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Enriching nursing knowledge and practice in Jordanian government hospitals through basic life support simulation training: A randomized controlled trial

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Abstract

Background: Healthcare providers must possess the necessary knowledge and skills to perform effective cardiopulmonary resuscitation (CPR). In the event of cardiopulmonary arrest, basic life support (BLS) is the initial step in the life-saving process before the advanced CPR team arrives. BLS simulation training using manikins has become an essential teaching methodology in nursing education, enhancing newly employed nurses' knowledge and skills and empowering them to provide adequate resuscitation.

Objective: This study aimed to evaluate the potential effect of BLS simulation training on knowledge and practice scores among newly employed nurses in Jordanian government hospitals.

Methods: A total of 102 newly employed nurses were randomly assigned to two groups: the control group (*n* = 51) received standard training, and the experimental group (*n* = 51) received one full day of BLS simulation training. The training program used the American Heart Association (AHA)-BLS-2020 guidelines and integrated theoretical models such as Miller's Pyramid and Kolb's Cycle. Both groups were homogeneous in inclusion characteristics and pretest results. Knowledge and practice scores were assessed using 23 multiple-choice questions (MCQs). Data were analyzed using one-way repeated measures ANOVA.

Results: The results indicated significant differences in knowledge scores, $F_{(2, 182)} = 58.514$, $p < 0.001$, and practice scores, $F_{(2, 182)} = 20.134$, $p < 0.001$, between the control and experimental groups at all measurement times: pretest, posttest 1, and posttest 2. Moreover, Cohen's d reflected the effectiveness of BLS simulation training as an educational module, showing a large effect (Cohen's d = 1.568) on participants' knowledge levels and a medium effect (Cohen's d = 0.749) on participants' practice levels.

Conclusion: The study concludes that BLS simulation training using the AHA-BLS-2020 guidelines and integrating theoretical models such as Miller's Pyramid and Kolb's Cycle significantly improves knowledge and practice scores among newly employed nurses, proving highly effective in enhancing their competencies in performing CPR. Implementing BLS simulation training in nursing education programs can significantly elevate the proficiency of newly employed nurses, ultimately improving patient outcomes during cardiopulmonary arrest situations. This training approach should be integrated into standard nursing curricula to ensure nurses are well-prepared for real-life emergencies.

Trial Registry Number: NCT06001879

Keywords

Jordan; simulation training; cardiopulmonary resuscitation; basic cardiac life support; education; nursing; hospital; clinical competence; curriculum

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Background

Successful cardiopulmonary resuscitation (CPR) requires adequate knowledge and practice (Kose et al., 2019). Basic life support (BLS) is considered the primary step of the life-saving process if there is a victim with cardiopulmonary arrest before the advanced CPR team arrives (Gutiérrez-Puertas et al., 2021; Isa et al., 2022; Park & Lee, 2021; Semeraro et al., 2021). Grasping essential BLS knowledge and practices is imperative for healthcare providers (HCPs) (Isa et al., 2022). Early CPR and defibrillation from 3-5 minutes increase the survival rate among cardiopulmonary arrest victims (Chowdhary et al., 2020; González-Salvado et al., 2018; Schroeder et al., 2023). Conversely, being one minute late to initiate chest compression reduces a victim's chance of survival by 7–10% (Asadi et al., 2021).

