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## Nursing Education for Pediatric Cardiac Care Centers in Developing Countries

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## Summary

Pediatric cardiac programs achieve excellent patient outcomes through the teamwork of a highly capable interdisciplinary team. Nurses are key members of this team and must possess a highly specialized set of skills and knowledge. A comprehensive nursing education program is needed to develop the necessary skills and knowledge to care for critically ill infants and children with heart disease who are often highly unstable, complex, and vulnerable. Orientation of novice nurses or those new to the unit begins with a needs assessment, resulting in a comprehensive plan to achieve the required competencies. Nurse residency programs are one method to provide a comprehensive orientation to novice nurses, using a combination of didactic instruction, precepted clinical experiences, and simulation. An ongoing nursing education plan is also important to refresh skills, especially with high-risk, low-volume procedures, as well as to meet regulatory requirements and develop new skills and knowledge. A key component of the pediatric cardiac nursing education plan is the development of preceptors, who provide hands-on instruction to mentor new nurses to develop the needed skills and knowledge while ensuring that patients receive safe care. Preceptor development can also provide experienced bedside nurses with opportunities to develop their knowledge and to continue professional development, which helps to positively influence job satisfaction. Numerous resources are available to develop a curriculum or the pediatric cardiac program. Evaluation is also an important component of the nursing education program to quantify individual as well as programmatic outcomes.

## Introduction

Nursing care of infants and children with heart disease requires a highly specialized skills and knowledge to provide excellent care. The nurse's knowledge base needs to encompass the physiologic foundations of heart disease in infants and children, its treatment, and co-morbidities associated with heart disease. In addition, the nurse needs to have a broad understanding of psychosocial support, technical skills, leadership and critical thinking skills, teamwork, educational skills, and other areas. The purpose of this paper is to review the components and scope of nursing education specific to the care of pediatric cardiac patients and their families, as well as education evaluative strategies for pediatric cardiac programs in developing countries.

## Characteristics of Critically Ill Pediatric Cardiac Patients

Infants and children affected by congenital heart disease (CHD) or acquired heart disease who require hospitalization and intervention require resource-intensive care. The bedside nurse must be highly skilled in the identification of early or subtle changes of cardiopulmonary instability, which may develop rapidly. In addition, the bedside nurse must be skilled at caring for patients that range in age from minutes after birth to early adulthood. The clinical manifestations of these patients may range from mild symptoms, such as tachypnea and poor feeding due to fatigue, to shock and cardiovascular collapse.

The American Association of Critical Care Nurses developed the Synergy Model for Patient Care in 1996 to conceptualize a nursing practice model, which is well suited to describe the needs of pediatric cardiac patients.<sup>1</sup> The primary assumption of the Synergy Model is that patient and family needs drive the required nursing competencies and skills; when the nurse competencies match the needs of the patient, unit, or system, synergy results and outcomes are optimized.<sup>1</sup> Patient characteristics span the wellness continuum to illness and include resiliency, vulnerability, stability, complexity, resource availability, participation in care and decision-making, and predictability.<sup>1</sup> For example, a neonate with

complex CHD and 22q11 microdeletion who underwent aortopulmonary shunt placement today may present as moderately resilient but highly vulnerable, unstable, complex, and unpredictable due to pulmonary over circulation and extracardiac effects of the genetic condition. The family may have few resources and require assistance to participate in care and decision-making. On the other hand, a five-year-old who underwent closure of a ventricular septal defect 24 hours previously is now on no vasoactive medications, and is breathing spontaneously is also moderately resilient but only moderately vulnerable and highly stable and minimally to moderately complex. Nurse competencies associated with the Synergy model are rated on a scale from one (competent) to five (expert) and include clinical judgement, advocacy and moral agency, caring practices, collaboration, systems thinking, response to diversity, facilitation of learning, and clinical inquiry.<sup>1</sup>

