

## Pediatric Echocardiography Examination Content Outline

### (Outline Summary)

#	Domain	Subdomain	Percentage
1	<b>Anatomy and Physiology</b>	Normal Anatomy and Physiology	<b>10%</b>
2	<b>Abnormal Pathology and Pathophysiology</b>	Abnormal Pathology and Pathophysiology	<b>12%</b>
3	<b>Congenital Anomalies</b>	Congenital Anomalies	<b>22%</b>
4	<b>Postoperative Anatomy</b>	Postoperative (surgically corrected/palliated) Anatomy	<b>20%</b>
5	<b>Clinical Standards and Guidelines</b>	Clinical Standards	<b>8%</b>
6	<b>Measurement Techniques and Quantification</b>	Measurement Techniques	<b>28%</b>

### (Detailed Outline)

1.	Anatomy and Physiology 10%	Knowledge and/or skill related to anatomy and physiology
<b>1.A.</b>	<b>Normal Anatomy and Physiology</b>	
1.A.1.	Identify great artery anatomy and flow patterns (i.e., aorta; aortic arch sidedness and branching; main and branch pulmonary arteries)	Know normal cardiac anatomy and physiology Be familiar with appropriate standard views for relevant anatomy Understand transition of circulation from fetus to newborn Know the utility of two-dimensional imaging, color Doppler, and spectral Doppler in assessing anatomy and physiology Understand basic abdominal and noncardiac thoracic structures and positions
1.A.2.	Identify normal valve structure, motion, and flow patterns	
1.A.3.	Identify normal ventricular morphology and motion	
1.A.4.	Identify normal transitional circulation (e.g., patent foramen ovale [PFO], patent ductus arteriosus [PDA], decreasing pulmonary vascular resistance)	
1.A.5.	Identify coronary artery origins, proximal branches, and color flow pattern	
1.A.6.	Identify normal systemic and pulmonary venous anatomy and flow patterns (i.e., superior vena cava, inferior vena cava, innominate vein, coronary sinus, azygos vein, pulmonary veins)	
1.A.7.	Identify normal abdominal situs and segmental cardiac anatomy	

<b>1.A.</b>	<b>Normal Anatomy and Physiology cont.</b>	
1.A.8.	Identify normal right and left atrial morphology (i.e., eustachian valve, Chiari network, appendages)	
<b>2.</b>	<b>Abnormal Pathology and Pathophysiology 12%</b>	<b>Knowledge and/or skill related to abnormal pathology and pathophysiology</b>
<b>2.A.</b>	<b>Abnormal Pathology and Pathophysiology</b>	
2.A.1.	Assess cardiomyopathies (e.g., dilated, hypertrophic, restrictive)	<p>Recognize abnormal cardiac anatomy and physiology Understand the use of two-dimensional imaging to illustrate abnormal anatomy and physiology in standard and nonstandard planes</p> <p>Understand the use of color and spectral Doppler in assessing abnormal anatomy and physiology Understand common forms of obstructive and myopathic heart disease Know the common forms and associated findings of pediatric acquired heart disease Associate disease processes and systemic illnesses with relevant cardiac findings Recognize sonographic signs of rejection in heart transplant patients Recognize findings associated with systemic hypertension, including ventricular hypertrophy and aortic arch obstruction Recognize common echocardiographic findings associated with chromosomal abnormalities and genetic diseases</p>
2.A.2.	Assess findings associated with pulmonary hypertension	
2.A.3.	Assess pericardial effusion	
2.A.4.	Assess coronary artery abnormalities associated with Kawasaki disease	
2.A.5.	Identify findings associated with infective endocarditis (e.g., valvular regurgitation, vegetation, abscess)	
2.A.6.	Identify intracardiac and vascular thrombus	
2.A.7.	Assess functional abnormalities associated with drug toxicity (e.g., adriamycin chemotherapy)	
2.A.8.	Assess findings associated with rheumatic fever	
2.A.9.	Assess features associated with cardiac transplantation and rejection	
2.A.10.	Assess lesions associated with gestational or maternal diabetes	
2.A.11.	Assess pleural effusions	
2.A.12.	Identify possible echocardiographic abnormalities associated with systemic hypertension in children	
2.A.13.	Identify lesions associated with connective tissue disorders (e.g., Marfan syndrome, Ehlers-Danlos syndrome, Loeys-Dietz syndrome)	
2.A.14.	Identify lesions associated with syndromes (e.g., Turner, Williams, DiGeorge, Noonan)	
2.A.15.	Identify lesions associated with Down syndrome	

