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REVIEW

Entrustable Professional Activities and Their Relevance to Pediatric Cardiology Training

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Abstract

Entrustable professional activities (EPAs) have become a popular framework for medical trainee assessment and a supplemental component for milestone and competency assessment. EPAs were developed to facilitate assessment of competencies and furthermore to facilitate translation into clinical practice. In this review, we explore the rationale for the introduction of EPAs, examine whether they fulfill the promise expected of them, and contemplate further developments in their application with specific reference to training in pediatric cardiology.

Keywords Medical education · Entrustable professional activities · Pediatric cardiology · Competencies

Introduction

Finding a direct correlation between medical education assessments and training a successful clinician has been a challenge among educators and physician leaders. Over the last decade, Entrustable professional activities (EPAs) have become a popular framework for medical trainee assessment and a supplemental component in evaluating competencies. The concept of EPAs emerged in 2005 and was designed to facilitate assessment of competency and milestone achievement as it translates to medical practice [1–3]. This is measured by assessing a trainees' progress on the basis of the level of supervision required to successfully carry out clinical duties within a specific EPA [3]. This assessment framework has gained attention throughout programs in North American medical education governing bodies. The Accreditation Council for Graduate Medical Education (ACGME) in the United States and the Canadian Medical Education Directives for Specialists (CanMEDS) framework in Canada have supported the incorporation of EPAs into residency and fellowship programs. This framework was designed to be utilized in tandem with the existing six-core competencies framework established by the ACGME which have been implemented across both undergraduate and graduate medical education programs [1, 2, 4].

The main distinction between clinical competency assessments and EPA frameworks is that the former focuses on conceptual domains to characterize a trainees' performance while EPA domains are operational in nature, focusing on discrete clinical tasks, procedures, and medical conditions [See Table 1] [3]. A single EPA incorporates multiple competency domains into a singular task and functions as an adjunctive method of trainee evaluation. The competency domains include the following: patient care, medical knowledge, practice-based learning, interpersonal & communication skills, professionalism, systems-based practice, and personal & professional development. Problems within the competency based assessment framework are that since it is conceptually based, it is often difficult to find practical applications or assessments of trainees that would translate a trainee's mastery of these assessments into everyday practice

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Table 1 Comparison of entrustable professional activities (EPAs) and competency-based milestone assessments [4]

Entrustable professional activity	Competency-based milestone assessment
Requires direct observation and evaluation	
Operational (task-oriented)	Conceptual (competency domains)
Specialty dependent on total number (i.e., 6 pediatric cardiology-specific EPAs)	6 main domains, 49 subcompetencies
EPA scores measure level of independence to perform a task (1 through 5)	Milestones measure level of proficiency within a domain (1 through 5)
Can contain multiple competency domains	

[5–7]. EPAs can address this weakness as they can be compiled into a set of discrete skills that are utilized.

We performed a metanarrative review to describe the current literature on EPAs and their potential efficacy, and shortcomings within pediatric cardiology. We chose this approach to distill the main concepts surrounding EPA development given the abundance of systematic reviews on EPA creation, assessment, and implementation. The goals of this study were to:

1. *Review the history of EPAs and their role within the field of pediatrics* **[See** Table 2**]**
2. *Review the current state of medical education within pediatric cardiology and its challenges* **[See** Table 3**]**
3. *Review the role of EPAs within pediatric cardiology* **[See** Table 4**]**

The EPA framework is a promising assessment mechanism for pediatric cardiology trainees. From a post-positivist perspective, it is important to consider how medical education has changed over time with its use of EPAs and whether there is a translational component to clinical practice.

Review of EPA Development and Research

History of EPAs & Competency Assessments

The introduction of EPAs started within obstetrics and gynecology as a clinical assessment of trainees performing deliveries [3, 8, 9]. This EPA framework included multiple competencies that culminated into obtaining a statement of awarded responsibility (STAR) [9]. This goal ensured that residents who obtained a STAR would be approved to perform that specific task unsupervised. EPAs consist of various tasks that can be "entrusted" to a learner, with appropriate supervision by a trained professional [1]. While competencies describe an individual's performance and abilities, the number of milestones and checklists can be overwhelming for the supervisor and the trainee. For example, the ACGME model outlines 28 competencies while CanMEDS outlines 28 key competencies with up to 126 enabling competencies [9]. EPAs would act as a supplement to the learner's progress by identifying tasks the learner can master on a spectrum of supervision, which indirectly addresses multiple competencies at once.

