

*Effective for residents who enter training on or after July 1, 2020.*

## **DEFINITION**

Pediatric Cardiology is the branch of medicine concerned with the study of congenital cardiac malformations, acquired heart diseases, and abnormalities of the systemic and pulmonary circulations and their prevention, diagnosis and management in the fetus, newborn, child, adolescent, and young adult.

## **PEDIATRIC CARDIOLOGY PRACTICE**

Pediatric cardiologists provide care for patients with a range of conditions affecting the cardiovascular<sup>1</sup> system. These include congenital heart malformations and inherited and acquired conditions from fetal life to young adulthood.

Pediatric cardiologists provide consultation for infants, children, and adolescents who are critically ill and those with emergent, urgent, and non-urgent presentations. They provide ongoing care for patients requiring hospitalization for their cardiac condition, and follow-up, and chronic disease management in the outpatient setting.

Pediatric cardiologists perform and interpret cardiac diagnostic and therapeutic procedures. This includes the interpretation of electrocardiograms (ECGs) and ambulatory ECG monitoring, and the supervision and interpretation of cardiac stress testing. They perform and interpret transthoracic echocardiograms, and interpret the significance of findings in fetal and transesophageal echocardiograms. They interpret and apply the results of cardiac imaging, hemodynamic measurements, and diagnostic angiograms. Pediatric cardiologists interrogate and troubleshoot the functioning of cardiac pacemakers and other implantable cardiac devices.

Pediatric cardiologists consult with other medical specialists, cardiac surgeons, and cardiologists with focused expertise to establish and implement management plans for their patients. The highly specialized care they provide is delivered within an interprofessional team of nurses, diagnostic technicians, and other health care professionals, in consultation

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<sup>1</sup> Throughout this document, the term "cardiovascular" is understood to refer to the cardiovascular system, the peripheral vascular system, the pulmonary circulation, the innervation and/or neurohumoral control and regulation of cardiac function, and hormonal and/or pharmacological influences as these may relate to the cardiovascular system.

with and including patients and their families.<sup>2</sup>

The acuity and complexity of the care needs of patients with pediatric cardiac conditions typically require the support of specialized pediatric services, thus delineating the practice location of pediatric cardiologists.

## ELIGIBILITY REQUIREMENTS TO BEGIN TRAINING

Royal College certification in Pediatrics.

**OR**

Eligibility for the Royal College certification examination in Pediatrics.

**OR**

Registration in a Royal College-accredited residency program in Pediatrics (see requirements for these qualifications).

A maximum of one year of training may be undertaken during concurrent training for certification in Pediatrics.

## ELIGIBILITY REQUIREMENTS FOR CERTIFICATION EXAMINATION<sup>3</sup>

All candidates must be Royal College certified in Pediatrics in order to be eligible to write the Royal College certification examination in Pediatric Cardiology.

## PEDIATRIC CARDIOLOGY COMPETENCIES

### Medical Expert

#### ***Definition:***

*As Medical Experts*, pediatric cardiologists integrate all of the CanMEDS Roles, applying medical knowledge, clinical skills, and professional values in their provision of high-quality and safe patient-centred care. Medical Expert is the central physician Role in the CanMEDS Framework and defines the physician's clinical scope of practice.

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<sup>2</sup> Throughout this document, phrases such as "patients and their families" are intended to include all those who are personally significant to the patient and are concerned with his or her care, including, according to the patient's circumstances, family members, partners, caregivers, legal guardian, and substitute decision-makers.

<sup>3</sup> These eligibility requirements do not apply to Subspecialty Examination Affiliate Program (SEAP) candidates. Please contact the Royal College for information about SEAP.

