The Effect of High-Fidelity Simulation on Medical-Surgical Nurses’ Mock Code Performance and Self-Confidence

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An estimated 209,000 adult, in-hospital cardiac arrests occur annually in the United States, with the survival rate estimated to be only 19% (Neumar, 2016). Preparing nurses to perform quality resuscitative care is vital; the Institute of Medicine (2015) noted use of simulation training can improve provider performance and quality of cardiopulmonary resuscitation (CPR). In particular, training programs using high-fidelity simulation (HFS) can provide a safe environment for nurses to learn and practice the skills required during emergency situations (Sullivan et al., 2015). Simulated mock code training is important for nurses working on medical-surgical units because they are often first responders to acute patient deterioration and must be ready to implement lifesaving interventions (Hart et al., 2014). In simulated mock codes, varying levels of fidelity can be used, with HFS shown to result in improved skill performance (Cheng et al., 2015). However, limited literature is available on HFS training to prepare nurses to provide care to deteriorating medical-surgical patients, with most available studies focused on nursing students or nurses in critical care (Crowe, Ewart, & Derman, 2018).

To improve rates of in-hospital cardiac arrest (IHCA) survival, nurse leaders must prepare medical-surgical nurses as first responders to implement emergency care consistent with American Heart Association (AHA) guidelines. According to AHA (2015) guidelines, defibrillation should occur as soon as an automated external defibrillator (AED) is available. To optimize survival, defibrillation should occur within 3 minutes of patient collapse (Kleinman et al., 2015). At the site of this pilot study, the goal for defibrillation during mock codes was within 3 minutes. In 2015, the median time to defibrillation was 3.6 minutes, which increased from 2.8 minutes in 2014 and corresponded with the hiring of over 90 new nurses to medical-surgical units.

Purpose

The purpose of this quasi-experimental pilot study was to evaluate the effect of HFS training on medical-surgical nurses’ mock code performance and self-confidence.
Background
Nurses working on medical-surgical units must be prepared to implement lifesaving interventions in the event of acute patient deterioration and cardiac arrest. Simulated mock codes have been shown to improve nurses’ performance by reducing time to defibrillation. Mock code simulations also can increase nurses’ self-confidence in performing cardiac arrest care.

Aims
To evaluate the effect of a high-fidelity simulation (HFS) training intervention on mock code performance (time to defibrillation) and self-confidence.

Method
A one-group, quasi-experimental pilot study was conducted with 37 medical-surgical nurses from a community hospital in the southeastern United States. A high-fidelity mock code simulation was created by the primary investigator and performance data were collected during simulations. Self-confidence was measured using the National League for Nursing Student Satisfaction and Self-Confidence in Learning instrument.

Results
Overall mock code performance improved, but changes were not statistically significant; however, time to defibrillation improved significantly (p=0.001). Changes in participant self-confidence (p=0.002) were also statistically significant.

Limitations and Implications
The small sample and one-hospital setting limited generalizability; however, findings supported the use of mock code simulations to improve medical-surgical nurses’ performance and self-confidence. Further research is needed to evaluate long-term effects of mock code simulations to identify optimal frequency for training.

Conclusion
HFS is recommended to help prepare medical-surgical nurses to perform effective patient care during cardiac arrest. It also provides a safe environment for nurses to practice and refine their skills, which can increase self-confidence for performance abilities.

Review of the Literature
A literature search was completed in CINAHL using the keywords medical-surgical nurse, cardiac arrest, code, and simulation. Date limits were set for 2014-2018. Limited recent research was found investigating the use of HFS to prepare medical-surgical nurses to provide cardiac arrest care to patients.

O’Donoghue and colleagues (2015) conducted a quantitative descriptive study of 184 medical-surgical nurses to assess nurse perceptions of their resuscitation roles, team performance, and educational needs. Less than half (44%) of surveyed nurses reported feeling comfortable or confident in performing resuscitation. However, a clear majority (90%) had participated in a patient resuscitation. Regarding resuscitative training, 40% had participated in a mock code simulation. However, the majority desired mock code and simulation training, with 77% indicating a preference for unit-based mock codes and 69% indicating a preference for simulation training as a team. Nurses’ educational preferences for simulation-based training far exceeded preferences for online training (30%) and lectures (21%). These findings demonstrated the need for training to improve the confidence of medical-surgical nurses in performing resuscitative care, and confirmed their preferences for receiving experiential learning via mock codes and simulation.