## Preparation for Practice

Nurses constitute the largest group of health-care workers globally.<sup>2</sup> Nursing preparation for clinical practice can vary widely from hospital-based to university-based schools or colleges of nursing. The World Health Organization defined outcome standards for nursing graduates at the entry into clinical practice level, including demonstrating established nursing competencies and understanding the determinants of health, meeting regulatory body standards for professional nursing licensure or registration, being awarded a professional degree, being eligible for entry to advanced education, and that schools employ tracking methods to quantify the success of graduates.<sup>3</sup> It is important to recognize that nursing preparation for entry into clinical practice is at the generalist level. Pediatric-focused education and clinical experience are generally quite limited, and content related to the care of an infant or child with heart disease is even more limited, if present. In the South Pacific nation of Fiji, nurses are educated at one of two schools of nursing; one private and one university-based. Nursing graduates from these programs are overwhelmingly female (95%) and have a median age of 22 years.<sup>4</sup>

## Impact of Nurses in the Pediatric Cardiac Intensive Care Unit

Intensive care, by nature, requires a highly specialized set of skills and knowledge implemented by a well-performing team of highly qualified, interdisciplinary healthcare professionals. A recent paper described the foundation of critical care as “Our machines and potions are impressive, but the most powerful ICU tool is--and likely always will be--skilled bedside staff, working in experienced teams, taught by experts, and supported by skilled colleagues.”<sup>5</sup> Shortages of qualified and experienced nurses affected all countries prior to the COVID-19 pandemic, primarily due to an aging workforce and lack of nursing faculty.<sup>6</sup> The COVID-19 pandemic exacerbated these issues and added new challenges, such as nurses leaving the profession to care for family members, occupational illness, growing levels of burnout and stress, and heavier workloads.<sup>6</sup> Initial and ongoing specialty education then becomes a key factor to attract and retain highly qualified and engaged staff.

Although the entire interdisciplinary team is the vehicle through which excellent patient outcomes are realized, nurses play a uniquely important role. Bedside nurses with more than two years of experience are associated with decreased pediatric cardiac surgical mortality<sup>7</sup> and decreased rate of cardiac arrest in pediatric cardiac patients.<sup>8</sup> In addition, university-based pre-licensure preparation and specialty certification are associated with decreased complications in pediatric cardiac surgical patients.<sup>9</sup>

## New Hire Orientation and Competency Assessment

The foundation of designing a unit orientation program, whether for nurses new to the nursing profession or experienced nurses new to the organization or unit, is a learning needs assessment.<sup>10</sup> The needs assessment helps to develop a personalized educational plan that also helps the new nurse acquire the tools and knowledge to provide excellent care that meets the standards of care for infants and children with heart disease. A self-assessment of skills and knowledge is then followed up with skill validation or

checklists and targeted education.<sup>11</sup> Pediatric cardiac nursing orientation best practices include a variety of learning modalities with specific learning objectives and competencies, including a didactic curriculum, guided clinical experiences with a preceptor, and often simulation.<sup>12,13</sup> Nurse residency programs utilize didactic instruction, precepted clinical experiences, role play, case studies, and simulation to facilitate the transition to clinical practice.<sup>14</sup> In addition to unit-specific clinical content, the nurse residency program includes practice in delegation and prioritization, communication, conflict resolution, critical thinking, leadership, and socialization to the role. Nurse residency programs reduce novice nurse stress, build confidence, improve patient safety, and reduce nursing turnover rates.<sup>14</sup> Nurses who have clinical experience but are new to the unit or organization also benefit from a comprehensive learning needs assessment to acknowledge the skills and experiences they bring with them, and to develop an organized learning plan to achieve unit competencies.

