Evaluation of the Effectiveness of Basic Life Support Courses among Health Care Professionals at the Ministry of National Guard Health Affairs

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ABSTRACT

Objectives: *Previous studies have indicated that cardiopulmonary resuscitation by some healthcare professionals does not measure up to current standards. We evaluated the attitude, knowledge, and behavior of healthcare professionals towards basic life support courses at the Postgraduate Training Center in Riyadh, Saudi Arabia.* ***Methods:*** *Cross-sectional and longitudinal analyses were performed. Data were initially collected after each basic life support course over 11-months. A follow-up questionnaire was sent 6-months after each course. The Kirkpatrick model was used to assess the effectiveness of the course for improving attitudes, knowledge, and behavior.* ***Results:*** *Total 455 trainees (87.5%) and 53 instructors (88.3%) responded at baseline. The mean attitude and knowledge scores were 55.6 ± 6.09 and 92.1 ± 7.06, respectively. After 6-months, 193 individuals responded. The mean knowledge score difference was -9.27 ± 12.9. The mean behavior score was 43.2 ± 4.29 at baseline; after 6-months, 26.4% of participants showed a decline in confidence in their cardiopulmonary resuscitation skills. Attitude and behavior scores were correlated (p<0.001).* ***Conclusion:*** *Healthcare professionals had generally positive attitudes and behavior concerning basic life support. There was a clear deterioration in basic life support knowledge 6-months after the course. To ensure the delivery of high-quality cardiopulmonary resuscitation, frequent training and knowledge assessment are imperative.*

Keywords: Basic life support, Cardiopulmonary resuscitation, Evaluation

Abbreviations: BLS: Basic Life Support; CPR: Cardiopulmonary Resuscitation; AED: Automated External Defibrillator; AHA: American Heart Association; MNG-HA: Ministry of National Guard-Health Affairs; KAIMRC: King Abdullah International Medical Research Center; PTC: Postgraduate Training Canter; KSAU-HS: King Saud bin Abdul-Aziz University for Health Sciences; RQI: Resuscitation Quality Improvement; MOH: Ministry of Health; SHA: Saudi Heart Association

INTRODUCTION

Cardiac arrest is considered a major public health challenge, and it remains a chief cause of mortality worldwide. The rapid identification of cardiac arrest and the delivery of effective basic life support (BLS) is essential for ensuring survival without significant impairment [1]. Particularly, effective cardiopulmonary resuscitation (CPR) can increase the survival rate of cardiac arrest by two-to-three-fold [2,3].

Saving lives is by far the most important mission for healthcare professionals. However, multiple studies have shown that many healthcare professionals perform CPR that does not measure up to the current standards [3-5]. Furthermore, it is well-documented that scores on knowledge assessments of CPR decrease by about half 3-6 months after taking a BLS course among healthcare professionals [2,3,6,7]. The quality of CPR is directly related to the prognosis of patients with cardiac arrest. Unfortunately, many studies have suggested that high-quality CPR is the exception rather than the norm [6]. The quality of CPR, whether in the hospital or on the scene of the cardiac event remains less [8]. Therefore, more effective BLS training for healthcare professionals might be necessary.

The Postgraduate Training Center (PTC) at King Saud bin Abdulaziz University for Health Sciences (KSAU-

HS) was launched in June 1996 by the Ministry of National Guard Health Affairs (MNG-HA). Since then, it has collaborated with several local and international institutes, such as the American Heart Association (AHA) and Saudi Heart Association (SHA), to provide certification, continuing education, and professional training to all healthcare professionals, both nationally and globally [9]. At the PTC, BLS courses are conducted 3 times per week, with an average of 24 participants per course. The PTC has had the highest number of trainees in the Middle East and North Africa since 2011 [9].

To improve training courses, including those for BLS, it is necessary to conduct evaluations of participants' current job performance, which can aid in identifying gaps in knowledge and skills as well as their current strengths and weaknesses. Such evaluations can lead to positive attitudinal changes as well as provide individuals with more opportunities to utilize new skills and knowledge in their fields of expertise [10-12].