A quality improvement project at one hospital in the United States used unit-based simulated mock codes on four medical-surgical units to improve nurses’ confidence and competence for providing resuscitative care (Reece, Cooke, Polivka, & Clark, 2016). Initially, unannounced unit-based mock codes occurred, followed by an educational intervention and subsequent unannounced mock codes. Researchers developed a tool to assess participants’ performance in the mock codes. Interestingly, several of the measured code components did not improve from the initial mock codes to those conducted in follow up. For example, 62.5% of nurses used the AED within 2-4 minutes in the initial mock codes, while only 37.5% did so on follow up. Researchers then conducted a descriptive-correlational study to evaluate the relationship between nursing unit/nurse characteristics and mock code scores. Other than a significant difference in performance for day shift nurses, no other major correlations were noted. A significant finding was an increase in nurses’ confidence after the mock codes, with the amount who reported feeling confident increasing from 49.2% to 77.9%. Researchers concluded less-experienced nurses and those working on night shift in particular would benefit from mock code learning experiences. Findings also highlighted the need for interventions to improve medical-surgical nurses’ confidence and their performance of resuscitative care (e.g., appropriate use of the AED). These findings are important because prior
research has shown lack of self-confidence can be a barrier to performing high-quality CPR and safe use of the AED (Hernandez-Padilla, Suthers, Fernandez-Sola, & Granero-Molina, 2014).

In a randomized-controlled trial to evaluate the effectiveness and ideal frequency of in-situ resuscitative training for non-critical care nurses, researchers randomized 66 nurses into four groups (Sullivan et al., 2015). The groups received standard AHA training or in-situ training every 2, 3, or 6 months. The in-situ training involved 15-minute simulations in which participants provided care to a patient (low-fidelity simulation manikin) requiring resuscitation. Debriefing followed and participants repeated the simulation to practice applying their learning. Significant findings included a decrease in the amount of time to start CPR and perform defibrillation, with all participants in the 2-month and 3-month groups performing defibrillation in less than 3 minutes. Researchers concluded simulation training can improve nurse performance during mock codes, and receiving training every 2 or 3 months may be beneficial for skill retention.

Finally, Josey and co-authors (2018) conducted a descriptive study to evaluate if hospitals with more active participation in in-situ mock code training have improved IHCA survival rates. Of the 26 participating facilities, 12 hospitals were determined to be more active with in-situ mock code training across units. Results showed these 12 hospitals had significantly better time to defibrillation (performed within 2 minutes). Further, the IHCA survival rate was 42.8% at the study site, a community hospital in the southeastern United States, and included a waiver of signed consent. Study information was reviewed with participants, including an explanation of data collection procedures and data storage. Data were stored in the primary investigator’s locked office at the study hospital. No identifying participant information was collected during the study to protect participant confidentiality.

Sample Selection

_A priori_ sample size calculation was conducted using G*Power 3 software for a paired samples _t_-test with the parameters of medium effect size 0.50, alpha 0.05, and power 0.80 (Cohen, 1992). A sample of 34 participants was deemed appropriate to detect statistically significant changes. Following IRB approval, registered nurse (RN) participants were recruited via announcements and posted advertisements on all medical-surgical units at the study hospital. Nurses working in specialty areas (e.g., intensive care units, emergency department) were excluded.

A convenience sample of 37 medical-surgical nurses participated. The study site has an HFS suite configured like the facility’s medical-surgical patient rooms; the code cart and patient care equipment were also the same as those on the medical-surgical units. A high-fidelity manikin was used to portray the simulated patient.

