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The influence of high fidelity simulation on first responders retention of CPR knowledge

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ABSTRACT

Introduction: The purpose of this study was to identify the impact of high-fidelity simulation on the retention of basic life support cardiopulmonary resuscitation (CPR) knowledge among a group of healthcare providers (HCPs).
Methods: A twenty-five question exam was completed by nurses and nurse technicians over a two-year period before and after mandatory CPR training with high-fidelity simulation.
Results: Most HCPs scored near 50% or below the passing score (80%) with a mean range of scores between 28% and 84%. HCPs missed questions on the exam that requested specific details related to technique or human physiology during CPR.
Conclusion: The current teaching method for basic life support may be enhanced by using high-fidelity simulation, but this modality alone is not enough to support HCPs retention of CPR knowledge. Additional studies are needed to identify strategies that will help HCPs remember specific and detailed information in the CPR algorithm.

1. Introduction

During a sudden cardiac arrest (SCA) or heart attack every second counts. As brain and organ injury increases the chance of survival decreases (American Heart Association, 2013). Cardiac arrest occurs in individuals of all ages. Basic life support (BLS) measures are performed to manually pump the heart and circulate oxygenated blood to vital organs (American Heart Association, 2013). Unfortunately, the body may suffer irreversible organ damage after four to seven minutes once blood flow has stopped and oxygen cannot be transported to the heart or brain (Niles et al., 2011).This simple cardiopulmonary resuscitation (CPR) method has proven to be effective when performed correctly by healthcare providers (HCPs) (American Heart Association, 2013).

The first five minutes of cardiopulmonary resuscitation (CPR) performance is crucial for optimal survival of a heart attack. There is a direct link between knowledge, actual performance of CPR measures and poor survival outcomes (American Heart Association, 2013 Updates). Therefore, we evaluated healthcare providers' (nurses and nurse assistants) knowledge after mandatory CPR training to determine the amount of retention at five time intervals.

2. Background

In the US, guidelines for CPR are updated every five years to include ongoing research findings. While researchers agree the technical aspects of CPR may be simple nonetheless performing them correctly has proven difficult (Al Hadid & Suleiman, 2012). Chee (2014) suggests that the retention of CPR skills is closely associated with the instructor, learner, curriculum, and frequency of timing in which the training takes place (deliberate practice). Experts in simulation concur with these findings and propose that simulated environments may be the future modality for acquiring and maintaining skills (Issenberg & Scalese, 2007). According to Chee (2014), deliberate practice is one of the best teaching strategies for adult students to learn and retain information. This learner-centered experience is embedded in an appropriate clinical context allowing for deliberate practice after a period of reflection (Chee, 2014; Issenberg & Scalese, 2007). Simulation is unlike traditional lectures and other formats in which the learner is a passive observer. Researchers conclude that healthcare simulation is gaining widespread acceptance as a teaching modality which can be used to enhance any existing education curriculum (Chee, 2014; Issenberg & Scalese, 2007). Additionally, high-fidelity simulation (HFS) including sophisticated mannequins, updated computer software, high-tech medical equipment and highly-trained personnel creates a more realistic environment helping users suspend disbelief (Aqel & Ahmad, 2014; Tawalbeh & Tubaishat, 2013).

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2.1. High-fidelity simulation

Using HFS, instructors can control the mannequin's life-like responses by making various adjustments to the scenario depending upon the students' interventions. An interaction between the mannequin, student and instructor enhances experiential learning. Students are given time to practice various skills while allowing the instructor to evaluate their clinical decision-making and critical thinking skills (Nevin, Neill, & Mulkerrins, 2014). Although CPR recertification skills are still performed using low-fidelity or static mannequins (resusci-Anne™), many healthcare organizations are beginning to incorporate HFS into their annual mandatory training courses (Ackermann, 2009; Tawalbeh & Tubaishat, 2013). Despite the significant data regarding the degradation of CPR knowledge and skills after standard recertification, limited research mentions a decrease in knowledge after HFS training (Adekola, Menkiti, & Desalu, 2013; Aqel & Ahmad, 2014; Sankar, Vijayakanthi, Sankar, & Dubey, 2013). Thus, the purpose of this study was to evaluate healthcare practioners' CPR knowledge and determine the effect of HFS on retention after mandatory BLS-CPR training.