The training courses must also be evaluated continuously, as this can assist both trainers and trainees in gaining new skills. Such data can also aid organizations in making more cost-effective decisions [13]. Kum, et al., have found that the training evaluations provide a more objective understanding of the performance, productivity, and funding status of the implemented training program [12].

Currently, one of the most widely used standard frameworks for evaluating training courses is the Kirkpatrick model was developed by Dr. Donald L. Kirkpatrick in 1959. This model has been successfully applied in various educational and training settings. It comprises of 4 levels of evaluation: reaction, learning, behavior, and results [14]. These 4 levels help to break down the complex process of evaluating a program [15]. The first level, reaction, refers to evaluating the reactions of individual participants at the end of the training. Evaluating reactions allows for a subjective critique of the teaching style and the course content [11]. The second level, learning, involves measuring the level of knowledge or skills learned as a result of participating in a training course. A typical method of evaluating learning is comparing results on knowledge assessments before and after the course [11,16]. The third level, behavior, involves measuring to what extent the participant has applied their newly learned skills and knowledge in the workplace [11]. While reactions and learning can be measured immediately after the training course, changes in trainees' behaviors require more time for assessment. The fourth level, results, involves measuring the overall impact of the training program on the organization, including finances, staff turnover, the incidence of challenging behavior, and staff interactions [11,14,15].

Kirkpatrick recommended evaluating all 4 levels of a training program. However, this can be challenging, given that the difficulty and cost of evaluation increase with each level-especially level 4 [17]. Currently, only the reaction level is evaluated for most training programs. In fact, roughly 78% of training courses were evaluated at only the first level, 49% at the second level (learning), and 25% at the third level (behavior); only 7% were evaluated at the fourth level (results) [18]. In this paper, we considered only the first three levels due to time and cost constraints.

Objectives

The purpose of this study is to evaluate, using the Kirkpatrick model, the effectiveness of a BLS course for healthcare professionals in Saudi Arabia. The primary objective is to evaluate the reactions, learning, and behavior of healthcare professionals towards BLS offered by the Ministry of National Guard Health Affairs [9]. The reactions included participants' impressions of the course, it's content; the equipment used in it, its instructors, and their overall attainment of course objectives. The learning was evaluated in terms of both knowledge and skills. The behavior included participants' application of said knowledge and skills in practice. The secondary objective is to evaluate instructors' behavior in performing the BLS course, as instructors' behaviors might have an impact on trainees' attitude.

MATERIALS AND METHODS

This longitudinal study was conducted between February 14, 2018, and January 31, 2019. The study took place at the Postgraduate Training Center (PTC) of King Saud bin Abdul-Aziz University for Health Sciences (KSAU-HS) and the Nursing Education Center of the MNG-HA, both of which are governmental institutions located in Riyadh Province (Ministry of National Guard Health Affairs; Postgraduate Training Center). The study was approved by the King Abdullah International Medical Research Center (KAIMRC). This study also complies with the requirements of the Declaration of Helsinki. The consent form was attached to the questionnaires, and it contained information related to the study including the purpose of the study and confidentiality of data.

The sample size was calculated based on the latest statistical yearbook published by the Ministry of Health (MOH), reflecting the total number of health-care professionals in Saudi Arabia during the year (1433H-1437H) 402,938 personnel [19]. Using 95% confidence interval and 5% margin of error the calculated sample size estimated to be 384, we added 30% to the sample size to compensate for non-respondents, incomplete questionnaires, or faulty entries and to ensure a sufficient number of respondents at re-testing. Inclusion criteria were all postgraduate healthcare professionals who were enrolled in basic life support courses between 14 February 2018 and 31 July 2018. Exclusion criteria were undergraduates and interns.

