

Education and Training in Pediatric Cardiac Critical Care: An Essential Tool to Improve Outcomes

Klebia Castello Branco,¹ Jorge Yussef Afiune²

Faculdade de Medicina da Universidade Federal do Ceará,¹ Fortaleza, CE – Brazil

Instituto de Cardiologia e Transplantes do Distrito Federal,² Brasília, DF – Brazil

Short Editorial related to the article: Challenges and Opportunities in Teaching and Training Pediatric Cardiac Critical Care in Developing Countries: A Narrative Review

In an article published in the *International Journal of Cardiovascular Sciences*, Campos and Carvalho¹ examine the challenges of educating and training teams in pediatric cardiac critical care in developing countries. They also highlight emerging opportunities for improvement and growth.

In recent decades, substantial advances have been made in the field of pediatric cardiology, including progress in pediatric cardiac surgery, catheter-based interventions, anesthesia, cardiac imaging and monitoring, neonatal and pediatric critical care, mechanical circulatory support, and the expansion of multidisciplinary teams. These advances have led to significant improvements in outcomes for children with congenital and acquired heart disease. However, congenital heart disease still places a significant burden on health care systems, especially in low- and middle-income countries.²

In high-income settings, pediatric cardiac intensive care units emerged as specialized environments once it became clear that caring for children with congenital and acquired heart disease required dedicated expertise. This recognition has driven the development of pediatric cardiac critical care as a defined subspecialty with structured training pathways and multidisciplinary care models, resulting in a significant increase in the number of dedicated pediatric cardiac intensive care units.³

However, in low- and middle-income countries, tertiary cardiac surgery centers are scarce, and many programs lack the necessary infrastructure, workforce, and supplies to provide the full spectrum of pediatric cardiac surgical care. Since maintaining domain expertise requires sustained procedural volume, the predominance of low-volume centers is associated with worse outcomes, which is consistent with the known relationship between center volume and surgical results. Campos e Carvalho¹ also underscore the late presentation of congenital heart disease, driven by limited diagnosis and restricted access to care, as an additional contributor to poorer outcomes in these settings.^{4,5}

In 2022, Tabbutt et al.⁶ led a task force of experts that included directors of 20 fourth-year pediatric cardiac critical

care training programs in the United States. The task force developed discipline-based learning objectives to serve as the foundation for a proposed standardized curriculum for pediatric cardiac critical care. A companion article delineated entrustable professional activities for pediatric cardiac critical care that can be broadly applied to physicians training in this field.⁷ In 2023, a volunteer panel of 10 Pediatric Cardiac Intensive Care Society fellowship program directors updated the pediatric cardiac critical care fellowship education and training entrustable professional activities. They defined and mapped 110 sub-competencies to the nine entrustable professional activities established in 2022. Their goal was to advance a standardized, competency-based assessment framework for pediatric cardiac critical care trainees.⁸ Despite these advances, there is still no universal standard for training or centralized oversight of certification in pediatric cardiac critical care. Debate continues over whether physicians caring for critically ill children with heart disease should undergo specialized training and certification.⁹ Pollak et al.¹⁰ discuss future directions for education and training in pediatric cardiac critical care. They also highlight tools currently used in the United States and internationally. These tools include competency-based medical education, entrustable professional activities, explicit learning objectives, simulation-based training, virtual reality, and three-dimensional printing models.

In low- and middle-income countries, additional barriers hinder adequate pediatric cardiac critical care training. As noted by Campos and Carvalho,¹ workload, time constraints, language barriers, and structural limitations within health systems hinder the standardization of optimal training processes. Drawing on adult-learning principles, their narrative review explores strategies to mitigate these challenges (eg, hybrid or fully online instruction, simulation-based education, inter-institutional collaboration, and “twinning” partnerships between centers with differing resources) to strengthen training quality and support the delivery of high-quality care to critically ill pediatric cardiac patients and their families.

