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An assessment of CPR skills using simulation: Are first responders prepared to save lives?

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ABSTRACT

The American Heart Association's (AHA) recommendation for biyearly recertification and annual mandatory CPR training may be suboptimal for first responders (nurses and technicians) working in outpatient clinics (American Heart Association, 2013). To determine the efficacy of the AHA guidelines, 40 simulated sudden cardiac arrest (SCA) encounters were conducted followed by debriefing and a subsequent SCA to determine a basic level of CPR proficiency. First responders' CPR skills were evaluated using a 19-item assessment form to quantify the event. A comparison of scores using two different viewing modalities was performed to provide an assessment of the training program. Of the 40 sessions, group mean performance scores for the first encounter were just above the organization's minimum required score of 24. Performance scores increased slightly (27-28) after the second encounter. Proficiency of skills was poor and frequent basic life support training may be indicated to help first responders provide high-quality CPR.

1. Background

The national survival rates for in-hospital sudden cardiac arrest (SCA) among adults have not changed significantly from 2012 to 2013 (23.1%–23.9%, respectively) (American Heart Association, 2013). These low survival rates suggest that there is still a need to improve and maintain proficiency of basic life support skills (BLS) during cardiopulmonary resuscitation (CPR) (AHA/RQI, 2015). Since BLS skills decay rapidly overtime, the AHA recommendation of two-year renewals of healthcare providers have been called into question (Anderson et al., 2011). Although the 4 h AHA 2010 BLS recertification course uses an interactive video and provides two comprehensive tests, this biyearly interval may be too long for providers to remember specific details of the BLS algorithm (Anderson, et al., 2011). For this reason, acute healthcare organizations require all providers with direct patient contact to attend a mandatory refresher course annually (Lighthall et al., 2013). Additionally, current research studies show that CPR knowledge and skills decline rapidly before the end of the one and or two year recommendation period (AHA-RQI, Annotated Bibliography, 2015).

In a quasi-experimental study of 112 nurses, CPR knowledge and skills decreased over time (Nori et al., 2012). In this study, the baseline knowledge on the pretest was 54.6%, and after training the scores increased to 89.9%. However, 10 weeks later the scores dropped to 80.6%, and after two years scores declined further to 64.3%. Similar results were also shown for the groups' psychomotor skills with an increase in scores from 18.7% pre-training to 93.3% post-training, with a subsequent decrease to 36.8% in 2 years (Nori, et al., 2012). When CPR is performed infrequently, knowledge and skills are lost within weeks of training resulting in poor resuscitation delivery (Nori et al., 2012).

Similarly, research suggests that CPR quality is directly related to survival outcomes, and varying rates of skill acquisition have been

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documented after standard training classes (Al Hadid and Suleiman, 2012). Since CPR is a complex psychomotor technique that is difficult to teach, learn, remember and perform, their study demonstrated that a boost session of simulation training significantly improved 40 student nurses' CPR performance. Similar findings were noted in Sutton et al. (2011), whose study demonstrated that low-dose high frequency CPR training sessions resulted in a significant improvement in skill retention among pediatric physicians. Even though the study evaluated several BLS teaching modalities among 74 providers, only the low-dose high frequency training method yielded a significant increase in skill retention.

Likewise, Oerman et al. (2010) showed an increase in retention of BLS skills among a group of student nurses when they used a HeartCode™ BLS voice-assisted mannequin. In a cohort of 604 nursing students from 10 schools of nursing in the US, performance-based measures of CPR skills were superior when compared to instructor-led training (Kardong-Edgren, et al., 2010). Students trained using the HeartCode™ system performed more compressions with correct hand placement than the others. They also provided better ventilations with adequate lung volumes when compared with the students from the instructor-led training. These researchers proposed the use of an automated system along with individualized feedback during training to help students master BLS skills. Kardong-Edgren, et al., (2012) suggest that automated systems can increase opportunities to improve CPR skills over time; however, the best experiential learning opportunities have yet to be explored.

