A High-Fidelity Simulation Boot Camp for Pediatric Cardiac Critical Care Nurse Practitioners

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Abstract

Context: Failure to recognize and manage complications in a postoperative child with congenital heart disease (CHD) can be fatal. The goal in managing these complications is to quickly identify and treat an acute event and prevent morbidity and mortality. Growing numbers of pediatric nurse practitioners (PNPs) are being utilized as front line providers in pediatric intensive care units (PICUs), with an increased responsibility for management of these complex patients; however, experience of PNPs in this setting is variable and little research has been conducted on the post-graduate educational programs used to train such providers.

Description: This multi-centered, prospective pre/post interventional simulation pilot study was conducted at The Johns Hopkins Medicine Simulation Center and was designed for the advanced practice nurse. The curriculum was mixed instruction of didactic, case studies, and hands-on high-fidelity simulation, which were based on high complexity cases and the eight CHD benchmark procedures. An expert opinion survey was conducted to guide the development of the curriculum. The aims of this project include: (1) increase the PNPs knowledge of the etiology of low cardiac output (2) reduce the time to identify and implement appropriate treatment for an acute deterioration through the use of high-fidelity simulation scenarios; (3) evaluate the PNPs confidence and satisfaction with the simulation based training.

Evaluation: There were 30 participants from 13 cardiac centers from the US and Canada. Knowledge was assessed with a pre/post- test format (max score 100). A paired-sample t-test was conducted and a statistically significant increase in the post-test scores was detected (pre-test: 67.8 ± 14.3; post-test: 56.0 ± 15.8; p < 0.0001). Confidence and satisfaction was evaluated utilizing an instrument developed by the NLN. Participants responded to questions using a five-point Likert scale, with higher scores indicating higher levels of quality. The participants reported a high level of satisfaction (M= 4.68, SD 0.30) and confidence (M=4.75, SD 0.31) with the simulation experience. Time to recognize and treat an acute deterioration was evaluated utilizing selected high-fidelity simulation. There was an overall improvement in median time, but statistical significance was not achieved based on the small number of groups. The proportion of tasks completed was statistically significant.

Discussion: Simulation boot camps have been conducted for physician training and have been shown to be an effective strategy for educating critical care providers. This was a novel approach to educate nurse practitioners from multiple academic settings in the high complexity cases, we employed Rapid Cycle Deliberate Practice (RCDP) for selected high-fidelity simulation scenarios. There was an overall improvement in knowledge and the PNPs reported satisfaction and confidence in the simulation experience.

Objectives

The aims of the project include:

1. Increase the PNPs knowledge of the etiology of low cardiac output in the postoperative CHD patient.
2. Reduce the time to identify and implement appropriate treatment (performance) for an acute deterioration through the use of high-fidelity simulation scenarios.
3. Evaluate the PNPs confidence and satisfaction with the simulation based training.

Methods

Curriculum Development

To determine the best management practices and develop the curriculum for the boot camp, we created a survey to gain expert opinion. A secondary IRB approval was obtained from Johns Hopkins, and a web-based survey was created. We identified a subset of experts from the U.S. who were registered with the Pediatric Cardiac Intensive Care Society and were from top-performing centers according to the US News and World Report. The aim of this secondary study was to delineate consensus of expert opinion on key teaching points with regard to the early identification and management of lesion-specific complications in the postoperative CHD patient.

The curriculum was a mixture of didactic instruction, case studies, and hands-on high-fidelity simulations, which were based on high complexity cases, the eight CHD benchmark procedures, and a mix of lesion-specific postoperative complications. The boot camp took place over one day and included 8 hours of training in total. The participants were divided into smaller groups of 3-6 for individualized instruction. The participants completed simulation scenarios, a debriefing, lecture, case study lecture, and high-fidelity simulation scenarios.

Measurement

Knowledge: Pre-test/post-test format composed of multiple-choice questions (MCQ).

Performance: Evaluation of 1* to 3** RCDP simulation scenario.

Confidence and Satisfaction: Evaluated by using a validated tool.

Results

Knowledge: Post-test mean scores improved by 19%. A paired-sample t-test revealed a statistically significant increase in the post-test scores (pre-test: 36.8 ± 14.3; post-test: 56.0 ± 15.8; p < 0.0001). Performance: A Wilcoxon signed rank test was used to assess time differences between the first and last 5-minute simulation and the last 5-minute evaluation. We found no statistical difference in the median times to task related to the small number of groups. However, median times to implement appropriate intervention improved across the scenarios. Notably, there was a significant increase in the proportion of clinically time sensitive tasks completed within five minutes, [P<: 60% (30/50) vs 86% (43/50), p=0.003]. After our simulation curriculum with RCDP methodology, a significantly higher proportion of participants met the goals than had at baseline testing.

Confidence: We evaluated the participants’ confidence and satisfaction after the education session by using the Student Satisfaction and Self-Confidence in Learning tool. This validated, 13-item instrument was “designed to measure student satisfaction (five items) with the simulation activity and self-confidence in learning (eight items) using a five-point Likert scale’’(20), in which higher scores indicate higher levels of quality. Results are shown as mean ± standard deviation. The participants reported a high level of satisfaction (4.7 ± 0.30) and confidence (4.6 ± 0.3) with the simulation experience.

Conclusions

This novel pediatric cardiac nurse practitioner-specific boot camp utilized a curriculum that was based on expert opinion and supporting literature. The outcomes were positive, showing an overall increase in knowledge and self-reported confidence and satisfaction with the educational experience. Performance time in the RCDP simulation scenarios improved from the first to the last 5-minute implementation. However, our pilot study was not powered to detect statistical significance for median time to accomplish a priori-determined vital tasks. The overall expert-designated tasks-to-complete improved from the first to the last RCDP trial. Therefore, RCDP may be an effective educational method for training PNPs in high-risk, time-task scenarios.

Simulation boot camps have been conducted for physician training and have been shown to be an effective strategy for educating critical care providers in high-stakes scenarios. This pilot, cardiac-specific, simulation-based NPN training program provided multimodal education for rapid identification and management of the most common pediatric postoperative cardiac emergencies, for which improvement in time-to-task can be life-saving. This program was feasible and well received by the participants. With the increased push for advanced practice nurses in the critical care setting, simulation-based education training is an effective tool for teaching complicated skills. Additional understanding of the known complications associated with CHD surgery and methods to effectively teach critical care providers on the early recognition and treatment of these acute events might help reduce FTR in this vulnerable population. Future simulation training for PNPs should include traditional simulation methods and RCDP education as a means to teach high-risk scenarios in which time to recognize and treat a complication or change is critical.

References

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