Providing appropriate education for nurses working in the pediatric intensive care unit (PICU) to develop and update the skill sets and knowledge required to care for infants and children with congenital heart disease (CHD) is a challenge. We provide care to children with a variety of congenital heart defects that require medical care and surgical corrections. In the extreme circumstance, we provide extracorporeal membrane oxygenation to those children who require extracardiac support postoperatively. Our program deals with a mean of about 150 cases annually that require surgical correction, in addition to the medically managed patients with CHD.

The hospital-based simulation center opened in 2010. It provides high-fidelity simulation to enhance current medical and nursing education. Patient scenarios are created on the basis of real patient cases, maintaining the realistic details of the disease and injury processes essential to provide the pertinent learning points of each case. Shortly after the simulation center opened, the PICU educator inquired about the process to provide PICU nurses an opportunity to learn about pediatric open heart surgery patients at the simulation center. The inherent challenge within our PICU is that we have 32 nurses with various skills sets and experiences who must be able to provide care for all patients within our unit, including children with CHD.

At that time, 7 PICU nurses were ready to learn how to provide nursing care to children who have undergone open heart surgery. This state of readiness is detailed later. A classroom format was used to present the material, which addressed identification of defects, along with medical and nursing management. This classroom training was followed by a 4-hour simulation session, wherein these nurses participated in 2 patient scenarios. Clinical objectives (Table 1) were reviewed and reinforced to define what needed to be learned and to ensure that learning occurred. Following this simulation training, each nurse was assigned to admit a pediatric open heart patient with an experienced nurse present to reinforce the prior learning.

Overview of the Literature

Few publications have addressed the process of training PICU nurses on how to care for pediatric open heart surgery patients in a simulation laboratory. Donoghue and colleagues\(^1\) used a high-fidelity simulation laboratory for Pediatric Advanced Life Support training of pediatric residents. Anesthesiologists have been using simulation laboratories to train their residents for a number of years, and published reports\(^2\) validate the positive learning outcomes within that environment. Kane and colleagues\(^3\)
explained the process of preparing and implementing an educational activity addressing pediatric codes for the pediatric cardiac ICU staff that included the simulation laboratory. The PICU staff’s levels of knowledge, skill, and comfort with resuscitation improved significantly after the simulation education was completed. Certainly, learning does occur within the simulation environment. Those participants surveyed agreed that the experience did provide an opportunity to learn.1,2,4,6 Both medical and nursing arenas have begun to integrate this option into training in an effort to better mimic real-life clinical experiences.
In a different arena, review of rapid response data led to concern about the deterioration of patients’ respiratory status among staff and managers on step-down cardiac units. Need for nurse education was identified by Disher and colleagues, which led to an evaluation of the process and identification of the need for specific nurse education. They provided a unit-based educational pilot study to address this issue. Knowledge deficits were identified, education through simulation was provided, and follow-up was evaluated. Nurses’ knowledge and self-confidence improved significantly from before to after simulation education. The study by Disher et al is another example of observing the participants’ own perceived self-evaluations.

In our project, our initial evaluations relied on anecdotal clinical reports after the simulation experience. Over the course of 3 years, we were also observing participants for their perceived knowledge and self-confidence before and after the simulations.

**Developing a Simulation Educational Program**

The educational process within our PICU is representative of our unique population and staffing. Our 10-bed PICU resides within our 32-bed special care unit. Because our pediatric population is so varied in terms of diagnoses and census, when there are empty pediatric beds, we admit adults as well. Therefore, our PICU nurses provide critical care nursing to all populations. Although each nurse who is new to our unit arrives with variable knowledge and skill sets, the general expectation of competency is that each nurse learn to care for the adult patients first. Once that competency is established, then the nurse is oriented to the pediatric population, starting with the 10- to 18-year-olds, then the infants through 9-year-olds. Generally, within 6 to 12 months, new nurses are oriented to the CHD patients, as described here. All new nurses are evaluated for their previous clinical skills and given appropriate patient assignments. Those nurses with pediatric skills who are not familiar with the adult population will be trained to provide care for adults, so that they can meet our expectation that we all provide care to all populations within our unit.