In summary, this review is a valuable resource for policymakers, educators, and clinicians who are seeking ways to improve pediatric cardiac care in settings with limited resources and in low- and middle-income countries. By delineating key challenges and actionable strategies, Campos and Carvalho¹ contribute meaningfully to the field. They also underscore the need for stronger education and training in pediatric cardiac critical care to improve outcomes for children with congenital heart disease in developing countries. Their work provides practical guidance for future initiatives and emphasizes the importance of sustained investment in education and resources to enable healthcare professionals in low- and middle-income countries to deliver high-quality care in pediatric cardiac critical care settings.

Keywords

Health Education; Professional Training; Pediatrics

Mailing Address: Klebia Castello Branco •

Rua Pastor Samuel Munguba, 1290. Postal code: 60430-372. Rodolfo Teófilo, Fortaleza, CE – Brazil

E-mail: klebiacb@gmail.com

Manuscript received September 04, 2025, revised manuscript September 08, 2025, accepted September 08, 2025

DOI: <https://doi.org/10.36660/ijcs.20250198>

References

1. Campos CV, Carvalho CRR. Challenges and Opportunities in Teaching and Training Pediatric Cardiac Critical Care in Developing Countries: A Narrative Review. *Int J Cardiovasc Sci.* 2025;38:e20250049. doi: 10.36660/ijcs.20250049.
2. GBD 2017 Congenital Heart Disease Collaborators. Global, Regional, and National Burden of Congenital Heart Disease, 1990-2017: A Systematic Analysis for the Global Burden of Disease Study 2017. *Lancet Child Adolesc Health.* 2020;4(3):185-200. doi: 10.1016/S2352-4642(19)30402-X.
3. McBride ME, Beke DM, Fortenberry JD, Imprescia A, Callow L, Justice L, et al. Education and Training in Pediatric Cardiac Critical Care. *World J Pediatr Congenit Heart Surg.* 2017;8(6):707-14. doi: 10.1177/2150135117727258.
4. Hasan BS, Bhatti A, Mohsin S, Barach P, Ahmed E, Ali S, et al. Recommendations for Developing Effective and Safe Paediatric and Congenital Heart Disease Services in Low-Income and Middle-Income Countries: A Public Health Framework. *BMJ Glob Health.* 2023;8(5):e012049. doi: 10.1136/bmjgh-2023-012049.
5. Vervoort D. Centralization and Regionalization of Congenital Heart Surgery in a Globalized World. *J Thorac Cardiovasc Surg.* 2021;161(6):e481. doi: 10.1016/j.jtcvs.2020.09.014.
6. Tabbutt S, Krawczeski C, McBride M, Amirnovin R, Owens G, Smith A, et al. Standardized Training for Physicians Practicing Pediatric Cardiac Critical Care. *Pediatr Crit Care Med.* 2022;23(1):60-4. doi: 10.1097/PCC.0000000000002815.
7. Werho DK, DeWitt AG, Owens ST, McBride ME, van Schaik S, Roth SJ. Establishing Entrustable Professional Activities in Pediatric Cardiac Critical Care. *Pediatr Crit Care Med.* 2022;23(1):54-9. doi: 10.1097/PCC.0000000000002833.
8. Chlebowski MM, Migally K, Werho DK, Sznycer-Taub N, Rhodes LA, Szadkowski A, et al. Cardiac Critical Care Fellowship Training in the United States and Canada: Pediatric Cardiac Intensive Care Society-Endorsed Subcompetencies to the 2022 Entrustable Professional Activities. *Pediatr Crit Care Med.* 2024;25(6):e303-9. doi: 10.1097/PCC.0000000000003464.
9. Tabbutt S, Taylor MB, Krawczeski CD. Should Physicians Caring for Children with Critical Heart Disease Undergo Specialized Training and Certification? *Pediatr Crit Care Med.* 2024;25(6):580-2. doi: 10.1097/PCC.0000000000003505.
10. Pollak U, Feinstein Y, Mannarino CN, McBride ME, Mendonca M, Keizman E, et al. The Horizon of Pediatric Cardiac Critical Care. *Front Pediatr.* 2022;10:863868. doi: 10.3389/fped.2022.863868.



This is an open-access article distributed under the terms of the Creative Commons Attribution License