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Original article

The effectiveness of and satisfaction with high-fidelity simulation to teach cardiac surgical resuscitation skills to nurses

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ABSTRACT

Background: There are few reports of the effectiveness or satisfaction with simulation to learn cardiac surgical resuscitation skills.
Objectives: To test the effect of simulation on the self-confidence of nurses to perform cardiac surgical resuscitation simulation and nurses' satisfaction with the simulation experience.
Methods: A convenience sample of sixty nurses rated their self-confidence to perform cardiac surgical resuscitation skills before and after two simulations. Simulation performance was assessed. Subjects completed the Satisfaction with Simulation Experience scale and demographics.
Results: Self-confidence scores to perform all cardiac surgical skills as measured by paired *t*-tests were significantly increased after the simulation (d = −0.50 to 1.78). Self-confidence and cardiac surgical work experience were not correlated with time to performance. Total satisfaction scores were high (mean 80.2, SD 1.06) indicating satisfaction with the simulation. There was no correlation of the satisfaction scores with cardiac surgical work experience ($\tau = -0.05$, ns).
Conclusion: Self-confidence scores to perform cardiac surgical resuscitation procedures were higher after the simulation. Nurses were highly satisfied with the simulation experience.

Background

This section needs a heading, I suggest that the title background is move from below to hereThe incidence of cardiac arrest after heart surgery is approximately 1.6–5.2% (Guney et al., 2009; Lapar et al., 2014) with a 0.5% incidence of emergency re-sternotomy (Adam et al., 2009). Survival to hospital discharge is 37–50% (Maccaroni et al., 2013; Ortmann et al., 2011). Learning the skills involved in cardiac surgical (CS) resuscitation is an important for nurses working in CS units.

The American Heart Association (AHA) (Wahr et al., 2013) recommends regular scenario training for significant and rare non-routine events (Class I [evidence of general agreement that a recommendation is useful and effective]; level of evidence B [data derived from a single randomized controlled trial or nonrandomized studies]). The common reasons for arrest after cardiac surgery (CS) are pulseless electrical activity (PEA), asystole and ventricular fibrillation (VF)/ventricular tachycardia (VT); (Maccaroni et al., 2013) Ortmann et al. (2011) and the chest may be reopened at the bedside in unstable patients. Therefore these are critical scenarios to practice with high fidelity simulation (HFS).

Cook et al. (2011) conducted a systematic review and meta-analysis on simulation education for health professionals and found simulation is associated with large effects for knowledge increase and moderate effects for patient-related outcomes. Leigh (2008) conducted a review of studies on patient simulation and self-efficacy, including studies with nurses and nursing students and found simulation provides a safe, non-threatening environment to practice patient care and leadership, critical thinking, decision-making, problem-solving and prioritisation skills. Self-confidence in the clinical setting has a direct relationship to job satisfaction and retention of nurses. Lack of self-confidence is identified as a source of stress amongst nursing students, particularly as it relates to caring for patients with complex health problems and communication with physicians (Heslop et al., 2001). In the hospital where this study was conducted, nurses with only a few years of nursing experience and no critical care nursing experience are placed in the intensive care units, so self-confidence is an important factor to consider. New nurses who have positively rated their

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educational experiences have been demonstrated to have higher self-confidence and job satisfaction and this has been linked with intent to stay in their role (Boyle et al., 1996). Keeping experienced nurses at the bedside may positively impact patient safety.

Studies examining the effect of simulation on nurses' self-efficacy to perform resuscitation skills have had mixed results (Buckley and Gordon, 2011; van Schaik et al., 2011). One study (van Schaik et al., 2011) of interprofessional pediatric resuscitation simulation training improved nurses' self-efficacy for knowledge but not for technical skills. Experience at real resuscitation events was able to increase self-efficacy for psychomotor skills. In another study (Buckley and Gordon, 2011) after Megacode simulation, a majority of subjects felt it had improved their ability to recognize an unstable patient and respond in a systematic way. Debriefing was rated as the most useful aspect of the simulation education in improved responses during emergencies (Buckley and Gordon, 2011).

Figueroa et al. (2013) demonstrated that simulation could significantly increase self-confidence to perform CS resuscitation amongst multi-disciplinary pediatric CSICU team members after Team Strategies and Tools to Enhance Performance and Patient Safety (Team STEPPS) education (9 hour course). The subjects felt better prepared to participate in and lead CS resuscitation events, perform advanced airway management skills, and cardioversion/defibrillation after the course and when surveyed again at three months after the course. The Team STEPPS education significantly increased closed-loop communication, use of huddles and debriefings, perception of mutual respect, and a sense of empowerment. However, only 79% of the participants found the course to be very useful. The study was limited by a sample size of 37 (Figueroa et al., 2013).