The evaluation of EPAs for a specific trainee is variable as it is based on the personality traits of, and dynamics between, the learner and supervisor. This is a problem with observation-based assessments and would require supervisors to be in consensus on determining what is acceptable for trainees to progress through EPAs [10–12]. Five factors which dictate the clinical supervisor's assessment of the learner include the following: (1) perceived learner features, (2) supervisor's propensity to delegate responsibility, (3) complexity of the EPA, (4) the clinical context, and (5) the nature of relationship between the supervisor and learner [8]. The number of EPAs and their importance for graduation depend on the program and consensus of content experts. While the initial creation of EPA tools were done with expert consensus opinion, Kane's framework on generalization would highlight the necessity for faculty supervisors to be consistent in their evaluations and minimize the subjectivity in assessing trainees [13].

Further EPA Development and Research

The field of pediatrics has been a burgeoning specialty with medical education research with its early adoption and modification of ACGME milestones and the incorporation of EPAs in residency and fellowship programs [2]. Since the inception of pediatrics milestones in 2009, they have been used to describe the progression of a learner's progress from the basics as a medical student to a practicing physician [2]. This work has since been advanced a list of 17 EPAs which could be utilized within pediatrics training serves as a prototype which could be modified into other medical specialties. By 2013, EPAs were designed for pediatric subspecialties with the assistance of the American Board of Pediatrics (ABP) and Council of Pediatric Subspecialties (CoPS). This led to the creation of 7 common subspecialty EPAs which were to be supplemented by 3–7 additional EPAs by each pediatric subspecialty.

Table 2 Literature summary table of papers pertaining to entrustable professional activities as well as EPAs specific to pediatric subspecialties

Authors	Country	Purpose	Type of source	Major themes
[6] Wass, V, et al.	Netherlands	Assessing clinical competence	Original research	Clinical competence testing needs to address its formative purpose, validity, reliability, standard setting, and blueprinting; outlines the ways trainees are assessed and what skills or knowledge is displayed based on the test utilized (Miller's pyramid of competence)
[7] Schuwirth LW, et al.	Netherlands	Strengths and weaknesses of different assessment methods are explored	Original research	Evaluation of multiple written assessment instruments—ultimately emphasizing that a strong assessment program will contain multiple methods of evaluating trainees and no "single" instrument will completely capture competency
[3] ten Cate O	Netherlands	First published study on EPAs and its use with competency frameworks	Original research	Initial outline of EPAs and how it could be used in conjunction with competency-based training—highlights EPA attributes
[5] van der Vleuten CP, et al.	Netherlands	Discussion of ways clinical competence can be assessed	Original research	Outlines the importance of assessment tools/programs needing qualitative assessments and a systematic approach as opposed to individualistic approaches
[9] ten Cate O, et al.	Netherlands	Description of an example EPA involving obstetrics residents	Original research	Outlines an example of how an EPA could be used to assess a specific clinical context
[1] ten Cate O	Netherlands	Detailed breakdown of EPA components	Original research	EPAs are thoroughly broken down into its components including the specific parts that need to be addressed when creating an EPA; there is also description of how it can be used with trainees and long-term plans when implementing them in a program
[12] Choo KJ, et al.	USA	Description of factors that influence how trainees and supervisors views on trust impact decision-making	Qualitative study	Factors included the trainee, supervisor, the relationship between the two, the task in question, and the environment/setting; attendings viewed perceived confidence as a gauge of trainee's comfort and trainee absence as a negative factor for entrustment
[11] Hauer KE, et al.	USA	Investigation of how supervisors develop trust in their trainees	Qualitative study	Supervisors gain trust through observation and interactions with the medical team and patients; progression leads to supervisor role change within the team and increased resident autonomy
[23] Post, JA, et al.	USA	Development of a quality assessment tool to rate EPAs developed by individual programs	Original research; quantitative study	Quality of EPA (QUEPA) tool which assessed an EPA across 7 domains; first tool created/published which was used to rate EPA quality
[2] Carraccio C, et al.	USA	Evaluation of the role of EPAs as a bridge to clinical competency milestones and everyday practice	Original research	Describes the utility of the EPA framework in making medical education a continuum of growth for the learner; potential to connect undergraduate, graduate, and post-graduate phases of a trainee's career; discussion surrounding maintenance of certification for certified physicians tied with EPAs

