



Entrustable Professional Activities

EPA 1 for Pediatric Cardiology

EPA 1: Acquire the Imaging Skills Required for All Aspects of Pediatric and Cardiology Care

Supervision Scale for This EPA

1. Trusted to observe only
2. Trusted to perform and interpret the imaging study with direct supervision and coaching
3. Trusted to perform and interpret the imaging study with indirect supervision for most simple and some complex cases
4. Trusted to perform and interpret the imaging study with indirect supervision but may require discussion for a few complex cases
5. Trusted to perform and interpret imaging studies without supervision

Description of the Activity

Upon completion of a general pediatric cardiology fellowship, the individual must be able to perform a complete transthoracic echocardiogram (TTE) and be able to interpret and identify normal cardiac anatomy, exclude lesions associated with risk for sudden death, identify common pediatric and simple congenital heart disease, and have knowledge of fetal and transesophageal echocardiography (TEE) and cardiac magnetic resonance imaging (MRI). They should be able to perform echocardiograms on patients with complex congenital heart defects and have sufficient knowledge to make a management plan and initiate treatment¹.

The specific functions which define this EPA include:

1. Performing and interpreting complete TTE on children and young adults with normal hearts and with both normal and abnormal anatomy and function
2. Communicating the results of these studies to patients, families, referring physicians, and health care professionals
3. Demonstrating the highest ethical principles and practices while performing, interpreting, and communicating imaging studies
4. Knowing the indications, strengths, and limitations of fetal and TEE
5. Knowing the indications for, strengths, and limitations of cardiac MRI, CT scan, and nuclear imaging in diagnosis and management of acquired and congenital heart disease
6. Searching the medical literature and applying evidence-based information to the noninvasive evaluation of a given patient's cardiac anatomy and function

Judicious Mapping to Domains of Competence

- Patient Care
- Medical Knowledge
- Practice-Based Learning and Improvement
- Interpersonal and Communication Skills
- Professionalism
- Systems-Based Practice
- Personal and Professional Development



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EPA 1 for Pediatric Cardiology

Competencies Within Each Domain Critical to Entrustment Decisions

PC 8:	Performing procedures
MK 1:	Demonstrating knowledge
PBLI 6:	Practicing EBM
ICS 3:	Communicating with health professionals
ICS 6:	Maintaining medical records
P 2:	Demonstrating professional conduct

Context for the EPA

Rationale: Cardiac imaging is fundamental to understanding anatomy and physiology when taking care of a patient with congenital or acquired heart disease. It is also an important screening tool to exclude the same. Cardiology fellows will be expected to be able to independently perform and interpret transthoracic echocardiography (TTE) upon completion of their fellowship as this is a necessary skill for the practice of the subspecialty.

Scope of Practice: Knowledge and skill needed in performing, interpreting, and reporting transthoracic echocardiography is an expectation of all general cardiologists. For other imaging modalities such as transesophageal echocardiography, fetal echocardiography, Cat Scan (CT) and Magnetic Resonance Imaging (MRI) only knowledge of indications, applications, and limitations is expected. TTE services are provided as both inpatient and outpatient procedures. Competence in TEE, MRI, CT scan, and fetal ECHO may require additional training after completion of core cardiology fellowship and for cardiologists who do not have additional training, consultation from colleagues with these advanced skills may be warranted. Practicing cardiologists should be aware of needs and advantages for multimodality imaging and refer patients accordingly.

Setting: Diagnosis and management in the following settings: inpatient, outpatient, consultation, routine, and acute/emergent or intensive care environment.

Patient Population: Fetus, infant, child, adolescent, and adult.

Curricular Components That Support the Functions of the EPA

1. Performing and interpreting TTE on children and young adults with both normal and abnormal anatomy and function
 - Demonstrates knowledge of the indication for the TTE prior to performing or interpreting one
 - Demonstrates knowledge of basic principles and physics of image acquisition and optimization inclusive of two dimensions, color, and spectral Doppler
 - Demonstrates ability to choose appropriate transducer, imaging frequency (pure versus harmonic) for two-dimensional, color Doppler imaging and spectral Doppler acquisition
 - Demonstrates ability to maximize image acquisition quality by adjusting depth, gain, compression, transmit focal zone, lateral gain
 - Identifies imaging artifacts
 - Details assessment of anatomy using the segmental approach to cardiac anatomy
 - Details protocol inclusive of all views and their variations to allow for imaging a structurally normal heart, simple and complex cardiac lesions