Few studies have examined the use of simulation for open chest procedures. Students at the Cardiac Surgery Advanced Life Support course significantly reduced time to first rhythm check, chest re-opening, and internal cardiac massage with repeated simulation of CS resuscitation scenarios (Dunning et al., 2006). Nunnink et al. (2009) reported simulation training significantly improved performance over video-based training on a knowledge test and subjective measure of self-confidence in performing emergency chest reopening. Schneider et al. (1995) were able to demonstrate that Megacode training improved time to intervention for some but not all resuscitation skills in the pre-hospital setting.

There is a need to further evaluate the use of HFS for high-risk, low frequency CS resuscitation procedures. Therefore, the purpose of this study was to: i) evaluate how HFS affects self-confidence to perform CS resuscitation, ii) evaluate the level of satisfaction with the simulation experience, and iii) identify which nurses prefer or benefit most from the use of this type of simulation.

Theoretical framework

Bandura's (1977) social learning theory is the theoretical framework for this study. Human behaviour is determined by behavioural factors (skills, practice, and self-efficacy) interacting with environmental factors (social norms, access, and influence on others) and cognitive factors (knowledge, expectations, and attitudes). Self-efficacy is the belief that one can perform certain behaviours in a given situation and that it will lead to a given outcome. Self-efficacy expectancy comes from previous experience with the behaviour, vicarious (observational) experience, persuasion (especially from influential persons) that they can perform the behaviour, and physiological response to the experience or anticipation of the experience of performing an event. One's perception of self-efficacy contributes to an individual's judgment of their ability to perform specific behaviours. Individuals with less efficacy to perform the behaviour either avoid the behaviour or give up quickly on learning a skill whereas individuals with higher levels of self-efficacy are likely to persevere to master it. Self-confidence is a significant component of self-efficacy (Bandura, 1977).

Methods

Design

This was a descriptive study involving pre- and post-simulation measures of self-confidence to perform critical aspects of CS resuscitation. Simulation scenarios involving PEA and cardiac tamponade/open chest resuscitation with internal defibrillation were completed by each group of three nurses. Performance measures were assessed as tasks completed or time to performance of a task (if timely performance was critical). Subjects assessed their satisfaction with the learning experience at the conclusion of the simulation experience.

Setting and sample

The research was conducted in the simulation center of a university-affiliated medical center in a large urban center in the western United States. The simulation center had a fully functional intensive care unit (ICU) with the same equipment as the actual ICU. A flyer recruiting subjects was posted in the CSICU and PICU. An investigator met with subjects to explain the study if they were interested in participating and obtained verbal consent to participate. Consented individuals were scheduled by their manager to attend a CS resuscitation simulation laboratory experience. Sixty-six nurses consented to participate in the study. Scheduling prevented six nurses participation; therefore 60 comprised the final sample size. As no performance data for CS resuscitation simulation could be found, a sample estimate to achieve a power of 80% could not be calculated. Data collection occurred from September to November 2013.

Instruments

Satisfaction with Simulation Experience Scale (SSES)

The SSES (Levett-Jones et al., 2011) is a 18 item scale composed of 3 subscales i) Debrief and Reflection (9 item)s, ii) Clinical Reasoning (5 items), and iii) Clinical learning (4 items). Learners rate their agreement with each item on a 5 point Likert scale (1 = strongly disagree, 5 = strongly agree). Possible scores on the scale are 18 to 90. Higher scores indicate higher levels of satisfaction (Levett-Jones et al., 2011). Previous scale internal consistencies have been satisfactory (Cronbach alpha = 0.77) with subscale Cronbach alphas of 0.94 for Debriefing and Reflection, 0.86 for Clinical Reasoning, and 0.85 for Clinical Learning respectively (Levett-Jones et al., 2011). Permission to use this instrument was obtained from the author.

Performance of critical behaviours worksheet

This was an investigator-designed instrument to record the presence or absence of behaviours during the simulations (same items as in Table 1) and time to perform critical skills (see Table 2). Face validity was performed for the instrument with nurses experienced in CS resuscitation.

Self-confidence in performing cardiac surgical skills

The investigators constructed a tool to measure self-confidence in performing CS resuscitation skills based on Bandura's Guide for Constructing Self-Efficacy Scales (2006) as there was no tool in the literature. Face validity was performed with nurses experienced in CS resuscitation. Subjects rated their behaviour self-confidence on

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