Table 2 (continued)

Authors	Country	Purpose	Type of source	Major themes
[8] ten Cate O, et al.	Netherlands	An overview of EPA history and its development	Original research	EPAs were designed as a bridge between competency milestones and clinical practice; it can be readily implemented across a variety of medical specialties; it's foundational aspects are based on entrustment decision-making and supervision of trainees
[20]. O'Dowd E, et al.	Ireland	Literature review of EPAs for post-graduate physician education, quality of studies, and future directions	Systematic review	Needs addressed include: best practice guideline for EPA development; increased focus on methodologic research surrounding EPAs; implementation of EPAs
[21] Meyer E, et al.	USA	Literature review of EPAs for undergraduate medical education	Scoping review	In spite of a large volume of studies surrounding EPAs in undergraduate education, there is a need to progress the literature to better designed studies and a methodologic approach to EPA design and evaluation
[22] Shorey, S, et al.	Singapore	Literature review of EPAs in medical education – development of EPAs, evaluation of EPAs, and future direction of EPAs	Systematic review	Majority of EPA studies were in Western countries; EPA utility and assessment is not as widely studied compared to its development; future studies should be directed at obtaining stakeholder feedback and further refinement of EPAs pertaining to specific cohorts and entrustment factors
[13] Smirnova A, et al.	USA	Outlining clinical performance assessments within graduate medical education	Original research	Thorough discussion into how clinical performance assessments can positively impact medical education; there are concrete solutions and proposals in the implementation of these systems
[45] Velazquez EP, et al.	USA	Fellows self-assessed themselves utilizing an online EPA form	Quantitative study	Fellow responses indicated they wanted at least indirect supervision on most EPAs; high variability in survey scores which may indicate unfamiliarity of EPAs with fellows
[10] ten Cate O, et al.	Netherlands	Identification of themes in what supervisors value in trainees in making entrustment decisions	Interpretive narrative synthesis review	Themes include: capability, integrity, reliability, humility, and agency
[40] Caro Monroig AM, et al.	USA	Exploration of medical students perspectives perceived factors influencing entrustment decisions	Qualitative study	Most notable theme seen from the study include the students awareness of agency as the primary driver for influencing entrustment decision-making
[27] Kinnear, B, et al.	USA	Understanding entrustment as a framework to enhance medical education	Original research	Entrustment decisions are complex and are comprised of multiple factors including the purpose, stakes, and processes incorporated in entrusting a task and finding a way to support learners
[43] Pitts, S, et al.	USA	Assessing fellow entrustment across pediatric subspecialties utilizing common EPAs	Quantitative study	Subcompetency milestones mapped with common EPAs increased similarly based on year of training; validation of EPAs to assess trainee performance

Table 2 (continued)

Authors	Country	Purpose	Type of source	Major themes
[44] Schwartz A, et al.	USA	Examining the level of supervision among trainees through undergraduate, graduate, and post-graduate training through EPAs	Quantitative study	Learners required less supervision through the course of their training until they started the next leg at which supervision increased again; entrustment is not seamless and is highly dependent on individual training settings
[24] Ten Cate O, et al.	Netherlands	Speculation of EPAs and its future development and implementation in programs	Original research	EPAs are no longer a novelty, moving into routine practice; need to understand implementation and outcomes based work on EPA-based programs and whether the ROI is worthwhile for educators and trainees
[46] Ten Cate O, et al.	Netherlands	Establishing a full description of an EPA	Original research	Fully described EPAs essential in creating a shared mental model for learners and programs; 8-part framework created to guide creators
[42]. Turner DA, et al.	USA	Evaluation of pediatric fellowship graduates and supervision requirements over common EPAs	Quantitative study	Based on survey results, most PDs agree newly graduated fellows are expected to have supervision pertaining to certain common EPAs (more than others); recommendation to provide support structures for new faculty
[17] Kerth, JL, et al.	Germany	Review of the use of EPAs in pediatric post-graduate medical education	Systematic review	Trend of studies over last 9 years has been from EPA creation to EPA assessment; further studies needed examining EPA efficacy and input/impressions from trainees and patients

Table 3 Literature summary table of papers pertaining to medical education within pediatric cardiology