Simulation training (ST) has become a vital teaching methodology in nursing education to refine nurses' knowledge and practice (Al Gharibi & Arulappan, 2020; Ekert et al., 2021; Handeland et al., 2021; Higgins et al., 2020; Kose et al., 2019; Kuehnel et al., 2021; Lee et al., 2021). The endless BLS training and high-quality CPR training using simulation have a direct proportion with victims' survival and patient outcomes (Binkhorst et al., 2021; Isa et al., 2022; Laco & Stuart, 2022; Oermann & Gaberson, 2016; Schroeder et al., 2023; Zhou et al., 2020) and a reverse relationship with unwanted outcomes (Laco & Stuart, 2022). World Health Organization (WHO) defined simulations as a pedagogical approach to nourish nursing practice and move nurses to become experts (Martins et al., 2018). It is essential to develop an excellent way to learn BLS and advanced cardiac life support (ACLS). This helps the trainer to complete all the important outcomes of the procedure using advanced technology simulation (Aksoy, 2020). BLS practice improves with frequent BLS practice training (Knipe et al., 2020). The American Heart Association (AHA) mentions that the knowledge and practice of BLS should be updated according to the necessities and new events (Kose et al., 2019).

Cardiopulmonary arrest has become a major cause of high mortality rates (Abelsson et al., 2020; Paddock, 2021). The COVID-19 pandemic increased the number of cardiopulmonary arrest incidents by 39% annually (Teoh et al., 2021). Cardiopulmonary arrest increases during the COVID-19 pandemic affected the quality of CPR because rescuers were concerned about the transmissibility of the viruses by generating chest compression, ventilation, and defibrillation (Wyckoff et al., 2022). Newly employed nurses were dissatisfied after receiving online training during the 4th year of the study period during COVID-19 and wanted to attain on-ground hospital training (Suliman et al., 2021). Nurses must always gain knowledge and practice in BLS components (Sachdeva, 2020). BLS knowledge and practice briskly minimize over time without frequent BLS training (Abelsson et al., 2020; Zhou et al., 2020). Nurses' competencies in BLS decreased without refreshing training after three months of training (Laco & Stuart, 2022).

Nurses are the first HCPs who should be engaged in BLS training (Kose et al., 2019). Why? Nurses are the primary witnesses to cardiopulmonary arrest (Jang et al., 2021). By profession, nurses spend a long time with patients in the departments, and they are usually the first healthcare team to detect collapsed victims and notice cardiopulmonary arrest (Gräsner et al., 2021; Jang et al., 2021; Otero Agra et al., 2020; Qalawa et al., 2020; Sachdeva, 2020). Cardiopulmonary arrest requires immediate action within minutes from the available HCP nearest to the event (Nusser, 2021). The nurse is the first respondent to start BLS until the ACLS team arrives (Asadi et al., 2021; Dick-Smith et al., 2021). Finally, nurses should be ready to face cardiopulmonary arrest effectively and correctly (Rente et al., 2021; Rushton et al., 2020). Adequate BLS knowledge is essential for life-saving in cardiopulmonary arrest (Isa et al., 2022). Simulation plays a vital role in learning and helps learners acquire knowledge (Park & Lee, 2021). It is important for BLS learning to include practical training in addition to theoretical education (Lee et al., 2021; Rente et al., 2021).

This study examines the efficacy of simulation-based CPR training and explores its implementation within Jordan's unique setting. Only one quasi-experimental study was found in Jordan. The study aimed to determine the potential effect of simulation training in improving Basic Life Support skills among hospital nurses (Toubasi et al., 2015). Previous studies conducted in Jordan did not utilize the RCT research method and were primarily focused on nursing students instead of hospital nurses (Nash et al., 2019). Moreover, incorporating simulation in nursing education is crucial but requires unique learning theories (Briese et al., 2020).

Our study goes beyond merely applying simulation techniques; it also enhances training by integrating theoretical models such as Miller's Pyramid and Kolb's cycle (Nash et al., 2019). These theoretical frameworks propose valuable understandings of the theoretical and practical aspects of training, guiding the design and evaluation of simulation-based educational interventions. According to Martins et al. (2018), the WHO has recommended these two models as the most effective in guiding BLS training through simulation to enhance nurses' knowledge and skills. Miller's pyramid and Kolb's Cycle emphasize the importance of repeating the training until the trainees eliminate all mistakes under supervision and guidance. The learners receive feedback from the trainer to increase their technical proficiency.