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**Key and Enabling Competencies: Pediatric cardiologists are able to...**

**1. Practise medicine within their defined scope of practice and expertise**

- 1.1. Demonstrate a commitment to high-quality care of their patients
- 1.2. Integrate the CanMEDS Intrinsic Roles into their practice of Pediatric Cardiology
- 1.3. Apply knowledge of the clinical and biomedical sciences relevant to Pediatric Cardiology
  - 1.3.1. Embryological development of the cardiovascular system and pathogenesis of congenital malformations
  - 1.3.2. Gross anatomy and histology of the cardiovascular system, normal and abnormal
  - 1.3.3. Physiology of cardiac muscle
    - 1.3.3.1. Mechanism underlying the resting membrane potential, conduction of an action potential, and transmission of electrical stimuli through the myocyte
    - 1.3.3.2. Ion transport within the cell
  - 1.3.4. Function and disorders of the pericardium
  - 1.3.5. Disorders of the coronary arteries
  - 1.3.6. Role and influence of heredity and genetic disorders and of biochemical and metabolic disturbances on cardiac development and/or function
  - 1.3.7. Influence of teratogens, such as infection and drugs, on development of the fetal heart
  - 1.3.8. Infectious processes and abnormalities and disorders of the immune system which may influence the cardiovascular system
  - 1.3.9. Effect of exercise on cardiac physiology
  - 1.3.10. Biologic effects of lifestyle on the cardiovascular system, including the role of smoking, lipids, diet, and exercise
  - 1.3.11. Presenting signs and symptoms, natural history, prognosis, genetic implications, and effects on lifestyle of all major structural and acquired heart diseases
    - 1.3.11.1. Congenital heart malformations
      - 1.3.11.1.1. Congenital heart malformations in adults
    - 1.3.11.2. Pericardial disease
    - 1.3.11.3. Cardiomyopathy
    - 1.3.11.4. Rhythm disturbances
    - 1.3.11.5. Heart failure
    - 1.3.11.6. Pulmonary hypertension

- 1.3.12. Effect of diseases of other organ systems on the cardiovascular system
- 1.3.13. Influence of therapies for other medical conditions, such as malignancies, which may have important secondary effects on myocardial function
- 1.3.14. Treatment options for fetal cardiac anomalies
- 1.3.15. Effect of cardiovascular disease and its therapies on neurodevelopment
- 1.3.16. Principles of the diagnosis of myocardial injury, including the diagnostic use and interpretation of cardiac enzyme measurement
- 1.3.17. Basic principles of physics relevant to imaging techniques used in Pediatric Cardiology
  - 1.3.17.1. Echocardiography
  - 1.3.17.2. Magnetic resonance imaging (MRI)
- 1.3.18. Principles of radiation safety and protection in the performance of cardiac diagnostic studies and therapeutic interventions, including safe use for both patient and operator
- 1.3.19. Pharmacology of medications used in the therapy of cardiac disorders
- 1.3.20. Principles of cardiopulmonary resuscitation and advanced pediatric cardiac life support
- 1.3.21. General principles of cardiopulmonary bypass and extracorporeal circulatory support
- 1.3.22. General principles of surgical and interventional management of both congenital and acquired cardiovascular disease
- 1.3.23. Role of cardiac transplantation and myocardial support devices in the treatment of end-stage cardiac failure
- 1.3.24. Indications for the use of pacemakers and implantable cardiac devices
- 1.4. Perform appropriately timed clinical assessments with recommendations that are presented in an organized manner
- 1.5. Carry out professional duties in the face of multiple, competing demands
  - 1.5.1. Prioritize among patients on the basis of the acuity and severity of clinical presentation
- 1.6. Recognize and respond to the complexity, uncertainty, and ambiguity inherent in the practice of Pediatric Cardiology

