

## *A Novel Educational Curriculum in Pediatric Cardiac Intensive Care*

### **I. Specific educational aims**

The growth of pediatric cardiac surgery over the past three decades has led to the rapid establishment of pediatric cardiac intensive care medicine as a specialty.<sup>1</sup> At most institutions, pediatric cardiology and critical care fellows rotate through the cardiac intensive care unit (CICU) for exposure to cardiac critical care.<sup>2</sup> We propose the development of an interactive, online curriculum for pediatric cardiology and critical care fellows in cardiac intensive care. Specifically, we aim to:

1. Create and make available a **rigorously-designed**, comprehensive set of online modules in pediatric cardiac intensive care for pediatric cardiology and critical care fellows.
2. Evaluate the efficacy and ease of use of these modules to teach core principles in pediatric cardiac intensive care to pediatric cardiology and critical care fellows.

One of the members of our team, Dr. Lillian Su, is now the Associate Chief and Medical Director of the Division of Cardiac Intensive Care at Phoenix Children's Hospital, and she plans to share these modules with the fellows at her new institution. This **collaboration** will allow for improved beta-testing of the created modules to improve their efficacy. Our ultimate goal is to create a **sustainable resource** for future learners at our institutions and nationwide.

### **II. Project Rationale**

While most pediatric cardiology and critical care fellows will not pursue sub-specialization in cardiac intensive care, the American Board of Pediatrics describes the intensive care management of patients with congenital heart disease as a core competency for both fields.<sup>3,4</sup> However, the rapid pace of the CICU and patient acuity often leave little time for structured didactic education during a typical week of service. Additionally, quaternary care CICUs, such as we have at Lucile Packard Children's Hospital, attract the most complex cases, causing concern that fellows will have limited exposure to "bread and butter" cardiac intensive care medicine. There are many examples of simulation-based curricula in pediatric cardiac critical care, however these curricula were designed to teach crisis management or procedural skills.<sup>5</sup> No curriculum has been published to guide the education of fellows in pediatric cardiac intensive care.

Our group identified a need for a CICU-specific curriculum in 2017 due to multiple requests for more structured CICU education by our fellows. A set of 12 PowerPoint presentations were created. Topics were chosen based on ABP content specifications for cardiology and critical care. The 12 sessions were separated by year, with 6 to be completed in the 1<sup>st</sup> year of fellowship, 4 in the 2<sup>nd</sup> year, and 2 in the 3<sup>rd</sup> year. Initially, these didactic sessions were presented as lectures during CICU service time, but due to service obligations, the sessions were poorly attended. Additionally, it was challenging to ensure that each fellow was exposed to each different didactic. The next iteration of this curriculum involved 1:1 learning sessions with attendings and fellows, but the matching of schedules became challenging and only a few fellow-attending dyads completed the sessions. Despite these challenges, the didactic sessions were well-received and have been iteratively improved over their time of use.

We propose the creation of a novel, online educational curriculum in pediatric cardiac critical care for cardiology and critical care fellows. Trainees will have access to asynchronous, interactive content to bolster their experiential learning in the CICU and ensure exposure to core concepts in CICU care.

### **III. Approach**

Our goal is to modify the existing 12 educational sessions into a set of online, interactive modules for fellows. After consultation with the Stanford Educational Technology group, we plan to use H5P software to create modules with specific interactive features (such as fill in the blank, multiple choice, and drag and drop answer choices) with real-time feedback to the learner about the accuracy of their answers. Between the 33 cardiology and critical care fellows at Stanford and the 21 fellows at Phoenix Children's, we anticipate a robust sample size for beta-testing of the initial modules.

#### **IV. Timeline and plan for implementation**

**October-December 2022:** Set up educational platform to house modules, resume consultation with Stanford Ed Tech, hire a medical student to convert modules to online format, finalize plan for evaluation

**January 2023-March 2023:** Conversion of modules from current format to online interactive modules with medical student help

**April 2023-June 2023:** Pilot online educational modules with current 1<sup>st</sup> year fellows at LPCH and Phoenix Children's and use data to improve module design

**July 2023:** Roll out modules to all cardiology and critical care fellows at both institutions

#### **V. Anticipated Work Product**

We will create an online series of modules covering core topics in pediatric cardiac intensive care. By demonstrating the utility and efficacy of the educational content, we can secure funding for continued purchasing of the educational platform (\$1000/year) for subsequent years of fellows at LPCH. With a year of data (by July 2024), we hope to publish a manuscript on the efficacy of this curriculum. Ultimately, we would like to make these modules accessible to fellows at other institutions.

#### **VI. Evaluation Plan**

Learners will be asked to briefly assess the efficacy and ease of use of each module by Likert scale. Results of these surveys plus additional quantitative metrics, such as how often questions are answered correctly on the first attempt, how often modules are done and repeated, which modules are selected for completion by fellows, and metrics by training program (cardiology versus critical care) will be used to improve the modules. Prior to beginning the modules and at the end of each academic year, fellows will complete a self-assessment of their learning. In the future, as fellows complete modules during each academic year, we can obtain data about retention of knowledge by testing the prior years' content.

#### **VII. Dissemination of Results**

We plan to use this curriculum to supplement the education of the cardiology and critical care fellows rotating through the CICU here at LPCH. Additionally, a web-based platform will allow for sharing across multiple institutions, both at Phoenix Children's and with other CICUs across the country. We hope to present our findings to the Pediatric Cardiac Intensive Care Society (PCICS) Education Committee and submit an abstract for the PCICS national meeting in 2023, and ultimately to make this curriculum available in a web-based format to all trainees. While pediatric cardiology and critical care fellows are the target audience of these modules, we expect these modules will also benefit residents interested in cardiology and critical care and advanced practice providers who work in CICUs.

## References

1. Horak RV, Bai S, Marino BS, Werho DK, Rhodes LA, Costello JM, Cabrera AG, Cooper DS, Tan Y, Tabbutt S, Krawczeski CD. Workforce demographics and unit structure in paediatric cardiac critical care in the United States. *Cardiol Young*. 2021 Dec 3:1-5. doi: 10.1017/S1047951121004753. Epub ahead of print. PMID: 34857058.
2. Horak RV, Alexander PM, Amirnovin R, Klein MJ, Bronicki RA, Markovitz BP, McBride ME, Randolph AG, Thiagarajan RR. Pediatric Cardiac Intensive Care Distribution, Service Delivery, and Staffing in the United States in 2018. *Pediatr Crit Care Med*. 2020 Sep;21(9):797-803. doi: 10.1097/PCC.0000000000002413. PMID: 32886459.
3. The American Board of Pediatrics Content Outline: Pediatric Critical Care Medicine. <https://www.abp.org/sites/abp/files/outline-critical-care-updated.pdf>. American Board of Pediatrics; 2020.
4. The American Board of Pediatrics Content Outline: Pediatric Cardiology. <https://www.abp.org/sites/public/files/pdf/content-outline-card-starting-100122.pdf>. American Board of Pediatrics; 2022.
5. Choudhury TA, Flyer JN, McBride ME. Simulation as an Educational Tool in the Pediatric Cardiac Intensive Care Unit. *Curr Pediatr Rep*. 2021;9(3):52-59. doi: 10.1007/s40124-021-00241-0. Epub 2021 May 25. PMID: 34055476; PMCID: PMC8144691.