## Pediatric Echocardiography (PE) Tasks

### Anatomy and Physiology 16%

**Normal anatomy and physiology**

- Apply knowledge of closure of the patent foramen ovale after birth
- Apply knowledge of decreasing pulmonary vascular resistance and pressure after birth
- Apply knowledge of ductal closure after birth
- Apply knowledge of normal chamber motion in systole and diastole
- Apply knowledge of normal great vessel flow in systole and diastole
- Apply knowledge of normal pulmonary venous flow in systole and diastole
- Apply knowledge of normal superior vena cava flow in systole and diastole
- Apply knowledge of normal valve flow in systole and diastole
- Apply knowledge of normal valve motion in systole and diastole
- Identify abdominal aorta
- Identify abdominal situs
- Identify all cardiac valves
- Identify all chambers, atrial and ventricular septa, and includes basic embryology
- Identify aortic arch
- Identify aortic arch vessels (e.g., brachiocephalic/strap)
- Identify arch sidedness (e.g., right versus left)
- Identify atrial situs
- Identify azygos vein
- Identify bridging innominate vein
- Identify coronary arteries and proximal branches
- Identify coronary artery origins
- Identify coronary sinus
- Identify inferior vena caval return to the right atrium
- Identify pulmonary artery and branches
- Identify pulmonary venous return to the left atrium
- Identify superior vena caval return to the right atrium
- Identify venous valves (e.g., eustachian and Chiari)

### Organ development

- Apply knowledge of ductal flow pattern before birth
- Apply knowledge of flow patterns across the patent foramen ovale before birth

### Pathology 49%

**Abnormal physiology**

- Analyze left heart inflow and outflow tract obstructions
- Analyze right heart inflow and outflow tract obstructions
- Identify abnormalities associated with constrictive cardiomyopathy
- Identify abnormalities associated with restrictive cardiomyopathy
- Identify anomalous left coronary artery from pulmonary artery trunk
- Identify arch anomalies
- Identify arch anomalies (e.g., aberrant LSCA)
- Identify lesions associated with Holt-Oram syndrome
- Identify lesions associated with tuberous sclerosis
- Identify possible echocardiographic abnormalities associated with chest pain in children
- Identify possible echocardiographic abnormalities associated with hypertension in children
- Identify possible echocardiographic abnormalities associated with syncope in children
- Perform pre-op arterial switch assessment for patients with DTGA
- Perform pre-op TOF assessment
### Congenital anomalies
- Analyze abnormalities of cardiac situs and position
- Analyze atrial and ventricular septal defects
- Analyze atroventricular septal defects
- Analyze various abnormalities of the aortic valve
- Analyze various abnormalities of the mitral valve
- Analyze various abnormalities of the pulmonic valve
- Analyze various abnormalities of the tricuspid valve and includes Ebstein anomaly
- Identify abnormal ventriculoarterial connection (e.g., D-TGV and L-TGV)
- Identify anomalies of pulmonary venous return
- Identify anomalous coronary arteries
- Identify arteriovenous fistulas
- Identify azygos and hemiazygos continuation of the inferior vena cava to the superior vena cava
- Identify cardiac tumors
- Identify conotruncal defects (e.g., TOF, DORV, truncus, and AP window)
- Identify cor triatriatum
- Identify discontinuous pulmonary artery branches
- Identify double aortic arch
- Identify left superior vena cava
- Identify lesions associated with muscular dystrophy
- Identify lesions associated with Shone complex
- Identify patent ductus arteriosus
- Identify pulmonary artery sling

### Postoperative (surgically corrected) anatomy
- Analyze arterial switch repair for transposition of the great arteries
- Analyze atrial switch (Mustard or Senning) repair of transposition of the great arteries
- Analyze Damus-Kaye-Stansel procedure
- Analyze Fontan anastomosis with and without fenestration
- Analyze Glenn anastomosis for univentricular heart
- Analyze modified Blalock-Taussig shunt or central shunt
- Analyze Norwood procedure for hypoplastic left heart syndrome
- Analyze patients after balloon dilation of valves and great vessels
- Analyze patients after stenting of great vessels
- Analyze pulmonary artery banding
- Analyze Rastelli repair for DORV
- Analyze repair of anomalous pulmonary venous connection
- Analyze Ross repair
- Analyze septal defect repairs
- Analyze shunt closure devices
- Analyze surgical repair for coarctation of the aorta
- Analyze tetralogy of Fallot repair
- Analyze valve repair/replacement

### Abnormal pathology (acquired)
- Analyze pericardial effusion and severity
- Identify abnormalities associated with dilated cardiomyopathy
- Identify coronary artery abnormalities associated with Kawasaki disease
- Identify echocardiographic abnormalities associated with cardiac transplantation rejection
- Identify echocardiographic abnormalities associated with hypertrophy cardiomyopathy (IHSS)
- Identify echocardiographic findings associated with post pericardiotomy syndrome
| **Identify echocardiographic findings with paralyzed diaphragm** |
| **Identify echocardiographic findings with pleural effusions** |
| **Identify functional abnormality associated with drug toxicity (e.g., Doxorubicin chemotherapy)** |
| **Identify lesions associated with gestational or maternal diabetes** |
| **Identify lesions associated with systemic lupus** |
| **Identify para-aortic abscess associated with infective endocarditis** |
| **Identify thrombus** |
| **Identify valve regurgitation associated with rheumatic fever** |
| **Identify vegetations associated with infective endocarditis** |