Education within our PICU is individualized for each new nurse, with the ultimate intention that we provide care for all patient populations. Our 10-bed PICU has a staff of 32 nurses. Given this, the CHD educational program is taught annually, with a varying attendance of 3 to 7 nurses. Although our focus is to educate the PICU nurses to manage these patients, nurses from the neonatal ICU and pediatric care areas also are invited to these classes. The neonatal ICU sometimes provides preoperative nursing care of critically ill patients, and the pediatric care area manages children with CHD once they are transferred from the PICU. Therefore, a cohesive transition is the goal, as the nursing care for children recovering from open heart surgery is sometimes managed on different nursing units.

To meet the educational needs of our staff, a classroom format was used to teach CHD embryology, medical and surgical interventions, and appropriate postoperative nursing care. Appropriate assessments and treatments of potential complications were included. Once the classroom training was completed, the participants were scheduled to attend the simulation component.

The PICU educator and 3 PICU nurses each with more than 20 years of PICU experience met to develop clinical scenarios. These scenarios were based on typical postoperative cardiac patients. The first 2 scenarios we developed met the initial clinical expectations of this group: the ability to admit a postoperative cardiothoracic patient from the operating room, and the ability to identify noncoagulopathic bleeding postoperatively that requires return to the operating room (Table 1). Simulation training of these experienced PICU nurses was provided by the simulation nurse educator to facilitate the development of the case scenarios.

**Simulation Experience**

The simulation experience is described in Table 2. Participants were preselected for each scenario, depending on the composition of the scenario and the individual strengths and learning needs of each PICU nurse. The learning needs assessment was
an informal evaluation based on each learner nurse’s previous clinical experiences and current clinical competence at the bedside. As the simulation day unfolded, participants were escorted from the classroom to the simulation ICU room and back, in an effort to maintain a mindset of the scenario and learning process as it evolved and to avoid distractions.

The simulation staff used a Gaumard newborn simulator for these 2 scenarios. Whenever possible, exact equipment that is used in the PICU was used on the mannequin, such as the same blood pressure cuffs, intravenous equipment, ventilators, and the like. The mannequin’s chest was prepared with similar surgical equipment to replicate the post-operative dressing placed by the surgeon, including mediastinal chest tubes.

After a number of the PICU nursing staff were invited to the simulation laboratory to experience these 2 scenarios, we created more complex scenarios for our more experienced PICU nursing staff. In the past 3 years, most nurses on our staff have attended the 6 scenarios that we have created thus far.

### Simulation Scenarios

Two simulation scenarios are described in Table 1. Identified objectives to be met are based on the American Association of Critical-Care Nurses practice standards for the pediatric open heart population. Once the stated objectives had been reached, the scenario was ended. Everyone (participants and nurses providing the simulation experience) attended the debriefing immediately after each scenario. The debriefing is an opportunity to learn by reflecting on the scenario. A review of the participants’ perceptions of the scenario, any discrepancies from the actual scenario, and the learning objectives are discussed. The intention is for sharing of knowledge, learning, and clarification of questions. Simulation literature consistently reiterates how important it is that this process provide a safe environment to learn, seek clarification, and practice in a nonjudgmental arena. The intention is that participant learners will always feel welcome within this learning environment without feeling judged. Given the novelty of this learning experience for many staff, the wish is that learning be positive, not punitive. The evaluation tool included in Table 1 was used to determine whether or not the stated objectives were met. We found this approach to be clear and concise for everyone.

<table>
<thead>
<tr>
<th>Agenda of simulation laboratory</th>
<th>Action by educator and participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orientation to simulation facility (15 minutes)</td>
<td>Participants were greeted upon arrival</td>
</tr>
<tr>
<td>• Limited tour of facility</td>
<td>Tour of facility was provided</td>
</tr>
<tr>
<td>• Introduction to high-fidelity mannequins</td>
<td>Participants changed into scrubs (standard uniforms)</td>
</tr>
<tr>
<td></td>
<td>Simulation technicians presented mannequins and demonstrated high-fidelity performance</td>
</tr>
<tr>
<td>Participant groups identified (3 minutes)</td>
<td>Participants were separated into preassigned groups</td>
</tr>
<tr>
<td>Scenario introduction (5 minutes)</td>
<td>Those not participating were able to view the scenario, which facilitated participation in debriefings</td>
</tr>
<tr>
<td>Participants (10 minutes)</td>
<td>Educator:</td>
</tr>
<tr>
<td>• Scenario participant</td>
<td>• Escorted participants to simulation room</td>
</tr>
<tr>
<td>• Scenario observer (watched scenario via live video feed)</td>
<td>• Presented a brief patient report</td>
</tr>
<tr>
<td></td>
<td>• Encouraged participants to assess patient</td>
</tr>
<tr>
<td>Scenario initiated (30 minutes)</td>
<td>Educators facilitating scenarios escorted participants back to classroom in an effort to suspend disbelief</td>
</tr>
<tr>
<td>Scenario completion (2 minutes)</td>
<td>Educator-facilitated process</td>
</tr>
</tbody>
</table>
Nurse Participants’ Experiences

