 senior cardiology residents, 14 echocardiogram sonographers, and 3 device clinic technicians who completed EPAs using the one45 software.

A total of 568 EPAs were triggered over the first 18 months of CBD, with 273 and 545 EPAs being triggered at 6 and 12 months postintervention, respectively. A total of 62 EPAs in the preintervention period, 33 at 6 months, and 48 at 12 months postintervention were excluded, as they were triggered to fellows, senior residents, sonographers, and device clinic technicians. The proportion of EPAs that expired decreased from 35.0% (177 of 506) pre-intervention to 23.3% (56 of 240) at 6 months (OR 0.57, 95% CI 0.33-0.98; *P* = 0.04), and 21.5% (107 of 497) at 12 months postintervention (OR 0.51, 95% CI 0.33-0.79; *P* = 0.03; Table 1). No significant difference occurred in the expiry rate among supervisors who had a higher number of EPAs (> the median of 7) triggered to them (OR 0.83, 95% CI 0.37-1.84; *P* = 0.6426).

Table 1. Entrustable professional activity (EPA) expiry rates and completion timelines pre- and post-intervention, at 6 and 12 months

	Preintervention (July 2020 to December 2021)	6 mo (March 2022 to August 2022)	12 mo (March 2022 to February 2023)
EPA's per resident-mo	3.10 ± 0.17	4.97 ± 0.38 (rate difference 1.87, 95% CI 1.08–2.66; <i>P</i> < 0.001)	4.29 ± 0.22 (rate difference 1.18, 95% CI 0.64–1.72; <i>P</i> < 0.001)
EPA's Expired (%)	35.0	23.3 (OR 0.57, 95% CI 0.33–0.98; <i>P</i> = 0.04)	21.5 (OR 0.51, 95% CI 0.33–0.79; <i>P</i> = 0.03)
Time to completion (d)	7.3 ± 5.99	5.1 ± 5.81 (difference –2.18, 95% CI –3.49 to –0.88; <i>P</i> = 0.001)	5.0 ± 5.78 (difference –2.31, 95% CI –3.55 to –0.71; <i>P</i> < 0.001)
EPA's completed within 48-h target (%)	54.4	69.6 (OR 1.92, 95% CI 1.16–3.17; <i>P</i> = 0.01)	71.5 (OR 2.11, 95% CI 1.27–3.5; <i>P</i> = 0.004)

Values are mean ± standard deviation, or %, unless otherwise indicated.
CI, confidence interval; OR, odds ratio.

The average time to completion of EPAs was 7.3 ± 5.99 days preintervention, which improved to 5.1 ± 5.81 days at 6 months (difference, –2.18, 95% CI –3.49 to –0.88; *P* = 0.001), and 5.0 ± 5.78 days at 12 months postintervention (difference, –2.31, 95% CI –3.55 to –0.71; *P* < 0.001). The number of EPAs completed per resident-months increased from 3.10 ± 0.17 preintervention to 4.97 ± 0.38 at 6 months (rate difference 1.87, 95% CI 1.08–2.66; *P* < 0.001), and 4.29 ± 0.22 at 12 months postintervention (rate difference 1.18, 95% CI 0.64–1.72, *P* < 0.001; Table 1).

With respect to the proportion of EPAs completed based on days to completion, 54.4% of EPAs (179 of 329) were completed within the target of 48 hours preintervention, which increased to 69.6% (128 of 184) at 6 months (OR 1.92, 95% CI 1.16–3.17; *P* = 0.01), and 71.5% (279 of 390) at 12 months (OR 2.11, 95% CI 1.27–3.5; *P* = 0.004; Fig. 1). Collectively over the 3 years of CBD, the highest proportion of EPAs were completed on day 0 at 37.1%, day 1 at 19.9%, and day 2 at 7.9%, whereas only 15.3% of EPAs were completed after 7 days.

Discussion

Adult cardiology residency programs across the country made the formal transition to CBD in July 2021, with some programs launching earlier, including Dalhousie University. This project was designed to implement a simple intervention to improve expiry rates, completion timelines, and rates of completion of EPAs, to facilitate the transition to CBD; overall, the project demonstrated positive results.

