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Featured Article

High-Fidelity Simulation Effect on Nurses' Identification of Deteriorating Pediatric Patients

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KEYWORDS

pediatric;
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high-fidelity simulation;
deterioration;
patient outcomes

Abstract

Background: We evaluated the effects of high-fidelity pediatric simulation experiences on nurses' early recognition of deterioration and patient outcomes.

Method: Pediatric nurses (n = 83) participated in a 12-month quality improvement project.

Results: Among 92 rapid response team/Code Blue events, 72.2% resulted in pediatric intensive care unit transfers; 84.8% of nurses' prior Pediatric Early Warning Score scores were accurate. The number of simulations that nurses completed during the study was not related to Pediatric Early Warning Score accuracy or pediatric intensive care unit transfer rates.

Conclusions: Although simulations did not affect these outcomes, this is the first study to link pediatric high-fidelity simulation experiences to individual nurses' clinical decision-making practices and patient outcomes.

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When deterioration of hospitalized pediatric patients goes unrecognized and untreated, these "failure to rescue" events may result in respiratory or cardiopulmonary arrest. Nurses' early recognition of their patients' signs and symptoms of deterioration is critical to prevention of negative patient outcomes. Studies showed that cardiopulmonary arrest in pediatric patients ranged from 0.7% to 3% per 1,000 patient days, with a survival-to-discharge rate of

15%-27% (Brilli et al., 2007; Gupta et al., 2014; Jindal, Jayashree, & Singhi, 2011; Van Voorhis & Willis, 2009). The leading causes of cardiopulmonary arrest in pediatric patients are respiratory failure and shock (Jindal et al., 2011). Underlying causes include respiratory compromise, hypovolemia from trauma or illnesses such as gastroenteritis, severe sepsis, and shock from infectious agents. Cardiac arrest occurs within 5 minutes of complete anoxia. The Pediatric Early Warning Score (PEWS) was developed to detect early indications of deterioration in pediatric patients and consists of three components: behavior, cardiovascular, and respiratory status. The higher the score, the higher the

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risk of deterioration (Haines, Perrott, & Weir, 2006; McCabe, Duncan, & Heward, 2009; Monaghan, 2005; Tucker, Brewer, Baker, Demeritt, & Vossmeier, 2009).

Key Points

- Early recognition of pediatric patient signs and symptoms of deterioration is critical to prevention of negative patient outcomes.
- Pediatric nurses (n = 83) participated in a 12 month quality improvement project.
- This is the first project to link pediatric high-fidelity simulation experiences to individual nurses' clinical decision-making practices and patient outcomes.

Literature Review

Early Recognition of Deterioration

Early recognition of deterioration and rapid intervention can prevent progression to cardiopulmonary arrest in hospitalized pediatric patients and minimize transfers to pediatric intensive care units (PICU) (Akre et al., 2010; Bonafide et al., 2012; Brilli et al., 2007). Critical deterioration as defined by Bonafide et al. (2012) is a transfer to PICU, followed by noninvasive or invasive mechanical ventilation or vasopressor infusion within 12 hours. In that study, critical deterioration

occurred eight times more often than respiratory and cardiac arrest and was associated with a 13-fold increased risk of in-hospital death. Hospitals have organized teams of specialists to respond rapidly to the bedside of deteriorating patients to provide additional assessment and intervention, with the goal of preventing further deterioration. These teams typically include a pediatric intensive care nurse, a respiratory therapist, and a pediatric intensivist (Akre et al., 2010; Bonafide et al., 2012; Brilli et al., 2007; Jindal et al., 2011; Sharek et al., 2007; Tibballs & Kinney, 2009). Brilli et al. (2007) observed that 50% of medical emergency team activations during a 12-month period resulted in PICU transfers. Although cardiopulmonary arrests were uncommon, other researchers noted that when they did occur, the outcomes were poor, with only 15%-36% of children surviving to discharge (Nadkarni et al., 2006).

High-Fidelity Human Patient Simulation Training

High-fidelity (HF) simulations create a realistic environment for health care professionals to "practice" high-risk patient care in a low-risk situation. Scenarios are designed to meet specific learning objectives including skill and assessment training, communication and teamwork practice, and knowledge acquisition of specific pediatric conditions (Beyea, Slattery, & von Reyn, 2010). Six studies

showed that HF human patient simulations were effective teaching strategies that improved nurses' knowledge retention from before to immediately after simulation experiences (Bultas, Hassler, Ercole, & Rea, 2014; Disher et al., 2014; Harvey, Echols, Clark, & Lee et al., 2014; Schubert, 2012; Straka, Burkett, Capan, & Eswein, 2012). Nurses' (n = 23) self-confidence in managing patients with cardiovascular deterioration improved significantly from before to after simulation experiences (Disher et al., 2014), and 260 novice nurses in a 10-week nurse residency program including several HF simulations significantly increased their self-reported confidence, competence, and readiness for entry into practice (Beyea et al., 2010). In a study in which 39 nurses participated in either an HF simulation-based scenario or case study review, only the simulation group significantly improved their confidence levels, teamwork skills, and clinical skills (Harvey, Echols, Clark, & Lee, 2014). Another study demonstrated (N = 494) nurses' self-reported improvement in their ability to manage critical patients before and immediately after simulation experiences (Famolare & Romano, 2013). Two studies used more objective measures of the effectiveness of simulations. For example, nurses (n = 97) who received HF simulation cases demonstrated more accurate judgments of patients at risk (40% vs. 36%, $p < .001$) compared with paper-based cases, although the percentage for both groups was quite low (Thompson, Yang, & Crouch, 2012). Behavioral check-off tools were used to evaluate 33 nurse performances during simulations at baseline and after 6 months; significant improvement was observed for a respiratory scenario but not for a circulatory scenario (Bultas et al., 2014).

Research on the effectiveness of HF simulation experiences has focused primarily on nurses' perceptions of knowledge attainment, confidence, and competency in skill performance. It is widely known that self-reported confidence and competence do not always translate to actual performance in clinical situations or patient outcomes (Bultas et al., 2014; Disher et al., 2014; Elfrink-Cordi, Leighton, Ryan-Wenger, Doyle, & Ravert, 2012). No studies have linked individual nurses' HF simulation experiences to the accuracy of their clinical decision-making and patient outcomes when their own patient's condition deteriorates.

The purpose of this 12-month quality improvement project was to (a) determine the extent to which nurses' participation in pediatric HF pediatric simulations improved the accuracy of their clinical judgments related to recognition of deterioration in pediatric patients and (b) improve patient outcomes after an emergency response team or Code Blue alert was activated. We also examined the contribution of variables known to improve clinical judgment and patient outcomes, that is, educational level, experience in caring for patients whose conditions were deteriorating, self-reported confidence and competence in the management of these patients, and critical thinking skills.

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