3.	Congenital Anomalies 22%	Knowledge and/or skill related to congenital anomalies
<b>3.A.</b>	<b>Congenital Anomalies</b>	
3.A.1.	Assess aortic arch anomalies (e.g., coarctation, interruption, anomalous branching patterns)	Be familiar with common forms of congenital heart disease
3.A.2.	Assess conotruncal defects (e.g., tetralogy of Fallot [TOF], double outlet right ventricle [DORV], truncus arteriosus, and aortopulmonary [AP] window)	Recognize common conotruncal defects and associated findings Know the utility of and be able to optimize two-dimensional imaging, color Doppler, and spectral Doppler in the assessment of congenital cardiac anomalies
3.A.3.	Assess abnormalities of the aortic valve	Understand and identify delayed transitional circulation and ductal-dependent lesions
3.A.4.	Assess abnormal atrioventricular and ventriculoarterial connections (e.g., dextro-transposition of the great arteries [d-TGA], levo-transposition of the great arteries [l-TGA] or physiologically corrected TGA)	Know how to recognize and interrogate aortic arch anomalies, including obstruction and abnormal branching patterns
3.A.5.	Assess atrioventricular septal defects (e.g., endocardial cushion defect, atrioventricular canal defect)	Understand common abnormalities in valve structure and function
3.A.6.	Assess ventricular outflow tract abnormalities (e.g., subvalvar obstructive lesions)	Be familiar with appropriate standard views for characterizing valve morphology and assessing valve dysfunction
3.A.7.	Assess atrial and ventricular septal defects	Recognize abnormal atrioventricular and ventriculoarterial connections
3.A.8.	Assess pulmonary venous anomalies (i.e., partially and totally anomalous connection/drainage; pulmonary vein stenosis)	Understand the various forms of atrial and ventricular septal defects Know how to recognize and interrogate left heart inflow and outflow tract obstruction
3.A.9.	Assess pulmonary artery (PA) abnormalities (i.e., supra-valvar and peripheral PA stenosis; dilated PAs; discontinuous PAs)	Identify and characterize aortopulmonary connections Know how to assess abnormalities in the main and branch pulmonary arteries
3.A.10.	Assess abnormalities of the mitral valve	Know how to identify and characterize coronary artery anomalies
3.A.11.	Assess patent ductus arteriosus and aortopulmonary collaterals	Understand how to recognize and define anomalous arteriovenous connections
3.A.12.	Assess abnormalities of the pulmonic valve	Recognize abnormal abdominal and cardiac situs/position
3.A.13.	Assess supra-valvar aortic stenosis	Recognize findings and disease patterns associated with abnormal situs
3.A.14.	Assess coronary artery abnormalities (i.e., sinusoids, fistulae, anomalous origins)	Be familiar with anomalous pulmonary and systemic venous connections
3.A.15.	Assess abnormalities of the tricuspid valve	Recognize intracardiac and myocardial masses and understand how to interrogate for physiologic and functional importance
3.A.16.	Assess abnormalities of abdominal and cardiac situs/position	
3.A.17.	Assess vascular rings and slings (i.e., double aortic arch, right arch with aberrant subclavian artery, pulmonary sling)	
3.A.18.	Assess systemic venous anomalies (i.e., interrupted inferior vena cava, bilateral superior vena cava)	
3.A.19.	Assess cardiac tumors	
3.A.20.	Assess cor triatriatum	