Trainees' reactions to the course were measured using a BLS course evaluation form adopted from the American Heart Association (AHA) (Appendix 1). This form examines 3 main areas of a BLS course: instructor (3 items: providing instruction and help during practice sessions, answering questions before skills tests, and professionalism and courtesy to students), course content (5 items: clear course learning objectives, level of course difficulty is appropriate, the content is presented clearly, the quality of video and written material, and the quality of equipment), and skill mastery (4 items: whether the course prepared students to successfully pass the skill session, whether students are confident in the skills that the course taught them, whether students will respond to an emergency because of the skills they learned in this course, and whether they took this course to obtain professional or continuing education credit). The questionnaire comprised of 12 items, each rated on a 5-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree").

Trainees' learning was assessed by using a BLS knowledge exam given at the end of the course. Six months after this initial exam, participants were sent an online survey containing the same questions evaluating knowledge. The second exam was aimed at examining the level of knowledge retention after the course.

To evaluate trainee behavior, we asked participants immediately after the course to complete a questionnaire comprising 11 items rated on a 5-point Likert scale ("strongly agree"=5 to "strongly disagree"=1) (Appendix 2). This questionnaire was sent again as an online survey six months later. For the analysis, we reported frequency distributions of the favorable and unfavorable responses; favorable responses were "strongly agree" or "agree," and unfavorable responses were "strongly disagree" or "disagree."

We also administered a 12-item questionnaire to instructors to evaluate their behaviors, although the specific items differed. All items were rated on a 5-point Likert scale (Appendix 3). No follow-up survey was sent to the instructors, as this was not the purpose of the study.

Before administering either of these questionnaires, we evaluated them for validity and reliability. The validity and reliability assessment was performed by 6 instructors certified in BLS (3 physicians and 3 nurses). This pilot sample was not included in the final sample. The questionnaires were found to be reliable, with Cronbach's alpha values of 0.88 and 0.85 (12 and 11 items) for instructors and trainees, respectively.

Statistical Methods

Statistical analyses were conducted using the IBM SPSS Statistics version 23.0 for Windows (IBM Corp., Armonk, NY, USA). The sample characteristics of instructors and trainees were presented with descriptive statistics (n (%) or mean ± standard deviation). Counts and percentages were used to describe the reaction, learning, and behaviors of trainees towards the BLS course, as well as the attitudes, behaviors, and satisfaction of instructors towards the BLS courses at MNG-HA.

RESULTS

A total of 580 questionnaires were distributed among the study participants, including 520 trainees and 60 instructors. Overall, 455 trainees (87.5%) and 53 instructors (88.3%) responded to the questionnaire (overall response rate: 88%). All of the trainees were healthcare professionals; physicians (n=160, 35.1%), nurses (n=150, 32.9%), technicians (n=73, 16%), occupational therapists (n=51, 11%), and EMS (n=21, 5%). Most of the instructors were nurses (n=30, 56.6%) and the rest were physicians (n=23, 43.4%) (Figure 1).
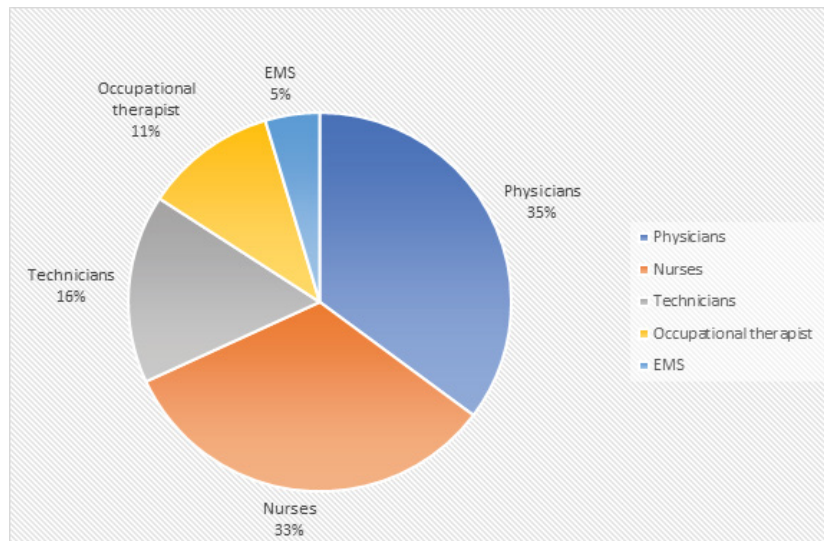
Figure 1 Distribution of basic life support participants