Entrustable Professional Activities

EPA 1 for Pediatric Cardiology

- Demonstrates knowledge regarding imaging details (views) that need to be acquired, interpreted, and reported for the given indications
 - Uses appropriate nomenclature of congenital heart disease
 - Demonstrates knowledge and can perform of assessment of ventricular size and function, applies principles of function assessment to complex and repaired congenital heart disease with ventricles that do not conform to expected geometric configuration
 - Demonstrates knowledge of limitation and application of different 2D and 3D methods for assessment of ventricular mass calculation
 - Demonstrates ability to assess coronary anatomy
 - Demonstrates ability to assess ventricular hypertrophy and myocardial abnormalities
 - Demonstrates ability to assess hemodynamic data
 - Demonstrates ability to assess and differentiate pericardial disease from cardiac abnormalities (e.g., tamponade from restrictive and constrictive process)
 - Demonstrates knowledge of surgical techniques and assessment of repaired and palliated CHD
 - Demonstrates knowledge of standards and guidelines to assess atrioventricular valve and semilunar valve size and function
 - Demonstrates knowledge regarding indices used to assess diastolic function
 - Demonstrates knowledge of indications, imaging views, standards, risks, and limitations of TEE
 - Applies knowledge of limitations of TTE and knows which additional or alternative imaging modality — MRI, CT, or cardiac catheterization — would be needed to get complete data that will allow for optimization of patient care
 - Demonstrates knowledge of indications, imaging views, standards, and limitations of fetal echocardiography
 - Demonstrates knowledge of indications, imaging views, standards, risks, and limitations of MRI and CT scan
 - Demonstrates awareness of or participates in a process established for quality improvement and error identification and classification on TTE
 - Knows when to order an MRI, CT scan, or TEE in order to supplement TTE data and apply to patient assessment and management
 - Demonstrates knowledge of application and use of noninvasive imaging modalities to guide interventions in cardiac catheterization and electrophysiologic (EP) studies
 - Demonstrates knowledge of indications, contraindications, and limitations to sedation utilized when performing procedures
2. Communicating the results of these studies to patients, families, referring physicians, and health care professionals
- Demonstrates knowledge of reporting elements for scribing a complete report of the performed TTE
 - Demonstrates ability (verbal/written) to convey the diagnosis and report it to the referring physician
 - Demonstrates skills needed to convey the diagnosis and incumbent management plans to the patients and or their family or legal guardian
 - Communicates the results of the exam, inclusive of hemodynamic and clinical implications, in a simplified manner to patients and families



Entrustable Professional Activities

EPA 1 for Pediatric Cardiology

- Communicates results to the referring and ordering physicians in a timely manner, with urgent and critical results that require change in medical management being communicated immediately to the ordering physician and care team
3. Demonstrating the highest ethical principles and practices while performing, interpreting, and communicating imaging studies
- Incorporates patients' and the care teams' knowledge and level of understanding in explaining the need for the procedure, the steps of the procedure, and the interpretation of results
 - Communicates reliability and limitations of the study findings based on evidence that is free from personal bias
 - Encourages questions from patients, families, and team members when discussing interpretation of results
4. Knowing the indications, strengths, and limitations of fetal echocardiography and TEE
- Fetal echocardiography (See the fetal echocardiography statement published in AHA²)
 - Demonstrates knowledge about indications and gestational age at which a fetal echocardiogram can be performed
 - Demonstrates knowledge of normal physiology of fetal and transitional circulation
 - Demonstrates knowledge of alterations in fetal circulation associated with CHD and assesses impact of the findings on outcome
 - Demonstrates knowledge of fetal arrhythmia evaluation, management, outcomes, and utility of fetal echocardiographic monitoring
 - Demonstrates knowledge of extracardiac anomalies in the fetus that impact prenatal and perinatal outcome
 - Demonstrates knowledge of existing innovations and standards in perinatal management
 - TEE
 - Demonstrates knowledge of application of TEE in assessment of vegetation, intracardiac abscess in endocarditis, and intracardiac thrombi
 - Demonstrates knowledge in the use of TEE in guiding interventional procedures, pre- and postoperative and intraoperative assessment
 - Demonstrates knowledge of strengths and limitations of TEE in assessment of acquired and CHD
5. Knowing the indications for strengths and limitations of cardiac MRI, CT scan, and nuclear imaging in diagnosis and management of acquired and congenital heart disease
- Demonstrates knowledge regarding radiation exposure and the safety precautions required with the use of these modalities
 - Demonstrates knowledge of utility of these tests in patient assessment
6. Searching the medical literature and applying evidence-based information to the noninvasive evaluation of a given patient's cardiac anatomy and function



Entrustable Professional Activities

EPA 1 for Pediatric Cardiology

- Searches the literature for the most up-to-date information for purposes of educating patients and families, shared decision making with the health care team, and helping to deal with the anxiety that accompanies ambiguity/uncertainty
- Searches the literature for evidence, focusing on the highest-grade evidence available
- Applies the evidence to the assessment and diagnosis of the congenital/acquired cardiac pathology and cardiomyopathy given the particular context for that patient

References

1. Srivastava S, Printz BF, Geva T, Shirali GS, Weinberg PM, Wong PC, Lang P. Task Force 2: Pediatric cardiology fellowship training in noninvasive cardiac imaging. *J Am Soc Echocardiogr*. 2015; 28: 1009-19 (Endorsed by the American Society of Echocardiography and the Society of Pediatric Echocardiography).
2. Donofrio MT, Moon-Grady AJ, Hornberger LK, et al. Diagnosis and treatment of fetal cardiac disease; A scientific statement from the American Heart Association. *Circulation*; 2014; 129: 2183-2241.

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