Authors	Country	Purpose	Type of source	Major themes
[30] Allen, HD, et al.	USA	ACCF/AHA/AAP recommendations for pediatric cardiology training	Original research	Original task force outlining general expectations and curriculum development guidance including duration of training, amount of clinical experiences including quotas on number of procedures and cases fellows are expected to complete during their 3 years of training
[32] Levine, JC, et al.	USA	Competency testing for transthoracic echocardiography for cardiology fellows	Original research	Creation of a 2-part assessment (similar to OSCE) where first and second year fellows performed a transthoracic echo and then interpreted the study; results indicated this system is highly acceptable, feasible, and approximates real life practice
[28] Campbell, RM	USA	Single center experience pin their pediatric cardiology fellowship training	Original research	In addition to the medical knowledge and technical skills learned in PC fellowship, this program also describes the importance of developing future leaders with a focus on patient-centered care, professionalism, communication, and teamwork
[34]. Ceresnak, SR, et al.	USA	Development of a pediatric cardiology boot camp	Original research; mixed methods study	Two-day intensive boot camp with incoming fellows across the country; pilot group (n = 8) pre/post exam scores improved dramatically across participants (54% vs 85%); 100% agreed it was a valuable experience; 92% expressed improved comfort level in various areas within cardiology
[29] Goldfarb, M	USA	Discussion on patient-centered care within pediatric cardiology	Editorial	Emphasis on the need for stellar communication skills and professionalism within pediatric cardiology as patient-centered care becomes a central theme; trainees encouraged to get involved in center-wide initiatives around patient care to develop leadership skills surrounding this topic
[26] Brown, D, et al.	USA	Assessment of post-graduate trainees entering pediatric cardiology fellowship	Qualitative study	Incoming fellows generally were hesitant about fellowship/career responsibilities, failure, personal life, emotional exhaustion; increased responsibilities, imposter syndrome, and burnout were also areas of identified fears
[33] Horst, J, et al.	Germany	National survey from pediatric cardiology fellows on their training experiences	Qualitative study	Pediatric cardiology fellows overall are satisfied with their training environment and career choice; there were concerns raised about curriculum's lacking structure, lack of transparency in training, and lack of hands-on technical training
[37] Tretter, JT, et al.	USA	Development of an online educational forum, Heart University, as a novel approach to pediatric cardiology education	Original research	Description of the program developed as an online learning resource for fellows and practicing physicians; inclusion of modules that also test trainees on basic principles of pediatric cardiology

Table 3 (continued)

Authors	Country	Purpose	Type of source	Major themes
[25] McMahon, C, et al.	Ireland, USA, UK, Brazil, India, Canada, South Africa	Discussion on training pediatric cardiology fellows for the next generation and bridging the gap between competency frameworks and clinical practice	Original research	Description of current state of pediatric cardiology training internationally; areas to investigate in future include role of EPAs as a gap between competencies and practice; improvements in learning assessments and feedback; bringing technology to forefront of education
[39] Tchervenkov, CI, et al.	Global	Discussion surrounding the state of training within congenital heart surgery on a global scale	Original research	The World Society for Pediatric and Congenital Heart Surgery (WSPCHS) and Global Council determined there is high variability and lack of consensus and criteria for CT surgery training on a global scale
[35] Teele, SA, et al.	USA	Pediatric cardiology program's response to Covid-19 with online education	Mixed methods study	Adaptive response to pandemic with creation of an online learning platform for fellowship program; asynchronous learning for fellows; data revealed fellows valued the online education – limited by clinical duties
[36] Weld, JK, et al.	USA	National lecture series for pediatric cardiology fellowship during Covid-19	Mixed methods study	Over the 2 month period – number of participants dropped by 60% toward the end of the program; however, overall trainees responded favorably (92%) in the material and having it continue. Example of a low-cost but effective model of education during the pandemic
[31]. McMahon, C, et al.	Europe	Description of pediatric cardiology training in Europe	Original research	Examination of the high variance of pediatric cardiology training programs and certifications in Europe including discussions on current issues programs face from a resource perspective and training capabilities

Table 4 Literature summary table of papers pertaining to entrustable professional activities specific to pediatric cardiology