The mean reaction score for trainees was 55.6 ± 6.09 (range=12-60). The reaction score was also divided into 3 subcomponents: reaction to instructors, course content, and skill mastery. The majority of trainees thought that instructors were helpful in conducting the practice sessions (97.8%, n=445). Nearly all (97.4%, n=443) of the trainees thought that the course's objectives were clear. Similarly, most trainees believed that they were more likely to respond to emergencies because of the skills gained in this course (97.8%, n=445) (Table 1).

Table 1 Trainees reaction toward basic life support course

Questions (n=455)	Agree n (%)	Neutral n (%)	Disagree n (%)
Instructor			
Provided instruction and help during my skills practice session	445 (97.8%)	8 (1.8%)	2 (0.4%)
Answered all my questions before my skills test	442 (97.2%)	10 (2.2%)	3 (0.7%)
Was professional and courteous to the students	438 (96.3%)	15 (3.3%)	2 (0.4%)
Course Content			
The course learning objectives were clear	443 (97.4%)	9 (2.0%)	3 (0.7%)
The overall level of difficulty of the course was appropriate	438 (96.3%)	15 (3.3%)	2 (0.4%)
The content was presented clearly	438 (96.3%)	14 (3.1%)	3 (0.4%)
The quality of videos and written materials was excellent	434 (95.4%)	15 (3.1%)	6 (1.4%)
The equipment was clean and in good working condition	394 (86.6%)	42 (9.2%)	19 (4.2%)
Skill Mastery			
The course prepared me to successfully pass the skills session	446 (97%)	7 (1.5%)	2 (0.4%)
I am confident I can use the skills the course taught me	444 (97.5%)	9 (98.0%)	2 (0.4%)
I will respond in an emergency because of the skills I learned in this course	445 (97.8%)	8 (1.8%)	2 (0.4%)
I took this course to obtain professional education credit or continuing education credit	439 (96.5%)	10 (2.2%)	6 (1.3%)

The mean BLS knowledge score was 92.1 ± 7.06 (range: 64-100). More than 95% (n=432) of trainees scored above 84 on the initial BLS test. However, at the 6-month follow-up, to which 193 of the 455 trainees responded (response rate: 42.4%), the mean difference in knowledge score was -9.27 ± 12.9. The majority (72.5%) of trainees showed a reduction in knowledge scores (by 4 to 52 points). In contrast, 11.4% showed no change in scores, while 16% of the trainees have gained knowledge since their initial testing.

The mean behavior score of the trainees was 43.2 ± 4.29 (range: 24-55). Most trainees (n=442, 97.1%) were confident in their CPR skills after the program and were comfortable in initiating CPR on their own (n=417, 91.6%). Moreover, 66.1% (n=301) stated that they would become more confident in performing CPR as they gained experience (Table 2).

Table 2 Trainees behavior toward basic life support course

Questions (n=455)	Agree n (%)	Neutral n (%)	Disagree n (%)
This course is adequate to equip me to perform CPR confidently	556 (98.0%)	5 (1.1%)	4 (0.9%)
I can confidently save a life with my BLS knowledge and skills	436 (95.8%)	15 (3.3%)	4 (0.9%)
I am confident in my CPR skill	442 (97.1%)	8 (1.8%)	5 (1.1%)
I can confidently initiate CPR alone	417 (91.6%)	32 (7.0%)	4 (1.3%)
I think BLS should be re-evaluated at least once per year	176 (38.7%)	129 (28.4%)	150 (33.0%)
I can confidently use a defibrillator	377 (82.8%)	68 (14.9%)	10 (2.2%)
I am reluctant to use AED because I fear harming the victim	72 (15.9%)	60 (13.2%)	323 (71.0%)
I would perform mouth to mouth rescue breathing during CPR	226 (49.7%)	142 (31.2%)	87 (19.1%)
The most senior physician should perform chest compressions	112 (24.7%)	92 (20.2%)	251 (55.1%)
The senior I get the more confident I become in performing CPR	301 (66.1%)	70 (15.4%)	84 (18.4%)
If a colleague is performing chest compression incorrectly, I will try to politely interfere	407 (89.4%)	31 (6.8%)	17 (3.8%)
Difference in behavior score at 6 months (n=193)	**Mean**	**Decline**	**No change**	**Gain**
I am confident in my CPR skills	-0.21 ± 0.67	26.4%	65.8%	7.8%
I can confidently initiate CPR alone	-0.20 ± 0.73	29.5%	58.5%	11.9%
I am reluctant to use AED because I fear harming the victim	-0.10 ± 0.82	24.4%	59.1%	16.6%
I would perform mouth to mouth rescue breathing during CPR	-0.07± 0.79	19.2%	66.3%	14.5%
The senior I get the more confident I become in performing CPR	-0.07± 0.85	27.7%	51.3%	20.9%

