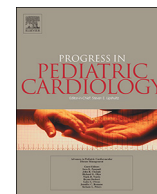




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A new, expanded approach to pediatric cardiology fellowship orientation[☆]

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A B S T R A C T

Background: Because of limited and varying resident exposure to pediatric cardiology, rapidly acquiring the necessary knowledge, clinical and technical skills can be overwhelming for incoming pediatric cardiology fellows. To address this, we developed a pediatric cardiology fellowship orientation at the beginning of fellowship using an extended orientation model.

Methods: We designed and implemented a three-week extended orientation for all rising first year pediatric cardiology fellows at our institution to take place the first month of their training. The extended orientation consisted of: 1) daily lunchtime didactic sessions focused on general pediatric cardiology topics; 2) hands-on echocardiography experience (total 4.5 days) and high fidelity simulations focused on cardiac emergencies, extracorporeal membrane oxygenation, and cardiac palliative care; and 3) day-long precepted experiences in core clinical rotations. Pre- and post-extended orientation knowledge self-assessment results were compared using paired *t*-tests.

Results: Due to protection from clinical duties during the three-week extended orientation period, all seven first-year pediatric cardiology fellows were able to participate in 100% of these sessions. After the extended orientation, participants demonstrated significant improvement in self-assessed knowledge in all clinical areas, with mean scores increasing from $45 \pm 15\%$ pre- to $74 \pm 11\%$ post-orientation ($p \leq 0.001$). The greatest improvements occurred in echocardiography, catheterization, and cardiac anatomy. Based on a post-orientation feedback, additional education dedicated to electrophysiology, including EKG interpretation, arrhythmia management, and pacemaker basics, was recommended.

Conclusion: A three-week extended orientation model for pediatric cardiology fellowship orientation at the beginning of fellowship effectively introduces incoming fellows to key clinical topics unique to cardiology. In the current educational era, this represents an alternative approach to the traditional orientation model. Facilitating full participation in these sessions without competing clinical duties may enable all fellows to start their training with the necessary clinical foundation and may improve their preparedness for clinical responsibilities.

1. Introduction

Pediatric residents have limited exposure to the knowledge, clinical, and technical skills necessary to successfully care for pediatric cardiac patients. New pediatric cardiology fellows must rapidly develop an understanding of cardiac anatomy, cardiac physiology, cardiac surgical techniques, and a basic proficiency in pediatric cardiac echocardiography, cardiac catheterization and electrophysiology. Additionally, they are tasked with caring for patients in a variety of settings, including: cardiac intensive care, outpatient clinic, cardiac catheterization laboratory, and as consultants in the emergency department, the pediatric intensive care unit and general pediatric inpatient wards, and

newborn nurseries. Though the breadth of necessary knowledge is growing, work-hour restrictions limit the contact time for development of these skills during pediatric residency. These factors make the transition to pediatric cardiology fellowship training more challenging than in previous decades.

A number of procedural disciplines including general surgery, otolaryngology, and pediatric critical care have adopted training “boot camps,” which are structured, hands-on introductory courses to teach common clinical and procedural skills in the respective specialty. These learning environments have been shown to improve trainee comfort, knowledge base, and procedural competence [1–4]. A boot camp approach has also been proposed as an effective tool for orienting

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matriculating pediatric cardiology fellows. Maskatia et al. have reported their four-year success with a pediatric echocardiography boot camp, which led to improved echocardiogram performance and knowledge base among incoming cardiology fellows [5]. A two day pediatric cardiology boot camp administered a few months prior to fellowship training has been shown to improve fellow confidence, reduce anxiety, and significantly improve knowledge base prior to cardiology fellowship [6, 7]. However, there is concern of loss of skills in the time from the boot camp until the fellow begins their formal training. Others have reported success with a four week boot camp or “extended orientation” at the beginning of cardiology fellowship training [8].

At our institution, rising first-year pediatric cardiology fellows have historically participated in a two-day orientation consisting of one day of introductory lectures focused on cardiac center logistics, clinical rotations, and emergencies that may be encountered while on overnight call, and a day of echocardiography didactics and hands-on practice. With a change in the Accreditation Council for Graduate Medical Education (ACGME) policy in 2017, matriculation for all pediatric specialty fellows was delayed until mid-July. Rising first-year fellows were freed of clinical responsibilities during the month of July, and participated in a comprehensive, three-week pediatric cardiology extended orientation. This consisted of a hybrid approach including orientation sessions, simulations, shadowing, and more traditional didactic components. We sought to assess the effectiveness of this extended orientation in introducing first-year cardiology fellows to general cardiology topics and procedures.