The simulation allowed the PICU nurses an opportunity to discuss any concerns or fears they had. As the scenarios evolved, each participant was able to ask any question. Reinforcement was provided as indicated for each action taken by the nurses. As well, it allowed them to begin developing some “muscle memory” required to build a skill set foundation. The skill sets needed to react in critical and stressful situations correctly are developed through practiced experiences such as those described in this article. The nurse’s experiences were positive, and they stated that they would return to the simulation center for more case scenarios. They appreciated the safe environment in which to learn and practice. Collectively this group of nurses stated that they now have a real sense of what to expect and what is expected of them. Months later, some of the nurse participants expressed appreciation for this simulation experience. They explained that the simulation cases reinforced what they had learned in the classes. One nurse stated, “I knew what to do when I admitted my first open heart patient.” Another nurse stated “I was not frightened when I had to call the cardiac surgeon with my patient’s labs and vital signs.” We used the simulation laboratory to facilitate an opportunity to practice with a new syringe pump that had been recently purchased and that the nursing staff had received in-service training to use. An experienced nurse had participated in a complex scenario where the patient needed prostaglandins to be initiated. The learning process of doing this on a new intravenous syringe pump during a simulation scenario proved very beneficial. A few weeks later, this same experienced nurse stated that she had admitted an infant with a very similar clinical course as the simulation case in which she had participated and that she was able to start the prostaglandins very efficiently as a direct result of her learning experience during the simulation scenario.

Discussion

Creating the scenarios was both exciting and challenging. In general, we used lived experiences in the PICU and adapted them for the simulation laboratory, while keeping the nuances of the scenario as realistic as possible. The PICU educator and 3 very experienced PICU staff nurses created these scenarios, learned the process of simulation, and provided this experience to the nurses who were learning to care for pediatric open heart surgery patients. The learners expressed great apprehension in anticipation of the simulation experience. The simulation laboratory was very new to the hospital. In fact, we were the first group of nurses to use this avenue to provide education to staff nurses. After the experience, all 7 nurse participants stated that this was the most realistic way to learn patient care and that they most definitely believed that they could more readily admit a pediatric open heart patient to the PICU and that they could identify a bleeding pediatric open heart patient and confidently provide care, including returning the patient to the operating room. Because our PICU is small, this education is provided only annually. As well, our patient volume is low, with a mean of 150 surgical cases annually. Because these factors truly limit our ability to conduct a quantitative study, we elected for this initial exploratory and descriptive study. Anecdotal accounts have provided feedback on the value of this new learning experience.

This venture has led to the creation of more complicated case scenarios. In an effort to provide time-efficient learning, the 3 classes have been converted into voice-over PowerPoint learning modules, to be reviewed independently. Following this, we provide a 3-hour review class, which entails review of the material, and case reviews. We have developed a number of other pediatric open heart scenarios for our PICU nurses. As our PICU nursing staff continues to change, our educational process to facilitate learning about this complex population of patients will continue to evolve. Recently the institutional review board granted approval so that we can use a survey questionnaire for simulation participants to identify their level of perceived skill, knowledge, and comfort when caring for a variety of patient populations. This survey will be used with future nurse learners.
The simulation center has provided another dimension to the ever-challenging process of educating nursing staff about such a diverse PICU population. This pediatric open heart simulation education program has provided a cornerstone for the development of future simulation-based nursing education at this tertiary care facility.

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References

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