The mean behavior score for instructors was 55.5 ± 4.44 (range=44-60). The majority of instructors believed themselves well prepared for the course (98.1%, n=52), and all instructors thought the amount of work required for the course was reasonable (100%). Instructors were overwhelmingly satisfied with their efforts throughout the course (96.2%). However, nearly half (41.5%, n=22) of the instructors believed that the course needed improvement. Nurses tended to have higher behavior scores than did physicians, but this difference was not significant (p=0.384) (Table 3).

Table 3 Instructor's behavior toward Basic Life Support Course

Questions (n=53)	Agree n (%)	Neutral n (%)	Disagree n (%)
I am well prepared for this course	52 (98.1%)	1 (1.9%)	0 (0.0%)
I demonstrate a thorough knowledge of Basic Life Support	52 (98.1%)	1 (1.9%)	0 (0.0%)
I maintain regular contact with all trainees during the course	53 (100.0%)	0 (0.0%)	0 (0.0%)
The amount of work required in this course was reasonable and appropriate	53 (100.0%)	0 (0.0%)	0 (0.0%)
I provide adequate feedback when a trainee has difficulties or questions	53 (100.0%)	0 (0.0%)	0 (0.0%)
I present course material at an appropriate pace	50 (94.4%)	3 (5.7%)	0 (0.0%)
I create a stimulating and learning atmosphere for all trainees	50 (94.4%)	3 (5.7%)	0 (0.0%)
Sometimes, I can be under pressure to pass trainees who have not demonstrated the skills successfully	12 (22.7%)	10 (18.9%)	31 (58.5%)
I am well aware of the core competencies of an AHA instructor	51 (96.2%)	1 (1.9%)	1 (1.9%)
This course needs improvement	22 (41.5%)	18 (34%)	13 (24.5%)
I am satisfied with my efforts during this course	51 (96.2%)	2 (3.8%)	0 (0.0%)
Considering all aspects, I would rate myself as a good instructor	39 (73.6%)	13 (24.5%)	1 (1.9%)

Six months after the BLS course, 26.4% of the trainees reported a decline in confidence in their CPR skills, while 65.8% exhibited no change. A total of 7.8% of trainees gained confidence in their skills. When asked about their confidence in initiating CPR alone, 29.5% of trainees showed a decline in scores, while 58.5% exhibited no change. A minority (11.9%) showed an improvement in confidence.