2. Methods

The extended orientation was a three-week orientation program in pediatric cardiology held in July 2017 at the Children's Hospital of Philadelphia and was attended by all first-year cardiology fellows. The incoming fellows were not assigned clinical duties ensuring 100% participation in the three-week extended orientation process. As this modified a current standard of fellow education, Institutional Review Board approval was not required.

2.1. Extended Orientation Objectives

The extended orientation was designed to include didactic instruction on high impact clinical topics, hands-on workshops, and simulation experiences relevant to pediatric cardiology training. The program was divided into three aspects: 1) didactic lectures or clinical simulations focused on fundamental pediatric cardiology skills, 2) hands-on echocardiography, and 3) shadowing experience in clinical rotations (including outpatient cardiology clinic, cardiac catheterization, cardiac surgery, cardiac intensive care, inpatient acute care, cardiology consultation, and cardiac morphology). The shadowing experiences provided instructive exposure to the fellow's role in each clinical rotation under the guidance of a senior fellow who oriented them to the expectations of each rotation. These shadowing experiences aimed to reduce the time spent learning about the hospital-based practices of each rotation so that fellows could focus on educational goals once they started their rotations. Learning objectives and educational approach for each of the covered topics are listed below and detailed in [Table 1](#).

2.1.1. Cardiac Physical Exam

- Approach to the cardiac physical exam, including auscultation of cardiac murmurs
- Using a combined approach of didactic lecture followed by bedside teaching with patients with a variety of cardiac anatomy and pathology

2.1.2. Cardiac Catheterization

- Basics of pediatric hemodynamic assessment with cardiac catheterization
- Cardiac angiography, including various projections used to diagnose cardiac lesions
- Introduction to cardiac catheterization equipment
- Case-based interactive lecture during which fellows were expected to make calculations using hemodynamic data from a series of patients with varying physiology (two-ventricle, single ventricle with complete mixing, etc.) followed by a hand-on session during which fellows had the opportunity to interact with cardiac catheterization equipment

2.1.3. Cardiac Intensive Care

- Introduction to management of cardiac emergencies
- Postoperative management of complex cardiac patients (e.g. after repair of tetralogy of Fallot, Norwood procedure etc.)
- Teaching using a combined approach of didactic lectures, high fidelity simulations of cardiac emergencies, and facilitated simulations of difficult family conversations

2.1.4. Anatomy and Pathology

- Normal cardiac morphology
- Different types of ventricular septal defects
- Staged palliation of single ventricle heart disease
- Teaching using a combined approach of didactic lectures as well as hands on experience with cardiac pathology specimens

2.1.5. Heart Failure

- Initial approach to evaluation and management of acute heart failure
- Teaching using a combined approach of didactic lectures as well as interactive question and answer session

2.1.6. Cardiopulmonary Bypass and Mechanical Circulatory Support

- Understanding the principles of cardiopulmonary bypass
- Understanding the basics of extracorporeal membrane oxygenation (ECMO)
- Knowledge of indications for and types of ventricular assist devices (VADs) available for pediatric and adult-size patients
- Teaching using a combined approach of didactic lecture by cardiac surgeons and perfusionists, observation of cardiopulmonary bypass in the cardiac operating room moderated by cardiac perfusionists, and two day high fidelity ECMO simulation course conducted by cardiac intensivists and ECMO-trained perfusionists

2.1.7. Pulmonary Hypertension

- Approach to assessing pediatric pulmonary hypertension
- Management of acute pulmonary hypertensive crisis
- Teaching using a combined approach of didactic lectures as well as interactive question and answer session

2.1.8. Echocardiography

- Understanding the basic modalities used to diagnosis heart disease and the views used to perform a complete pediatric echocardiogram
- Teaching using an introductory lecture explaining the standard views used for pediatric echocardiographic studies, followed by four full days spent performing real-time echocardiograms under the guidance of echocardiographic sonographers and attending

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