In the Dalhousie University Cardiology Program, the target completion timeline for EPAs by supervisors is 48 hours, to encourage timely feedback. After the first 18 months of CBD, the average time to completion was well above target, and only 54.4% of EPAs were completed within this 48-hour target. At 12 months postintervention, these numbers improved significantly, with the average time to completion decreasing to 5.0 ± 5.78 days, and 71.5% of EPAs being completed within 48 hours.

Feedback is a key step in the acquisition of clinical skills, and is most effective if performed in a timely manner, as it better relates to performance, is more specific, and has higher educational value.¹⁴ Several studies have examined the effects of receiving immediate vs delayed feedback, with some variation depending on the type and context of feedback being delivered. Generally, immediate feedback has been shown to be beneficial for task-oriented feedback,¹⁵ which is relevant in CBD, as most EPAs are task-specific. Residents found immediate task-focused feedback beneficial, as it was explicit and helpful for progressing through a task, whereas negative sentiments were expressed regarding delayed feedback, often secondary to delays in EPA completion by staff.¹⁶ In cardiology, EPAs are not only task-specific, but several are also rotation-specific, meaning that feedback delivered electronically weeks later is less valuable if the resident has moved on to a different rotation, as they will not have the opportunity to reattempt the EPA or improve upon their performance. Overall, the intervention in this study promoted more timely delivery of feedback, which is important for feedback to be useful and actionable.

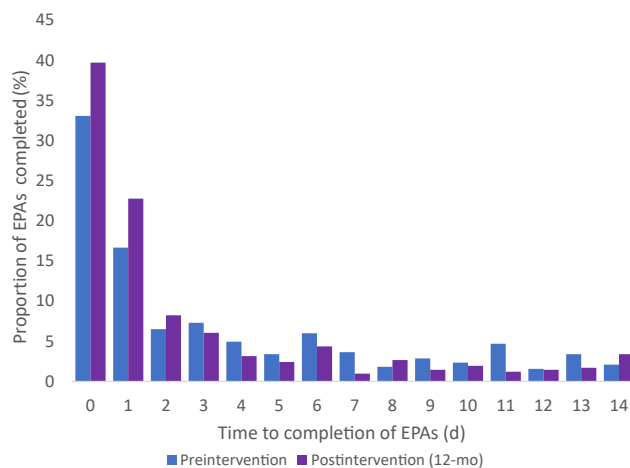


Figure 1. Proportion of entrustable professional activities (EPAs) completed according to time from completion (days), both preintervention and postintervention at 12 months.

In addition to timelines for receiving feedback, frequently cited challenges of CBD are inconsistent participation by faculty, and the burden associated with tracking down staff to complete EPAs, as faculty are in some cases too busy, unwilling, or too forgetful to complete them.^{8,17,18} This is reflected in the large variation in completion times in this study, which was expected, and is likely representative of the experience at other centres. In the Dalhousie University Cardiology Program, EPAs expire within the one45 software after 14 days, at which point the resident has to either resend the EPA to the same supervisor and track them down with a reminder, or repeat the EPA altogether with a different supervisor. Both scenarios add time, effort, and are logistically challenging in an already busy and demanding residency. In this study, the percentage of expired EPAs decreased significantly at 12 months postintervention, which is helpful to reduce the resident administrative burden associated with CBD.

The highest proportion of EPAs were completed on days 0-2 after being triggered, with a significantly smaller proportion being completed after 7 days. This trend is useful from a program perspective, and suggests that reminder e-mails sent after the first few days can be useful in preventing EPAs from expiring altogether. Use of an electronic platform with built-in automated reminders, or a dedicated administrator to send reminders to supervisors with pending EPAs would be helpful to promote EPA completion, and would offload this burden from residents.

Lastly, this study showed an increase in the number of EPAs completed per resident-months, at 6 and 12 months postintervention. Resident-months was used to better standardize the number of EPAs completed, as there were varying number of residents enrolled in CBD each year. Despite an increase in the number of EPAs being completed with this intervention, CBD remains a relatively new and evolving field, and ongoing efforts from both faculty and residents are required.