Authors	Country	Purpose	Type of source	Major themes
[16] Ross, RD, et al.	USA	SPCTPD/ACC/AAP/AHA training guidelines for pediatric cardiology programs	Original research	Introductory statement by the council created for providing curriculum guidelines for pediatric cardiology fellowships including the introduction of EPAs
[4] Frank, L	USA	Primer on domains, competencies, and EPAs within pediatric cardiology	Original research	A summative study defining and examining the differences between competency assessments, EPAs, and domains within the context of pediatric cardiology versus other subspecialties
[15] Srivastava, S, et al.	USA	Review of curriculum components of EPAs within pediatric cardiology	Original research	General primer on the full-length description of EPAs specifically pertaining to pediatric cardiology as developed by the ABP and CoPS
[14] Baffa, JM, et al.	USA	Assessing graduation readiness using EPAs within pediatric cardiology	Conference abstract / quantitative study	Fellowship program directors in USA surveyed about PC trainees – consensus is that imaging skills and non-ICU level care should yield higher EPA scores than other areas; overall the expectation is that trainees upon graduation are not expected to practice independently based on EPA progress; emphasis on need for support structure/guidance for new graduates
[41] Beeri, R, et al.	Europe	7th ESC Education Conference discussion surrounding EPA use and trusting cardiology trainees	Conference paper	Majority of attendants agreed trainees should be certified only once they can perform clinical duties unsupervised; highlighted importance of providing supervision and mentorship to trainees and identified barriers to providing continuity of assessments/education; 100% thought EPAs were valuable, 69% thought EPAs were applicable to clinical practice
[38]. Werho, DK et al.	USA	Creating EPAs for the pediatric cardiac intensive care unit	Mixed methods study	Creation of 9 EPAs specific to CICU training; next steps include integration into curricula and assessing EPA quality

The Subspecialty Pediatrics Investigator Network (SPIN) created supervision scales through consensus expert opinion for 6 of the 7 EPAs that are used across all pediatric subspecialties [14]. In addition, 6 additional EPAs were uniquely created within pediatric cardiology. These were introduced in 2015 and ABP and CoPS to be incorporated into pediatric cardiology programs [15, 16]. The specific EPAs are as follows: (1) diagnosis and management of patients with arrhythmias and conduction abnormalities; (2) caring for patients who require catheter-based interventions; (3) diagnosis, initial management, and referral of children with advanced or end-stage heart failure or pulmonary hypertension for medical therapy, extracorporeal membrane oxygenator, ventricular assist devices, or cardiac transplantation; (4) diagnosis and management of patients with congenital or acquired cardiac issues; (5) diagnosis and management of patients with acute congenital or acquired cardiac issues requiring intensive care; and (6) application of imaging skills required for all aspects of pediatric and congenital cardiology care [15].

Since the creation of this initiative, EPAs have been utilized in varying degrees in North American programs and data collection is ongoing [15, 17]. Currently, there are no mandates that require programs to adopt EPAs into their assessment models. EPA frameworks have begun to gain interest from medical programs outside of North America as other international centers are looking toward standardizing their fellowship assessment models. Research is ongoing in examining the translational component of assessment frameworks to clinical practice within various validity frameworks (i.e., Kane's framework for validation) [13, 18]. While these were successfully created through a consensus expert panel of physicians and educators, EPAs have not demonstrated any notable validation within Kane's framework beyond the generalization phase [19]. There has been criticism around the adoption of multiple assessment frameworks without knowing their efficacy as they can generate more work for both the trainer and trainees.

Prior literature reviews examined the vast numbers of studies performed on EPAs across different medical specialties and levels of education [17, 20–22]. Several programs which explored EPA use had prior experience with other assessment frameworks such as competency milestones. Successful EPA incorporation has been demonstrated in programs where faculty are trained and prepared to utilize it as a formal evaluation tool [22].

EPAs are in a position to become a standard assessment framework across all levels of medical education. It is important that EPAs are kept to a certain standard and that they hold construct validity to ensure that they can be a bridge for competency frameworks and clinical practice [23]. The work led to the development of the Quality of EPA (QUEPA) tool, an instrument assessing EPA quality with the following seven attributes: 1. having focus, 2. being observable, 3. having clear intention, 4. being realistic, 5. articulating trustworthiness, 6. being generalizable across rotations, and 7. integrating multiple competencies [23]. The natural progression of EPA research has now moved away from discussing the creation of EPAs and is focusing on the practical aspects of the implementation and assessment of EPAs in medical education [24]. The other concern remains whether EPAs as programs demonstrate superior training and transition to clinical practice compared to traditional methods [24].