While many AHA approved BLS programs are offered each year to providers, most programs lack a component to measure performance and competencies (AHA-RQI, Annotated Bibliography, 2015). Recently, the AHA identified several studies to guide the development of their resuscitation quality improvement (RQI) program. This program identified key points to be addressed in future AHA CPR initiatives:

1. Improve providers performance of high-quality CPR
2. Ensure that initial CPR training for providers are effective
3. Refresher courses should be offered to help providers retain skills
4. Frequent practice sessions should improve CPR skills among providers

The studies listed in the AHA-RQI annotated bibliography provided CPR performance data from the US and other countries. In these studies, researchers targeted nursing students or providers working in an acute care settings. However, there were no studies in this bibliography about CPR performance of providers as first responders in outpatient settings (AHA-RQI, Annotated Bibliography, 2015). Also, there was no recent literature within the last five years that identified a deficiency of CPR performance among healthcare workers (HCWs) in outpatient clinics.

Given the decay of CPR skills over time, the purpose of this observational study was to evaluate the effectiveness of one organization's annual CPR course on HCWs' performance. In addition, the training was used to assess the difference between two observational modalities on performance scores for this population. This study was guided by two research questions: Does the organization's annual CPR course improve HCWs BLS performance? Do BLS performance scores vary between instructors using different observational modalities?

2. Methods

Institutional Review Board approval was granted for this study and data were collected over a two year period (2010–2012). A convenience sample of HCWs (nurses, nurse assistants, and patient care technicians) from the hospital's outpatient clinics participated in this observational study. As part of their annual mandatory mock sudden cardiac arrest (SCA) training, twenty groups of HCWs BLS performance was evaluated by replicating real life situations using simulation technology. A high-fidelity human patient simulator (SimMan®) with life-like features (blinking eyes, palpable pulses, audible voice) was used in all encounters. In 2 h sessions, HCWs attended a short lecture of the AHA 2010 BLS guidelines for CPR and participated in two simulated mock SCA encounters. Two BLS certified instructors evaluated the groups' performance by scoring the training using direct observation or video review. A 19-item assessment form created by the organization's Education Department was used to score CPR performance among groups of BLS certified HCWs (Table 1).

All training took place in the same room using a high-fidelity human patient simulator, a one-way mirror and audiovisual recording to provide feedback during and immediately following the course. Each group consisted of a registered nurse and at least two to four other HCWs. The groups were allotted sufficient time to practice CPR skills in two simulated mock arrest encounters, specifically designed for the patient to lose consciousness within a minute of the nurse assistant's or patient care technician's initial contact. All other team members entered the room once help was requested, and the registered nurse was instructed to be the leader. The encounters lasted until all basic components of CPR (start CPR, place AED pads on patient, and bring the emergency cart to scene) were attempted or performed as recommended by the AHA.

2.1. Setting

All training classes were conducted in the hospital's simulation center, which is located within close proximity of the outpatient clinics. The center has 2000 square feet of dedicated space used to replicate a variety of healthcare settings and medical conditions. Every room in the center is equipped with a one way mirror, cameras and speakers to provide audio-video capabilities for immediate discussion and data collection. HCWs from the hospital's outpatient clinics were assigned to groups by the nurse educator based upon their availability to complete the organization's mandatory training. Each group was given an orientation of the simulation center, the room where the mock SCA training takes place, the simulator, and the required BLS equipment (automated external defibrillator [AED] and emergency cart).

During the course, a brief review of the AHA 2010 BLS guidelines for CPR was given. Every group participated in two simulated encounters that were videotaped to allow for deliberate or repeated practice. The first session provided an opportunity to work as a team and become familiar with the equipment. The second session provided the team with an opportunity to perfect their skills based upon feedback and information obtained from the presentation and the first encounter. Last, the nurse educator guided the debriefing process of each encounter using the AHA 2010 BLS guidelines and the video recording.

2.2. Assessment tool

The19-item assessment tool was developed from the AHA 2010 BLS guidelines by the organization's Education Department (Table 1). This tool used a three point scoring system to rate BLS performance based upon the completion and complexity of the task. A separation of three distinct sections (1, 2 & 3) was created using time to designate the initiation of a task as recommended by the AHA. In section 1, a single point was given for each of the four items required to initiate CPR. In section 2, a maximum of two