The curriculum for international pediatric cardiac nursing education has been suggested by the Pediatric Cardiac Intensive Care Society (PCICS) and is also available in a virtual platform (see **Table 1**).<sup>14,15</sup> A useful method to divide up the neonatal and pediatric care content is to identify specific problems common to these groups, such as altered cardiac output, heart failure, pulmonary hypertension, cyanosis, malnutrition, single ventricle physiology, delayed neurodevelopment, altered family coping, and then use specific defects and diagnoses to illustrate these concepts. It is also important to include basic and advanced life support and recognition of clinical deterioration as core concepts.

## Preceptors

Successful transition of bedside nurses to the pediatric cardiac care clinical setting requires a capable preceptor to guide the transition to practice. The preceptor has a vital role to ensure that safe patient care is maintained at all times while also guiding the new nurse to acquire new knowledge of unit and organizational policies and procedures, develop new psychomotor skills, and to create and implement an appropriate care plan.<sup>16</sup>

**Table 1.** Suggested Pediatric Cardiac Intensive Care Nursing Curriculum

Cardiac content	Professional practice content
Congenital cardiac defects	Precepting/mentoring
Neonatal cardiac care issues	Professionalism
Pediatric cardiac care issues	Staff support
Acquired heart disease	Moral distress and resilience
Arrhythmia management and pacing	Communication
Mechanical circulatory support	Supporting family coping
Nutrition	Team dynamics
Adult congenital heart disease	
Transition of care	
Pregnancy and heart disease	
Co-morbidities and other considerations	

Adapted from Zyblewski SC, Callow L, Beke DM, et al. Education and Training in Pediatric Cardiac Critical Care: International Perspectives. *World J Pediatr Congenit Heart Surg.* 2019;10(6):769-777. doi:10.1177/2150135119881369 and Virtual Nurse Curriculum Course <https://pcics.org/education/virtual-programs/>

Skilled preceptors are crucial and also help to socialize new nurses to their role and to the unit culture, as well as build the new nurse's confidence and knowledge. In the critical care setting, the preceptor helps the new nurse organize and prioritize in rapidly changing clinical situations, develop clinical reasoning skills, and respond effectively and empathetically to difficult situations such as death or end-of-life.<sup>16</sup>

An experienced and capable bedside nurse interested in becoming a preceptor should receive education on adult learning principles creating a learning plan, orientation expectations and competencies, evaluation strategies, effective communication and giving constructive feedback, and creative ways to work with a variety of learning styles.<sup>17</sup> The preceptor should have support from an experienced nurse leader during the orientation process to problem solve challenging situations with orientees. Preceptors play an important role in transition to clinical practice and should receive commensurate recognition and opportunities for professional development.

## Ongoing Education

Following unit orientation, it is imperative to develop an ongoing education plan for all nursing staff in the pediatric cardiac unit to maintain competency, provide professional development, and keep pace with evidence-based best practices.<sup>11</sup> This plan should encompass applicable regulatory requirements for ongoing skill validation, such as point-of-care testing or basic/advanced

life support. High-risk, low-volume clinical skills should be identified and a plan developed to ensure ongoing competency, as these skills such as renal replacement therapy, are infrequently needed but pose high patient risk because of their complexity.<sup>18</sup> Some effective methods of ongoing skill validation include a Skills Fair day or skill stations set up in the unit, checklist-guided just-in-time education provided by unit clinical leaders, or online educational modules followed by knowledge and/or skill validation.<sup>11,18</sup> The introduction of new equipment or procedures can also use these types of skill and knowledge validation.

Professional development opportunities, such as preceptor training, leadership development, and team building, may be more suited to a more didactic learning strategy, synchronous or asynchronous platforms. Didactic instruction could be made more engaging and meaningful using application strategies such as case studies or role play.

## Simulation

Simulation is an exciting and intense educational strategy that can improve individual skills and knowledge, benefit team performance, patient safety, and decision-making capability.<sup>19</sup> Simulation comes in many forms, from low-fidelity in-situ mock codes using a CPR manikin to specific skill trainers like a model arm to practice intravenous cannulation to high-fidelity complex simulation in a dedicated simulation lab. Low-fi-



delity simulation requires few resources, while a dedicated high-fidelity simulation laboratory may require a high level of resources to implement. Simulation provides training in affective communication skills as well as psychomotor skills, and can be adapted for an individual or for entire teams. Given that highly functioning teams are foundational to achieving excellent outcomes in the care of infants and children with heart disease, simulation should be considered an important component of nursing education, even if resources are limited to low-fidelity simulation.