3. Methods

3.1. Sample and setting

A convenience sample of HCPs (registered nurses, licensed practical nurses, nursing assistants and patient care technicians) from five specialty outpatient clinics was included in this study. They were previously recertified in BLS-CPR skills using the 2010 AHA updated guidelines. As part of the organization's mandatory BLS training program, all HCPs were required to participate in at least one mock-code prior to recertification. Over a two year period (7/2011 to 8/2013) HCPs from the outpatient clinic underwent mandatory CPR training (i.e. mock cardiopulmonary arrest code) using high-fidelity simulators in the hospital's simulation center. Also, one group of participants took the exam nearly two years later. This test occurred prior to their AHA recertification, and they received only one training session with HFS. All sessions were faculty-led and videotaped to guide the debriefing process immediately after each encounter. HCPs participated as small groups in one mandatory session of two mock code scenarios to enhance training.

3.2. Procedures

One group of HCPs was given the written examination prior to their annual mandatory training, and all other participants were given the test after the training period. This study was approved by the Institution Review Board. A registered nurse obtained informed consent and distributed a 25-question written CPR exam to all HCPs. HCPs volunteered depending upon their availability to take the test during and/ or immediately after clinic hours. Information about CPR was not reviewed prior to taking the test, and no instructional CPR posters were noted in the clinic area. Individuals were provided 30 to 45 min of uninterrupted quiet time in a private office and were monitored throughout the testing period. The test was given at five different time intervals (baseline, <-3 months, <6 months, <9 months, and at two years after HFS mock-code training but prior to recertification). No identifying or demographic information was collected on the test. This course of action provided the HCPs with anonymity and a level of assurance their scores would not be used either favorably or unfavorably within the organization. Also, all individuals could only take the test once regardless of the time when they completed their mandatory training.

The 25-question exam was derived from the AHA 2010 guidelines for BLS-CPR and emergency cardiovascular care (ECC) recertification; however, questions about child and infant CPR were excluded. The exam questions focused on both one and two rescuer performance of adult BLS-CPR skills and the correct use of an AED device. Five questions replaced those related to infant and child. These questions addressed the rate and depth of compressions, number of rescue breaths, and the amount of time required to take a pulse along with its location. Two questions were identical and repeated; however, the multiple choice answers were placed in a different sequence.

The results of the written exam were not reviewed with the staff and were used as a quality measure for the clinic educators to improve their training program. At the end of the data collection period, additional information about CPR was provided to the staff along with pocket cards, instructional posters in the clinic area, and the AHA 2010 BLS Quick Reference Guide.

3.3. Data analysis

All data were analyzed using frequency distributions, ANOVA and the student t-test with the IBM Statistical Package for Social Sciences (SPSS) version 21, and a 0.05 probability level was used to determine a statistical difference between the groups.

4. Results

Of the 57 individuals that took the written exam, only two received passing scores >80%. Five percent of the group members scored (72%) below the passing score. The range of percent scores for all of the tests was between 28% and 84%. For each time interval including the baseline, the mean percent scores were near or below 50%. Total mean scores for all exams in the <3 month interval were 54%, slightly higher than all other mean scores. Individuals that took the exam prior to simulation training and during the <9 month interval after the simulation training had the lowest total mean percent scores (43% and 44%). There were no significant differences between any of the total mean percent scores for all time intervals (Table 1).

Most HCPs missed 12 of the 25 questions (48%) on the written exam, and only two answered seven questions correctly (28%). Also, 95% (54/57) of the individuals who took the exam answered the AED questions incorrectly. A few HCPs remembered the number of seconds recommended to give a breath in the presence of an advanced airway. Approximately 80% (45/57) missed both questions about the correct use of the bag valve-mask (BVM) device for both one and two rescuers. Nearly 85% (48/57) of the HCPs incorrectly answered the physiology question related to the reason for performing chest compressions. Sixty percent (34/57) of this cohort incorrectly answered all three questions regarding hand placement, depth and rate of compressions. Two identical questions related to the specific rate and depth of compressions were repeated. The order of the multiple choice answers were rearranged, and 50% (29/57) of the HCPs missed all four questions.

Table 1
The difference of the mean percent group score for Healthcare Providers for each time intervals using ANOVA.

Group Type	SS	df	MS	F-statistic	Significance
Group 1 <3 months					
Between	728	7	104	0.53	.78
Within	392	2	196		
Total	1120	9			
Group 2 <6 months					
Between	998	7	142	1.43	.48
Within	200	2	100		
Total	1198	9			
Group 3 <9 months					
Between	810	7	116	14.4	.07
Within	16	2	8		
Total	826	9			
Group 4 <2 years					
Between	1513	7	216	.73	.69
Within	592	2	296		
Total	2105	9			

Note the significance level is 0.05.