## **2. Perform a patient-centred clinical assessment and establish a management plan**

- 2.1. Prioritize issues to be addressed in a patient encounter

- 2.2. Elicit a history, perform a physical exam, select appropriate investigations, and interpret their results for the purpose of diagnosis and management, disease prevention, and health promotion
    - 2.2.1. Elicit a history relevant to the cardiac presentation
    - 2.2.2. Elicit a maternal, perinatal, neonatal, and family history, as relevant
    - 2.2.3. Identify the clinical significance of findings on the cardiovascular physical exam
    - 2.2.4. Select and apply results of the following diagnostic investigations
      - 2.2.4.1. Biochemical studies
      - 2.2.4.2. Genetic testing
      - 2.2.4.3. Chest X-ray
      - 2.2.4.4. Advanced cardiac imaging
        - 2.2.4.4.1. Computed tomography (CT)
        - 2.2.4.4.2. Magnetic resonance imaging (MRI)
      - 2.2.4.5. Nuclear imaging
      - 2.2.4.6. Clinical electrophysiology
        - 2.2.4.6.1. Electrocardiography
        - 2.2.4.6.2. Ambulatory ECG monitoring, including Holter and loop recorders
        - 2.2.4.6.3. Exercise (stress) testing
        - 2.2.4.6.4. Interrogation of permanent pacemakers and implanted devices
        - 2.2.4.6.5. Invasive electrophysiology testing
      - 2.2.4.7. Echocardiography
        - 2.2.4.7.1. Transthoracic
        - 2.2.4.7.2. Transesophageal
        - 2.2.4.7.3. Fetal
        - 2.2.4.7.4. Stress
      - 2.2.4.8. Right and left heart catheterization and hemodynamic assessment and angiography
  - 2.3. Establish goals of care in collaboration with patients and their families, which may include slowing disease progression, treating symptoms, achieving cure, improving function, and palliation
    - 2.3.1. Recognize and respond to changes in patient's clinical status that indicate a need to reassess goals of care
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2.3.2. Recognize when ongoing resuscitation efforts are no longer effective and should be discontinued

2.4. Establish a patient-centred management plan for

2.4.1. Critically ill patients, including provision of hemodynamic support, non-invasive ventilation, and monitoring

2.4.2. Hospitalized patients with acute illness, or acute exacerbations of chronic illness

2.4.3. Ambulatory patients with acute presentations and/or chronic cardiac conditions

2.4.4. Monitoring evolution of the cardiac condition

2.4.5. Symptom management

2.4.6. End-of-life care

### **3. Plan and perform procedures and therapies for the purpose of assessment and/or management**

3.1. Determine the most appropriate procedures or therapies

3.1.1. Nutritional therapy: enteral and parenteral

3.1.2. Pharmacotherapy

3.1.3. Invasive electrophysiology studies and interventions

3.1.4. Temporary or permanent pacemakers and other cardiac devices

3.1.5. Catheter based interventions, including balloon atrial septostomy

3.1.6. Surgical intervention

3.1.7. Mechanical circulatory support

3.1.8. Cardiac transplantation

3.1.9. Supportive and end-of-life care

3.2. Obtain and document informed consent, explaining the risks and benefits of, and the rationale for, a proposed procedure or therapy

3.3. Prioritize a procedure or therapy, taking into account clinical urgency and available resources

3.4. Perform diagnostic and therapeutic procedures in a skilful and safe manner, adapting to unanticipated findings or changing clinical circumstances

3.4.1. Provide a diagnostic report

3.4.1.1. Perform and interpret electrocardiograms

3.4.1.2. Interpret ambulatory ECG monitoring, including Holter and loop recorders

3.4.1.3. Supervise and interpret exercise (stress) testing

- 3.4.1.4. Perform and interpret transthoracic echocardiography, including M-mode, 2D, and Doppler
- 3.4.2. Provide interpretation of images and/or hemodynamic measurements
  - 3.4.2.1. Transesophageal echocardiography
  - 3.4.2.2. Right heart catheterization and hemodynamic assessment
  - 3.4.2.3. Left heart catheterization, hemodynamic assessment, coronary angiography, ventriculography, and aortic angiography
- 3.4.3. Identify and diagnose major findings of:
  - 3.4.3.1. Fetal echocardiography
  - 3.4.3.2. Advanced cardiac imaging, including CT and MRI
- 3.4.4. Interrogate pacemakers and implanted cardiac devices
- 3.4.5. Perform therapeutic procedures
  - 3.4.5.1. Direct current (DC) cardioversion and defibrillation
  - 3.4.5.2. Pericardiocentesis

**4. Establish plans for ongoing care and, when appropriate, timely consultation**

- 4.1. Implement a patient-centred care plan that supports ongoing care, follow-up on investigations, response to treatment, and further consultation
  - 4.1.1. Determine the need and appropriate timing of referral to other health care providers
  - 4.1.2. Provide referral for advanced cardiac procedures
  - 4.1.3. Assess the need and timing of transfer to another level of care
  - 4.1.4. Determine the most appropriate medical transport for safe patient transfer to another health care setting

**5. Actively contribute, as an individual and as a member of a team providing care, to the continuous improvement of health care quality and patient safety**

- 5.1. Recognize and respond to harm from health care delivery, including patient safety incidents
- 5.2. Adopt strategies that promote patient safety and address human and system factors

## Communicator

### **Definition:**

As *Communicators*, pediatric cardiologists form relationships with patients and their families that facilitate the gathering and sharing of essential information for effective health care.