Review of Medical Education within Pediatric Cardiology

Challenges with Medical Education in Pediatric Cardiology

The practice of pediatric cardiology has changed drastically in response to the advent of new technologies, improved surgical techniques, and an overall growth of understanding within the field. There are questions surrounding how best to train cardiology fellows to become capable, independent, practitioners while being familiar with the latest practices and knowledge [25]. Therefore, competency-based training must evolve in order to meet the demands of the specialty as there are new technical skills and standards of care when considering medical and surgical management. One example is the recent change from ACGME programs requiring a specific number of echocardiograms, electrophysiology studies, and cardiac catheterizations for fellow graduation. Due to increasing sub-specialization and concerns for duty-hour violations, these measures were re-examined and are no longer a requirement. The pace of change in our field will inevitably leave trainees insufficiently prepared without constant evolution and re-evaluation of how we train them [26]. One way addressing this feeling of insufficiency has been to build the trainee's confidence and competence through entrustment with various tasks [27]. This sentiment aligns with EPA frameworks and therefore is a potential benefit.

The validity of theoretical and esoteric models of competency-based education and their applicability in mastering patient-centered care in a few years is a concern for trainees [28]. An additional aspect of training that has garnered attention in pediatric cardiology programs is the teaching of communication skills and the provision of 'customer service' [28, 29]. As consultants, the unique expertise of pediatric cardiologists is important to physicians and patient families with the highly emotive information they can provide. Therefore, training fellows to communicate effectively rely on sensitivity and respect [28]. Whether these skills can be effectively taught and transferred to trainees through the monitoring of EPAs has yet to be seen. Examples such as these have been a part of the paradigm shift in the role of

subspecialists and therefore should be included in trainee assessments.

Pediatric cardiology is unique as it requires broad medical knowledge, exemplary communication skills, and technical mastery. Competency-based assessment frameworks within pediatric cardiology have revolved around medical knowledge and technical exposure rather than prowess. An overview of recommendations published by the American Academy of Pediatrics, American Heart Association, and American College of Cardiology (AAP/AHA/ACC) provided a framework for fellowship programs to determine the amount of time within specific inpatient/outpatient experiences and procedure volume requirements to graduate a categorical fellow [30]. These recommendations summate to mechanical aspects of training and do not provide guidance in developing finesse of the skills or knowledge required. As EPAs are gradually adopted into programs, educators are interested in determining if a new assessment framework would lead to successfully training pediatric cardiologists [25]. European pediatric cardiology programs vary significantly from their training practices and requirements and have expressed interest in the creation of a standardized approach to training and certifying pediatric cardiologists [31].

Measuring technical competencies in pediatric cardiology is challenging. Two-dimensional echocardiography is an example that even with basic knowledge of imaging windows, positioning, and machine optimization, technical mastery requires prowess combined with the comprehensive understanding of complex congenital heart disease. Reaching that level of proficiency takes time and is often the reason pediatric cardiology fellowship is described as an apprenticeship. One program developed an assessment tool for both the performance and clinical interpretation of transthoracic echocardiography [32]. Fellows who were assessed felt that intermittent observation from faculty is inadequate and that the volume of echocardiographic studies performed is a poor surrogate for technical competency [32]. In addition to the steep knowledge and technical learning curves, fellows attributed disorganized learning structures, burnout from excessive duty hours, imposter syndrome, and a feeling of inadequacy to anxiety and uncertainty after graduation [26, 33]. One way programs have taken initiative with these issues is the creation of "boot camps" for first-year fellows. These short-term, intensive training periods function as a primer in pediatric cardiology and provide a space for fellows to discuss their anxieties for fellowship [34].

Pediatric Cardiology Education During the COVID-19 Pandemic

The content and delivery of education have been challenged the last two years during the COVID-19 pandemic. Pediatric cardiology was no exception to its impact on the educational curriculum, necessitating training programs to adjust accordingly [25]. Some programs created an online lecture series for fellows nationally, while others (i.e., Boston Children's Hospital) developed online platforms to create a curriculum that incorporated both synchronous and asynchronous learning [35, 36]. These approaches utilized assigned learning teams in which each fellow was given specific tasks to complete, including cardiac lesion flow diagrams, creating educational content for other trainees, and developing mock board exam questions [35, 36].