4.	Postoperative Anatomy 20%	Knowledge and/or skill related to postoperative (surgically corrected/palliated) anatomy
<b>4.A.</b>	<b>Postoperative (surgically corrected/palliated) Anatomy</b>	
4.A.1.	Assess tetralogy of Fallot repair	<p>Know the common palliative and corrective surgical and transcatheter procedures for treatment of congenital heart disease</p> <p>Know how to interrogate postoperative anatomy/physiology from appropriate standard views</p> <p>Know the utility of and be able to optimize two-dimensional imaging, color Doppler, and spectral Doppler in the postoperative assessment of palliated and repaired congenital cardiac anomalies</p> <p>Recognize common postoperative complications</p> <p>Differentiate normal and abnormal findings following surgical repair of common congenital defects</p> <p>Understand normal and abnormal findings following transcatheter balloon angioplasty/valvuloplasty and device closure of atrial, ventricular, and ductal shunts</p> <p>Recognize various types of intracardiac and intravascular devices and be able to interrogate position/location</p>
4.A.2.	Assess valve repair/replacement	
4.A.3.	Assess surgical repair for coarctation of the aorta	
4.A.4.	Assess atrial and ventricular septal defect surgical repairs	
4.A.5.	Assess shunt closure devices (i.e., atrial septal defect, patent ductus arteriosus, and ventricular septal defect devices/coils)	
4.A.6.	Assess Fontan palliation procedure with and without fenestration	
4.A.7.	Assess bidirectional Glenn anastomosis	
4.A.8.	Assess arterial/ atrial switch operation	
4.A.9.	Assess patients after balloon dilation of valves and great vessels	
4.A.10.	Assess modified Blalock-Taussig shunt or central shunt	
4.A.11.	Assess Norwood stage 1 procedure and modifications	
4.A.12.	Assess Ross procedure	
4.A.13.	Assess repair of total/partial anomalous pulmonary venous connection	
4.A.14.	Assess pulmonary artery banding	
4.A.15.	Assess Rastelli repair	
4.A.16.	Assess implantable devices and lines (e.g., catheters, pacemaker/defibrillator leads, cannulae, stents)	
5.	Clinical Standards and Guidelines 8%	Knowledge and/or skill related to clinical standards and guidelines
<b>5.A.</b>	<b>Clinical Standards</b>	
5.A.1.	Obtain a parasternal view (i.e., short axis, long axis, right, high left)	<p>Understand standard echocardiographic views per published guidelines</p> <p>Understand appropriate instrumentation selection and settings for patient age/size</p> <p>Understand basic ultrasound principles for the purposes of image optimization and acquisition</p> <p>Know published guidelines for performance and quantification of a pediatric echocardiogram</p>
5.A.2.	Obtain a suprasternal view (i.e., short axis, long axis)	
5.A.3.	Obtain an apical view (i.e., two-chamber, three-chamber/long axis, four-chamber with apex down, five-chamber)	
5.A.4.	Obtain a subcostal view (i.e., sagittal/long axis, coronal/long axis)	
5.A.5.	Select appropriate settings to optimize image quality and Doppler information	
5.A.6.	Select appropriate transducer(s) for patient size, window, and modality	

5.A.7.	Identify imaging artifacts	
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6.	Measurement Techniques and Quantification 28%	Knowledge and/or skill related to measurement techniques and quantification
<b>6.A.</b>	<b>Measurement Techniques</b>	
6.A.1.	Interrogate the aortic arch using color and spectral Doppler	<p>Understand the use of color and spectral Doppler for quantifying normal and abnormal anatomy and physiology</p> <p>Apply knowledge of two-dimensional imaging, color Doppler, and spectral Doppler quantifications to grade severity of valve dysfunction</p> <p>Know how to use the modified Bernoulli equation to estimate pressure gradients</p> <p>Estimate right ventricular pressure using tricuspid and pulmonary jet velocities and ventricular septal defect gradient</p> <p>Understand the physiologic importance of shunt direction and velocity</p> <p>Understand how to differentiate normal and abnormal pulmonary and systemic venous flow</p> <p>Know how to quantify ventricular size, mass, and function using 2-dimensional imaging and M-mode</p> <p>Understand the importance of the electrocardiogram (ECG) signal and corresponding sonographic findings</p> <p>Understand important diastolic function parameters, flow patterns, and ratios</p> <p>Understand basic echocardiography equations</p>
6.A.2.	Interrogate the atrial and ventricular septum using color Doppler	
6.A.3.	Assess aortic stenosis and grade severity	
6.A.4.	Interrogate the pulmonary venous return using color and spectral Doppler	
6.A.5.	Interrogate the pulmonary artery and branches using color and spectral Doppler	
6.A.6.	Assess right ventricular pressure using tricuspid and pulmonary regurgitant jet velocities	
6.A.7.	Assess pulmonary stenosis and grade severity	
6.A.8.	Interrogate systemic venous return using color and spectral Doppler	
6.A.9.	Assess tricuspid regurgitation and grade severity	
6.A.10.	Assess aortic regurgitation and grade severity	
6.A.11.	Analyze ventricular regional wall motion qualitatively using two-dimensional imaging and/or M-mode	
6.A.12.	Assess mitral regurgitation and grade severity	
6.A.13.	Assess mitral stenosis and grade severity	
6.A.14.	Assess ventricular septal defect gradients	
6.A.15.	Calculate maximal pressure gradients using the modified Bernoulli equation	
6.A.16.	Assess pulmonary regurgitation and grade severity	
6.A.17.	Demonstrate echocardiographic findings at specific times during the electrocardiogram (cardiac) cycle	
6.A.18.	Assess atrial septal shunting gradients	
6.A.19.	Assess tricuspid stenosis and grade severity	
6.A.20.	Measure chamber sizes and wall thickness using M-mode	
6.A.21.	Calculate fractional shortening using M-mode	
6.A.22.	Perform linear measurements using two-dimensional imaging methods	
6.A.23.	Calculate ejection fraction using two-dimensional imaging methods	

6.A.24.	Calculate indices of diastolic function (e.g., E/A ratio, E/E' ratio, mitral valve inflow pattern, pulmonary venous flow pattern)
6.A.25.	Measure chamber sizes and wall thickness using two-dimensional imaging methods