### **Key and Enabling Competencies: Pediatric cardiologists are able to...**

#### **1. Establish professional therapeutic relationships with patients and their families**

- 1.1. Communicate using a patient-centred approach that encourages patient and family trust and autonomy and is characterized by empathy, respect, and compassion
- 1.2. Optimize the physical environment for patient and family comfort, dignity, privacy, engagement, and safety
- 1.3. Recognize when the perspectives, values, or biases of patients, patients' families, physicians, or other health care professionals may have an impact on the quality of care, and modify the approach to the patient accordingly
- 1.4. Respond to a patient's non-verbal behaviours to enhance communication
- 1.5. Manage disagreements and emotionally charged conversations
- 1.6. Adapt to the unique needs and preferences of each patient and family to his or her clinical condition and circumstances

#### **2. Elicit and synthesize accurate and relevant information, incorporating the perspectives of patients and their families**

- 2.1. Use patient-centred interviewing skills to effectively gather relevant biomedical and psychosocial information
- 2.2. Provide a clear structure for and manage the flow of an entire patient encounter
- 2.3. Seek and synthesize relevant information from other sources, including the patient's family, with the patient's consent

#### **3. Share health care information and plans with patients and their families**

- 3.1. Share information and explanations that are clear, accurate, and timely, while assessing for patient and family understanding
- 3.2. Disclose harmful patient safety incidents to patients and their families

#### **4. Engage patients and their families in developing plans that reflect the patient's health care needs and goals**

- 4.1. Facilitate discussions with patients and their families in a way that is respectful, non-judgmental, and culturally safe
- 4.2. Assist patients and their families to identify, access, and make use of information and communication technologies to support their care and manage their health



- 4.3. Use communication skills and strategies that help patients and their families make informed decisions regarding their health
- 5. Document and share written and electronic information about the medical encounter to optimize clinical decision-making, patient safety, confidentiality, and privacy**
  - 5.1. Document clinical encounters in an accurate, complete, timely, and accessible manner, in compliance with regulatory and legal requirements
    - 5.1.1. Provide clear, concise, and timely reports of cardiac diagnostic studies
    - 5.1.2. Communicate critical values or unexpected results in a timely manner
  - 5.2. Communicate effectively using a written health record, electronic medical record, or other digital technology
  - 5.3. Share information with patients and others in a manner that enhances understanding and respects patient privacy and confidentiality

## **Collaborator**

### ***Definition:***

As *Collaborators*, pediatric cardiologists work effectively with other health care professionals to provide safe, high-quality patient-centred care.

### ***Key and Enabling Competencies: Pediatric cardiologists are able to...***

- 1. Work effectively with physicians and other colleagues in the health care professions**
  - 1.1. Establish and maintain positive relationships with physicians and other colleagues in the health care professions to support relationship-centred collaborative care
  - 1.2. Negotiate overlapping and shared responsibilities with physicians and other colleagues in the health care professions in episodic and ongoing care
    - 1.2.1. Make effective use of the scope and expertise of other health care professionals
    - 1.2.2. Delegate responsibilities respectfully to members of the interprofessional health care team
  - 1.3. Engage in respectful shared decision-making with physicians and other colleagues in the health care professions
    - 1.3.1. Contribute Pediatric Cardiology expertise to interprofessional teams
    - 1.3.2. Consult with other specialists and colleagues with regard to the patient's medical and surgical issues

- 1.3.3. Consult with other health professionals with regard to the patient's social and/or developmental concerns