Design and Method

Design and Intervention

A one-group, repeated measures, quasiexperimental design was used to evaluate the effect of HFS training on medical-surgical nurses’ mock code performance and self-confidence. The HFS mock code intervention was designed to be implemented with small groups (no more than eight nurses per group) to ensure an active role for each participant. Each small group participated in two HFS mock codes, with performance data collected during each of the mock codes and self-confidence data collected after each HFS mock code. After receiving training, clinical nurse educators at the study hospital assisted with facilitating the HFS mock codes and collecting the performance data. The primary investigator also was present to explain the study and collect self-confidence data.

After the initial HFS mock code intervention, group performance was reviewed in a debriefing. This debriefing was guided by the clinical nurse educator who accompanied the participants in the HFS room. It was augmented with review of the AHA (2015) basic life support (BLS) algorithm and hospital policies and equipment. Following the debriefing, a second HFS mock code intervention occurred. The first HFS mock code thus served as the pretest and the second as the posttest. The HFS mock code was identical at both time points. The scenario involved a patient who reported chest pain and became unresponsive and pulseless, requiring participants to implement BLS care.

Outcome Measures

Overall mock code performance was measured using the Mock Code Evaluation Tool that was previously created by Clinical Education Services staff at the study hospital. This tool was created by educators at the study site and did not undergo procedures to determine validity; however, it was created based on components of the AHA (2015) BLS algorithm. A maximum score of 11 points was possible, with 1 point assigned for each of the following: determining unresponsiveness, checking pulse, calling code, placing bed in CPR mode, initiating CPR, retrieving code cart, assigning timekeeper, delivering rescue breaths, applying backboard, turning on AED and following prompts, and performing defibrillation. For the defibrillation item, no points were awarded if defibrillation took longer than 3 minutes to initiate. Therefore, the primary outcome measure of time to defibrillation was recorded in sec-
Time to Defibrillation and Mock Code Evaluation Tool Results

<table>
<thead>
<tr>
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<th>Time to Defibrillation (in seconds)</th>
<th>Mock Code Evaluation Tool (0-11)</th>
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<tbody>
<tr>
<td></td>
<td>Pretest</td>
<td>Posttest</td>
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<tr>
<td>Group 1</td>
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<tr>
<td>Group 2</td>
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<td>Group 6</td>
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<td>44</td>
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<tr>
<td>All Groups Mean</td>
<td>134.7</td>
<td>63.4*</td>
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</tbody>
</table>

*Significant change (p=0.001)

Findings

The sample (N=37) consisted primarily of females (n=36, 97%) who identified themselves as White, non-Hispanic (n=30, 81%). Most participants were less than age 35 (n=24, 65%) and had 5 or less years of RN experience (n=23, 62%). More than half were employed on medical units (n=22, 59%), with the remaining nurse participants employed on surgical units and two women's health units with care not associated with pregnancy. Regarding clinical experience with resuscitation, 56% of participants (n=22) had performed CPR in their careers; of those, half (n=11, 29%) had performed it one to five times. Thirty (81%) nurse participants had participated previously in a mock code.

Performance Outcomes

The mean time to defibrillation for all participant groups was 134.7 seconds during the pre-test HFS and 63.4 seconds during the posttest HFS, which represented statistically significant improvement (p=0.001). Scores on the Mock Code Evaluation Tool could range from 0 to 11, with higher scores indicative of better mock code performance. The mean pre-test HFS score on the tool was 9.2 (range 7-10), while the mean posttest HFS score was 10.5 (range 9-11). Although mean scores increased, the change was not statistically significant (p=0.140). See Table 1.

Self-Confidence Outcomes

On the NLN (2005) instrument, the highest score possible for self-confidence was 40. The mean self-confidence score significantly increased from 32.2 following the pretest HFS to 38.7 after the posttest HFS (p=0.002). Scores on the five items that measured satisfaction also were summed (highest possible score of 25). Mean satisfaction score increased significantly, from 21.0 to 24.7 (p=0.001). See Table 2.