**Genetic disorders**

- Identify lesions associated with DiGeorge syndrome
- Identify lesions associated with Down syndrome
- Identify lesions associated with Friedreich ataxia
- Identify lesions associated with Marfan syndrome
- Identify lesions associated with mitochondrial disease
- Identify lesions associated with Noonan syndrome
- Identify lesions associated with sickle cell anemia
- Identify lesions associated with trisomy 18
- Identify lesions associated with Turner syndrome
- Identify lesions associated with Williams syndrome

**Protocol** 26%

**Clinical standards and guidelines**

- Obtain a high, left parasternal imaging view
- Obtain a parasternal long-axis view
- Obtain a parasternal short-axis view
- Obtain a right parasternal imaging view
- Obtain a subxiphoid coronal imaging view
- Obtain a subxiphoid longitudinal imaging view
- Obtain a suprasternal long-axis view
- Obtain a suprasternal short-axis view
- Obtain an apical 2-chamber view
- Obtain an apical 4-chamber view apex down
- Obtain an apical long-axis/5-chamber view
- Provide technical assistance during intravenous contrast agents

**Measurement techniques**

- Analyze the severity of aortic regurgitation
- Analyze the severity of pulmonary regurgitation
- Analyze ventricular regional wall motion qualitatively
- Assess atrial septal shunting gradients
- Assess right ventricular pressure by tricuspid and pulmonary regurgitant jet velocities
- Assess severity of tricuspid and mitral regurgitation
- Assess the isovolumic contraction and relaxation time
- Assess ventricular septal defect gradients
- Calculate aortic valve area using the continuity equation
- Calculate cardiac output using aortic cross sectional area and Doppler interrogation of flow
- Calculate ejection fraction by 2-D
- Calculate fractional shortening or ejection fraction by M-mode
- Calculate indices of diastolic function (e.g., EA Ratio)
- Calculate left ventricular mass by 2-D
<table>
<thead>
<tr>
<th>Task</th>
<th>Details</th>
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<tbody>
<tr>
<td>Calculate left ventricular mass by M-mode</td>
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<td>Calculate maximal pressure gradients using the expanded Bernoulli</td>
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<tr>
<td>Calculate maximal pressure gradients using the modified Bernoulli</td>
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<td>Calculate mean pressure gradients of valves</td>
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<td>Demonstrate echocardiographic findings at specific times during the</td>
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<td>ECG (cardiac) cycle</td>
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<td>Interrogate aortic arch by color and spectral Doppler</td>
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<td>Interrogate atrial and ventricular septum by color and spectral Doppler</td>
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<td>Interrogate four cardiac valves by color and spectral Doppler</td>
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<td>Interrogate pulmonary artery and branches by color and spectral Doppler</td>
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<td>Interrogate pulmonary venous return by color and spectral Doppler</td>
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<td>Interrogate systemic venous return by color and spectral Doppler</td>
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<td>Measure chamber sizes and wall thickness by 2-D</td>
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<td>Measure chamber sizes and wall thickness by M-mode</td>
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<td>Perform linear measurements by 2-D</td>
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<td>Utilize pressure half-time for severity of aortic regurgitation</td>
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<td>Utilize pressure half-time for severity of mitral stenosis</td>
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<td>Non-sonographic techniques</td>
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<td>Perform M-mode recording of ventricles and cardiac valves</td>
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<tr>
<td><strong>Physics and Instrumentation</strong></td>
<td><strong>2%</strong></td>
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<tr>
<td><strong>Hemodynamics</strong></td>
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<tr>
<td>Assess normal IVC flow in systole and diastole</td>
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<td>Perform all the diastolic function assessments</td>
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<td><strong>Imaging instruments</strong></td>
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<td>Select appropriate settings to optimize image quality and Doppler</td>
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<td>Select appropriate transducer(s) for patient size, window, modality</td>
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<td><strong>Treatment</strong></td>
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<td><strong>Interventional procedures</strong></td>
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<td>Provide technical assistance during echo-guided balloon atrial</td>
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<td>septostomy</td>
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<td>Provide technical assistance during echo-guided pericardiocentesis</td>
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<td>Provide technical assistance during transesophageal echocardiography</td>
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<td><strong>Other</strong></td>
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<td><strong>New technologies</strong></td>
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<tr>
<td>Perform 3-D echocardiography</td>
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<td>Perform Doppler tissue imaging (DTI)</td>
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<td><strong>Miscellaneous</strong></td>
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<tr>
<td>Identify implantable devices</td>
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<td>Identify tip of indwelling catheter</td>
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