## Resources

As many wise people have said, trying to reinvent the wheel is foolish. Resources to develop a nursing curriculum for pediatric cardiac centers, in whole or in part, are readily available on the Internet, with zero to minimal cost. Examples of some of these resources are listed in **Table 2**. Other online learning opportunities may include university-based courses or specialty confer-

ences with remote attendance options; these generally require registration fees. The availability of virtual learning options has greatly expanded in the post-COVID pandemic era, and this type of learning can be cost-effective and high quality, especially if paired with follow-up application in a clinical setting.<sup>20</sup>

## Program Evaluation

The nursing educational program needs to be evaluated regularly, to quantify outcomes on an individual as well as program level. This important step is crucial to identify opportunities for improvement as well as needed revisions and updating. Different types of evaluation include formative, summative, process, outcome, and impact.<sup>21</sup> Examples of each type of evaluation, specific to nursing education, are shown in **Table 3**. Evaluation of the nursing education program is vital to ease the transition to practice and improve nurse retention, which is especially important in this global shortage of skilled and

**Table 2.** Online Resources for Pediatric Cardiac Nursing Education

Website	Developer	Content Examples	Availability
<a href="https://www.heartuniversity.org/">https://www.heartuniversity.org/</a>	Cincinnati Children's Hospital	Pediatric and adult CHD webinars, conference proceedings, grand rounds, lectures and classes, and guidelines.	Free, some content requires registration for a free user account
<a href="https://pcics.org/education/nursing-resources/">https://pcics.org/education/nursing-resources/</a>	Pediatric Cardiac Intensive Care Society	Specific CHD lesions, postoperative care, nutrition, arrhythmias, pacemakers. Special interest groups are available to members. Virtual complete nursing curriculum available, but requires a fee.	Most resources are free. Individual or institutional membership fees based on country of residence.
<a href="https://learn.openpediatrics.org/learn">https://learn.openpediatrics.org/learn</a>	Boston Children's Hospital, Harvard Medical School	Extensive catalog of cardiovascular and critical care content covering assessment, specific types of CHD, postoperative care, management, procedures, hemodynamic monitoring, mechanical simulation, etc.	Registration required for free user account.

**Table 3.** Types of Evaluation in Nursing Education

Evaluation Type	Examples
Formative	Needs assessment (both individual and unit-wide), progress meetings and feedback, stakeholder analysis, SWOT (Strengths, weaknesses, opportunities, threats) analysis.
Summative	Satisfaction surveys, content examination scores, participant evaluation surveys, observations of patient care, patient/parent satisfaction surveys.
Process	Does the program meet its goals and objectives? Is it efficient? Are the learning methods feasible?
Outcome	Performance evaluations, completion of skills checklists and required competencies, chart audits, nurse-sensitive indicators (falls, pressure injuries, hospital-acquired infections).
Impact	Cost/benefit analysis, nursing retention, nurse vacancy rate, mortality, complications.

proficient frontline nurses.<sup>22</sup> Nursing education programs also provide career development and advancement opportunities for preceptors and nurse educators, which may positively influence nurse retention.<sup>23</sup>

## Conclusions

Skilled and knowledgeable bedside nurses are the cornerstone of the interdisciplinary healthcare team and make significant contributions to excellent patient outcomes. Nursing education is the key to developing nurses as bedside experts and team contributors. Educational strategies begin with the transition to practice for novice nurses, continue with ongoing professional and career development, and incorporate multimodal, evidence-based learning strategies and evaluative methods.

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## Conflict of Interest

None declared

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