The transition to CBD has been a significant change for both residents and faculty, as it requires a diversity of skill to be executed effectively.³ Similar to the emphasis on frequent feedback for learners enrolled in CBD, direct and timely

feedback to faculty members on their performance as supervisors is also important. The current study demonstrates that feedback delivered in the form of annual performance reviews, with personalized CBD statistics, was helpful for improving EPA expiry rates, completion timelines, and rates of completion.

Faculty development is essential to the success of change in medical education, and is necessary to facilitate the transition to CBD.¹⁹ Experts have suggested that faculty development may be the rate-limiting step to competency-based medical education implementation, and recommend a focus on faculty skill development to better navigate this curriculum change. The ideal faculty-development model for CBD has yet to be established, but tends to include a combination of formal, informal, individual, and group learning activities, such as workshops, grand rounds, and videos, among other elements.¹⁹ A systematic review showed that one success factor for effective faculty development in medical education included the provision of feedback, which is in line with results of the intervention used in our study.²⁰

This quality-improvement project was implemented with a pre-post design; thus, in the absence of a control group, a limitation is the inability to account for all confounders. In this study, the attending cardiology supervisors remained the same both pre- and post-intervention, and no other interventions were implemented during this period. It is also possible that given the nature of the project, an improvement in faculty participation can be expected over time as supervisors become more familiar with CBD. However, a comparison of the outcomes in the preintervention period demonstrates that EPA completion rates, rates of expired EPAs, and time to completion had worsening trends in the second year of the launch, compared to those in the first, arguing against this concept (Supplemental Table S2). Rather, this finding demonstrates that, over time, there was perhaps a collective diminished participation of faculty in completing EPAs promptly, and the performance reviews served as a reminder that contributed to improved participation.

CBD is a curriculum change that will take time to adopt across programs nationwide. Studies have highlighted the fact that faculty development ideally should be longitudinal in

nature, as opposed to a one-time bolus of activity,¹¹ as ongoing and continuous sessions with repetition, are important to facilitate this transition.²¹ It is anticipated that the effects of the intervention in this study will also decrease with time, suggesting that continuing this intervention periodically (ie, annually) may be beneficial. Overall, the transition to CBD is a culture shift, meaning that ongoing methods of faculty development such as this are important for constant growth.

As the study was done during the first few years of the transition to CBD, a limitation is the sample size with respect to the number of residents enrolled in CBD. Despite this limitation, a sufficient number of EPAs were used for the analysis, with 506 and 497 EPAs completed pre- and post-intervention, respectively; therefore, results are not felt to be impacted significantly by this limitation. Additionally, a proportion of expired EPAs may have been intentionally left uncompleted by supervisors if these were triggered in error or inappropriately matched to the clinical scenario. This number also is felt to be small and insignificant, as faculty are encouraged to let the program administrator know so they can be manually deleted. Lastly, this study focused strictly on quantitative aspects of EPAs; however, future studies examining the qualitative aspects of EPAs would be helpful in assessing their usefulness to resident learning.

Conclusion

Adult cardiology residency programs across the country made the formal transition to CBD in July 2021, with some programs launching earlier, including Dalhousie University. The implementation of CBD has been a significant transition for both residents and staff, and has brought several challenges that have contributed to increased levels of stress and anxiety for residents. A simple intervention, consisting of performance reviews in the form of a group presentation, along with personalized data sets distributed to faculty members with individual CBD statistics, contributed to decreased EPA expiry rates, improved completion timelines, and an increase in completion rates, which are important to alleviate the burden associated with CBD. Ongoing faculty development is key for successful implementation, which may include annual continuation of this strategy.

Ethics Statement

The research ethics board approval for this study was waived by the Nova Scotia Health Authority, as this education project was deemed to be a quality-improvement initiative.

Patient Consent

The authors confirm that patient consent is not applicable to this article. This is an education article and does not involve patient related data.

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Disclosures

The authors have no conflicts of interest to disclose.

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Supplementary Material

To access the supplementary material accompanying this article, visit *CJC Open* at <https://www.cjopen.ca/> and at <https://doi.org/10.1016/j.cjco.2024.07.007>.