The reaction and behavior scores of trainees were significantly and strongly correlated (p<0.001). However, we observed no correlation between reaction and learning or behavior and learning (Figure 2).
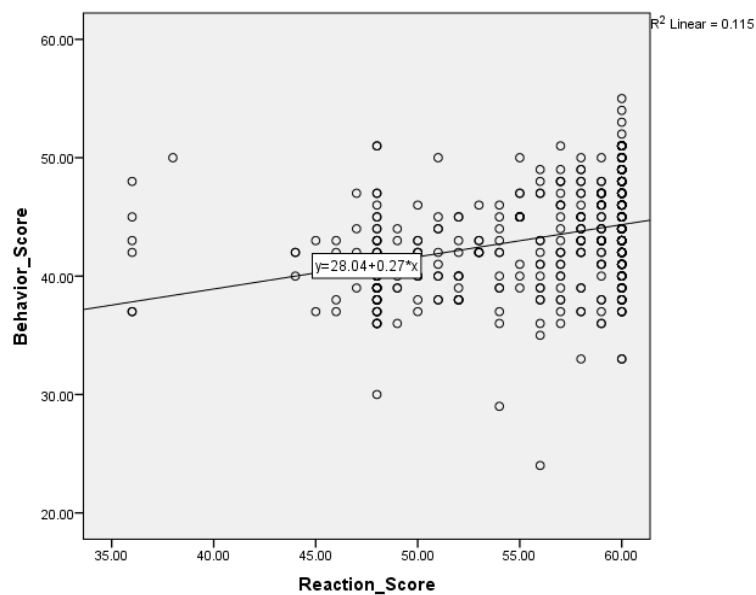
Figure 2 Correlation between reaction score (%) and behavior score (%) of trainees toward basic life support course

DISCUSSION

In this study, trainees' reactions to the BLS program were overwhelmingly positive. Specifically, they were content with their instructors and reported getting constructive feedback from the instructors. The courses provided by the PTC clearly present their content and adhere to goals set by the AHA. The trainees were largely pleased with the skills they obtained during the course.

However, we observed a significant decline in trainees' confidence. Over time, the trainees were more reluctant to use an automated external defibrillator (AED) (24.4%), citing the harm done to the patient as the main reason for not doing so. This finding contrasts with a local study conducted in 2017 on healthcare professionals' attitude toward BLS training, which revealed that participants were more confident in using an AED after taking the BLS course. The discrepancy in results might result from their use of a 3-month follow-up (whereas we used a 6-month follow-up) [20]. It is also possible that participants would undergo further behavior change beyond 6-months. The Resuscitation Quality Improvement (RQI) program might help in preventing such a loss of confidence [21].

As for the instructors, they generally believed that they were well-prepared for the course and thought they provided adequate feedback to trainees. The continuous delivery of productive feedback was highly appreciated by trainees, as evidenced by their reactions. To our knowledge, no prior studies have examined BLS course instructors' behavior in this regard.

Although the learning and behavior levels of the Kirkpatrick model are theoretically related, only a few studies have actually found a relationship between them. This might be attributed to the difference between the real-life work environment and that of training. However, find a significant relationship between trainees' reactions to the BLS course and behavior (p<0.001).

As noted earlier, healthcare professionals lose up to 50% of their knowledge within the first 3-months of training [2]. Another study revealed remarkable deterioration in CPR knowledge during the first 8-weeks after training [22]. Poor resuscitation skills among healthcare professionals are related to poor prognosis among patients with cardiac arrest [23]. Although a BLS license is valid for 2 years, it remains unclear what the ideal amount of time is between 2 courses [24,25]. The RQI program is the AHA's solution to the low-quality CPR and the rapid deterioration of knowledge. This program uses low-dose, high-frequency CPR training (10-15 minutes) throughout the year on a quarterly basis (rather than once every 2-year). Furthermore, it uses an e-simulation station that mimics real life and gives extensive feedback after the simulation is finished. According to a major study, the RQI program led to a 21% increase in survival rate one year after its implementation. This new approach also improved trainees' confidence in their CPR [21].

Limitations

This study has several limitations. First, it was conducted at a single institution. Therefore, multicentre studies are required to ensure better external validity and to generalize the results to other settings. Second, the reaction and behavior components were measured using a questionnaire, which is susceptible to response bias. Thus, the conclusions that can be drawn from our results may be limited. Finally, the response rate was low-less than 50% of participants responded to the questionnaire in the second phase.

CONCLUSION

This study examined the effectiveness of a BLS course using the Kirkpatrick model. Overall, results showed that healthcare professionals had positive reactions towards the course and experienced improvements in their BLS-related behaviors. To ensure the delivery of high-quality CPR, frequent updating of CPR skills and knowledge is imperative.

DECLARATIONS

Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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