Discussion

Although the sample consisted of medical-surgical nurses who were
relatively new to practice, 59% (n=22) had performed CPR during their careers. Thus, it is important for medical-surgical nurses to receive training to prepare them to provide resuscitative care. Results demonstrated HFS can improve medical-surgical nurses’ performance in mock codes. The mean time to defibrillation significantly decreased on the posttest HFS mock codes, meeting the hospital’s goal of initiating defibrillation within 3 minutes. All participant groups also were found to have met the hospital’s goal during the posttest HFS mock codes. Although statistical significance was not achieved, improved total scores on the Mock Code Evaluation Tool suggest improved BLS performance on the posttest HFS mock codes.

Participant self-confidence scores improved significantly, with a mean score 38.7 of 40 after the posttest HFS mock codes. As low self-confidence has been cited as a barrier to performing high-quality resuscitative care (Hernandez-Padilla et al., 2014), this is an important finding. Reviewing hospital policies and equipment and practicing the skills required during resuscitation increased the self-confidence of the medical-surgical nurses in this pilot study. In addition, participant satisfaction improved. Although this was not an aim of the pilot study, this finding is important to shape ongoing HFS training interventions.

**Limitations**

The small sample lacked diversity and one hospital setting limited generalizability of findings. Additionally, the intervention and data collection occurred in a 1-day time period. Data were not collected to determine if the HFS mock code intervention resulted in long-term changes.

**Recommendations for Future Research**

To improve generalizability, future studies should obtain a larger, more diverse sample, and conduct research at more than one hospital. Because all data collection in this pilot study occurred on the same day as the HFS training, additional research is needed to determine the long-term effect of HFS mock code training on medical-surgical nurses’ performance and self-confidence. Future research should determine if there are sustained changes in performance and self-confidence to provide guidance on the optimal frequency for HFS mock code training. Studies also are needed to evaluate the effect of having trained and confident medical-surgical nurses on clinical performance during actual patient emergencies. This could be accomplished by tracking resuscitation outcomes following hospital-wide HFS mock code training. Continued research is important to build substantive evidence on this topic, as few studies have focused specifically on medical-surgical nurses.

**Nursing Implications**

This pilot study found HFS training can improve medical-surgical nurses’ performance during mock codes by decreasing the time to defibrillation to a mean of 63.4 seconds, far lower than the recommended 3 minutes. Researchers recommend medical-surgical nurses participate in HFS mock code training to prepare themselves to perform resuscitative care during actual patient emergencies. Hospital nurse educators and clinical nurse specialists can develop mock code training programs to provide medical-surgical nurses the opportunity to practice the skills required during cardiac arrest. Although HFS can promote a heightened sense of realism, it is acknowledged that not all hospitals have this equipment. Mock code training should be implemented with available resources such as low- or medium-fidelity manikins.

A barrier to performing high-quality cardiac arrest care can be lack of self-confidence among nurses (Hernandez-Padilla et al., 2014). Providing nurses with opportunities for repeated practice and experiences of mastery is important to improve their self-confidence. The use of HFS mock code training increased medical-surgical nurses’ self-confidence significantly through hands-on skills.

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<thead>
<tr>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
<th>Group 4</th>
<th>Group 5</th>
<th>Group 6</th>
<th>All Groups Mean</th>
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<tbody>
<tr>
<td>35.17</td>
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<td>38.13</td>
<td>38.7*</td>
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<tr>
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<td>25</td>
<td>24.4</td>
<td>24.13</td>
<td>24.7**</td>
</tr>
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</table>

*Significant change (p=0.002). ** Significant change (p=0.001)
practice and review of guidelines and equipment. HFS mock code training thus is recommended to improve medical-surgical nurses’ self-confidence. Hospital nurse educators and clinical nurse specialists who conduct these HFS training interventions should debrief participants following the mock codes. Debriefing entails providing feedback to participants and encouraging reflective thinking, and it is an important simulation component because it helps to promote transfer of learning to future patient care situations.

Conclusion

Medical-surgical nurses must be prepared to deliver timely and effective lifesaving interventions with confidence (Crowe et al., 2018). In this pilot study, HFS mock codes provided nurses with opportunities to practice lifesaving skills that are not practiced routinely within their clinical settings. Participants’ self-confidence improved, as did their resuscitation performance in the simulated patient care setting. The significant decrease in time to defibrillation has the potential to improve patient outcomes.

REFERENCES