**2. Work with physicians and other colleagues in the health care professions to promote understanding, manage differences, and resolve conflicts**

- 2.1. Show respect toward collaborators
- 2.2. Implement strategies to promote understanding, manage differences, and resolve conflict in a manner that supports a collaborative culture
  - 2.2.1. Achieve consensus when there are differences in recommendations provided by other health care professionals

**3. Hand over the care of a patient to another health care professional to facilitate continuity of safe patient care**

- 3.1. Determine when care should be transferred to another physician or health care professional
- 3.2. Demonstrate safe handover of care, using both oral and written communication, during a patient transition to a different health care professional, setting, or stage of care

**Leader**

***Definition:***

As *Leaders*, pediatric cardiologists engage with others to contribute to a vision of a high-quality health care system and take responsibility for the delivery of excellent patient care through their activities as clinicians, administrators, scholars, or teachers.

***Key and Enabling Competencies: Pediatric cardiologists are able to...***

**1. Contribute to the improvement of health care delivery in teams, organizations, and systems**

- 1.1. Apply the science of quality improvement to systems of patient care
- 1.2. Contribute to a culture that promotes patient safety
- 1.3. Analyze patient safety incidents to enhance systems of care
- 1.4. Use health informatics to improve the quality of patient care and optimize patient safety

**2. Engage in the stewardship of health care resources**

- 2.1. Allocate health care resources for optimal patient care
  - 2.1.1. Allocate limited or high cost resources considering utility, efficacy, and fairness

2.2. Apply evidence and management processes to achieve cost-appropriate care

**3. Demonstrate leadership in health care systems**

3.1. Demonstrate leadership skills to enhance health care

3.2. Facilitate change in health care to enhance services and outcomes

**4. Manage career planning, finances, and health human resources in personal practice(s)**

4.1. Set priorities and manage time to integrate practice and personal life

4.2. Manage personal professional practice(s) and career

4.3. Implement processes to ensure personal practice improvement

**Health Advocate**

***Definition:***

As *Health Advocates*, pediatric cardiologists contribute their expertise and influence as they work with communities or patient populations to improve health. They work with those they serve to determine and understand needs, speak on behalf of others when required, and support the mobilization of resources to effect change.

***Key and Enabling Competencies: Pediatric cardiologists are able to...***

**1. Respond to an individual patient's health needs by advocating with the patient within and beyond the clinical environment**

1.1. Work with patients to address determinants of health that affect them and their access to needed health services or resources

1.1.1. Facilitate access to community resources and patient and family support groups to support recovery, coping, and health literacy

1.1.2. Facilitate access to needed health services or resources, including home oxygen, home medication provisions, occupational therapy and physiotherapy, and funding for medications

1.2. Work with patients and their families to increase opportunities to adopt healthy behaviours

1.2.1. Work with patients and families to promote exercise participation suitable for their condition

1.2.2. Counsel patients and families about the importance of dental care

1.2.3. Work with patients and families to increase their understanding of their illness and health care needs

- 1.2.4. Work with patients and families to increase opportunities for autonomy with regards to their care
  - 1.2.5. Promote practices that support optimal neurodevelopment
  - 1.3. Incorporate disease prevention, health promotion, and health surveillance into interactions with individual patients
    - 1.3.1. Recommend screening for relatives of patients with genetic or familial cardiovascular conditions
- 2. Respond to the needs of the communities or populations they serve by advocating with them for system-level change in a socially accountable manner**
- 2.1. Work with a community or population to identify the determinants of health that affect them
  - 2.2. Improve clinical practice by applying a process of continuous quality improvement to disease prevention, health promotion, and health surveillance activities
  - 2.3. Contribute to a process to improve health in the community or population they serve

## Scholar

### **Definition:**

As *Scholars*, pediatric cardiologists demonstrate a lifelong commitment to excellence in practice through continuous learning, and by teaching others, evaluating evidence, and contributing to scholarship.