Heart University is another example of an online educational forum that provides an asynchronous learning environment with training modules and provides direct access to publications including White papers, Guideline papers, and Landmark papers [37]. These platforms, while initially developed out of necessity during a pandemic, have demonstrated educational innovation and potential to change the way programs provide instructional materials to fellows [25]. While the impact of these platforms are unknown beyond their general favorability among trainees, there is no indication that these methods of education will disappear in the near future. EPAs and competency frameworks may be adversely affected from online education due to the clinical nature of EPAs and the lack of in-person entrustment.

The Relevance of EPAs within Pediatric Cardiology

Since the introduction of pediatric cardiology EPAs, there have been relatively few studies evaluating their adoption into programs and their overall efficacy. While the framework is thorough, it is time- and resource-intensive to track EPAs for every fellow during their training [15]. There has also been the creation of EPAs pertaining to pediatric cardiology subspecialties, such as cardiac critical care [38]. The inherent flexibility of the EPA framework allows program directors to determine how they wish to utilize EPAs in their fellowship program and therefore limits assessing their efficacy and utility [4, 14].

Congenital cardiothoracic surgery requires an extremely high level of technical expertise and it is understood that training and mentorship continue for our surgical counterparts following completion of formal training in order to excel professionally [39]. For example, few surgical trainees would be entrusted to perform a complex surgical procedure independently within the first year following completion of training. Likewise, it may be appropriate to reconsider certain EPAs specific to pediatric cardiologists which unrealistically expect training to independency within a three-year training period (or any subsequent year(s) of subspecialty training), but may require continued mentorship and evaluation [14]. If EPA thresholds for graduation are consensus-based assessments from programs, then there should be

standardized evidence to justify the progression of trainees through fellowship.

The opinion of medical learners is an important factor to consider with the implementation of EPAs. Medical student perspectives on EPAs revealed that the most important aspect to their learning was the reciprocated interest in the supervisor–trainee relationship and building trust through feedback [40]. While this has not been examined among pediatric cardiology fellows, previous studies have shown that there is a strong preference from fellows for structured learning and progression throughout their training [33]. The culture of learning and mentorship is at the heart of continued medical education and reinforces the desirability of EPAs as an assessment model.

Entrustment is a key component within a field as complex as pediatric cardiology. Whether EPAs can objectively measure this in both technically and medically intensive tasks is important to understand [41]. These discussions are not unique to this subspecialty as other pediatric subspecialties have noted trainees are requiring supervision beyond graduation even with successful completion of their EPAs throughout fellowship [42, 43]. This trend may indicate that independent practice is not the goal but instead highlighting that entrustment is not a linear process in spite of a trainee's growth in competency through the years [44].

To date, there have not been any studies examining patient/family perception and their input on EPAs. One study reported on a small group of pediatric fellows who performed self-assessments on EPAs and revealed that trainees continue to desire supervision and guidance through all three years of training although the self-assessments may have been affected by the trainees' lack of familiarity with EPAs [45].

Conclusion

Pediatric cardiology is a unique in that there is an element of craftsmanship that lends itself to an apprenticeship model that is pivotal to the education and success of aspiring residents and fellows. Cardiology fellows have emphasized the steep learning curve as a point of uncertainty and anxiety in training [26, 33]. While multiple studies outlined the criteria to successfully train a pediatric cardiologist, it is unclear whether these approaches are in the best interest of the trainee's professional development.

Evaluating an EPA framework requires a significant amount of time for programs to implement robust EPAs and follow their trainees into their early years of clinical practice. It is worthwhile to utilize a common framework to evaluate and optimize EPAs subspecialties (i.e., QUEPA) to ensure there is consistency when evaluating trainees [23]. We anticipate the next phases of EPA research should begin assessing EPAs and its efficacy in carrying the mission it was designed for initially [46].

The creation of EPAs provided a novel framework to create a continuous assessment model through a trainee's medical career. At this juncture, EPAs have not been examined with respect to their ability to translate training to high performance in everyday practice. It is essential to question whether the addition of EPAs will be a benefit for programs or if this is merely performative. Future studies should be directed at evaluating pediatric cardiology fellowship programs and their progress in EPA implementation and trainee outcomes.

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Declarations

Conflict of interest The authors have no financial conflict of interest to disclose and no funding was secured for this review.

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