### **Key and Enabling Competencies: Pediatric cardiologists are able to...**

- 1. Engage in the continuous enhancement of their professional activities through ongoing learning**
  - 1.1. Develop, implement, monitor, and revise a personal learning plan to enhance professional practice
  - 1.2. Identify opportunities for learning and improvement by regularly reflecting on and assessing their performance using various internal and external data sources
  - 1.3. Engage in collaborative learning to continuously improve personal practice and contribute to collective improvements in practice
- 2. Teach students, residents, the public, and other health care professionals**
  - 2.1. Recognize the influence of role-modeling and the impact of the formal, informal, and hidden curriculum on learners
  - 2.2. Promote a safe and respectful learning environment

- 2.3. Ensure patient safety is maintained when learners are involved
- 2.4. Plan and deliver learning activities
- 2.5. Provide feedback to enhance learning and performance
- 2.6. Assess and evaluate learners, teachers, and programs in an educationally appropriate manner

### **3. Integrate best available evidence into practice**

- 3.1. Recognize practice uncertainty and knowledge gaps in clinical and other professional encounters and generate focused questions that can address them
- 3.2. Identify, select, and navigate pre-appraised resources
- 3.3. Critically evaluate the integrity, reliability, and applicability of health-related research and literature
- 3.4. Integrate evidence into decision-making in their practice

### **4. Contribute to the creation and dissemination of knowledge and practices applicable to health**

- 4.1. Demonstrate an understanding of the scientific principles of research and scholarly inquiry and the role of research evidence in health care
- 4.2. Identify ethical principles for research and incorporate them into obtaining informed consent, considering potential harms and benefits, and vulnerable populations
- 4.3. Contribute to the work of a research program
- 4.4. Pose questions amenable to scholarly investigation and select appropriate methods to address them
  - 4.4.1. Execute scholarly work
- 4.5. Summarize and communicate to professional and lay audiences, including patients and their families, the findings of relevant research and scholarly inquiry

## **Professional**

### ***Definition:***

As *Professionals*, pediatric cardiologists are committed to the health and well-being of individual patients and society through ethical practice, high personal standards of behaviour, accountability to the profession and society, physician-led regulation, and maintenance of personal health.

**Key and Enabling Competencies: Pediatric cardiologists are able to...**

**1. Demonstrate a commitment to patients by applying best practices and adhering to high ethical standards**

- 1.1. Exhibit appropriate professional behaviours and relationships in all aspects of practice, demonstrating honesty, integrity, humility, commitment, compassion, respect, altruism, respect for diversity, and maintenance of confidentiality
- 1.2. Demonstrate a commitment to excellence in all aspects of practice
- 1.3. Recognize and respond to ethical issues encountered in practice
- 1.4. Recognize and manage conflicts of interest
- 1.5. Exhibit professional behaviours in the use of technology-enabled communication

**2. Demonstrate a commitment to society by recognizing and responding to societal expectations in health care**

- 2.1. Demonstrate accountability to patients, society, and the profession by responding to societal expectations of physicians
- 2.2. Demonstrate a commitment to patient safety and quality improvement

**3. Demonstrate a commitment to the profession by adhering to standards and participating in physician-led regulation**

- 3.1. Fulfil and adhere to professional and ethical codes, standards of practice, and laws governing practice
  - 3.1.1. Adhere to legal obligations, as well as local policies and procedures relevant to consent and assent
  - 3.1.2. Contribute to public safety through adherence to requirements for mandatory reporting, such as driving restrictions
- 3.2. Recognize and respond to unprofessional and unethical behaviours in physicians and other colleagues in the health care professions
- 3.3. Participate in peer assessment and standard-setting

**4. Demonstrate a commitment to physician health and well-being to foster optimal patient care**

- 4.1. Exhibit self-awareness and manage influences on personal well-being and professional performance
  - 4.1.1. Demonstrate knowledge of occupational hazards in Pediatric Cardiology practice and implement measures to minimize those risks

*PEDIATRIC CARDIOLOGY COMPETENCIES (2020)*

- 4.2. Manage personal and professional demands for a sustainable practice throughout the physician life cycle
- 4.3. Promote a culture that recognizes, supports, and responds effectively to colleagues in need

*This document is to be reviewed by the Specialty Committee in Cardiology by December 2021.*

**APPROVED** – Specialty Standards Review Committee – May 2019