Furthermore, these models assist trainers in gaining best practices in non-threatening environments and keeping patients away from harm. Therefore, our study aimed to evaluate the impact of simulation-based BLS training interventions on knowledge and practice scores among newly employed nurses in Jordanian government hospitals. The researchers hypothesized that there were no significant differences in the pretest mean. However, significant differences exist in the posttest means between the experimental and control groups in the knowledge and practice domains.

Methods

Study Design

The study was a prospective, single-masked, randomized control trial (RCT) using repeated measurement tests, including pretest and posttest immediately after the intervention and posttest-2 three months after the intervention. Pretests and posttests were completed using the Google Forms Platform link. This study was registered with the

ClinicalTrials.gov Protocol Registration and Results System (PRS), with registration ID number NCT06001879, on 16 August 2023.

Samples/Participants

Homogenous inclusion criteria between the control and experimental groups were ensured in this study (Sarvan & Efe, 2022). The researchers in this study selected nurses with less than two years of nursing experience working in non-critical hospital departments. The inclusion criteria also involve newly employed nurses who did not previously perform CPR in their professional practice and did not attend any BLS training at their or external institution. Furthermore, this study excluded participants with ICU capabilities (Laco & Stuart, 2022). ICU nurses often have extensive experience and training in CPR, which may influence the study results. This study excluded ICU nurses by verifying nurses' work experience area during data collection. By selecting nurses with less than two years of experience and excluding those with ICU experience, the study focuses on a homogeneous group of participants with similar BLS proficiency levels, thereby minimizing potential bias, enhancing the internal validity of the study, and allowing more accurate evaluation.

Sample size computation was performed using G*POWER software (version 3.1); parameters selected to calculate sample size include alpha ($\alpha = 0.05$), power ($P = 0.8$), and effect size ($ES = 0.275$). This study's sample size was 72 participants; a 30% dropout rate was added because the study lasted three months. The final sample size was 102 participants, 51 participants for each group. Computer-generated randomization (Random Allocation Software, version 1.0) was applied in blocks to distribute five hospitals into two arms. The first group was the control group, selected from three hospitals; the second was the experimental group, selected from two hospitals. The facilitator arranged with the nursing directors about how the study would proceed and prepared a list of the available participants who met the study's eligibility criteria. The researchers randomly selected the participants from the lists using Excel sheet randomization characteristics.

Instruments

This study used the American Heart Association (AHA) BLS questionnaire adopted from the previous study's questionnaire (Yunus et al., 2015) and divided into two parts: the knowledge part consisting of 13 MCQs and the practice part consisting of 10 MCQs; each correct answer was awarded one mark, and each wrong answer was given zero. The pilot study in this study was performed, and the AHA's BLS test Cronbach's α was (0.748), reflecting the suitability and stability of these tools.

Interventions

The control group participants spent between 90 and 120 minutes reading and comprehending the steps and instructions outlined in the standard intervention brochure for AHA-BLS 2020. The brochure included a brief guideline about basic life support guidelines. These participants were then directed to conduct the posttest based on the guidelines provided in the brochure. The simulation of a basic life support training intervention was prepared in English. The facilitator utilized the 2020-AHA guidelines for BLS training (American Heart Association, 2020) and integrated with theoretical models such as Miller's Pyramid and Kolb's Cycle (Nash et al., 2019). The researchers selected one full day, 5 to 7 hours, for training, consistent with previous studies (Knipe et al., 2020; Kose et al., 2019), with each session consisting of ten learners until the desired sample was reached. The intervention was simplified into two parts: the knowledge part of the training required two hours of PowerPoint presentations and the clinical simulation training part required three hours to acquire BLS practice.

Simulation in BLS training required low-fidelity manikins with simple tasks (Cura et al., 2020). The facilitator prepared the equipment needed for the intervention, which included adult and pediatric manikins, a Charlie simulator to relieve choking, bag-valve-mask ventilation, PPE, and a chest compression board. The manikins have chest inflation and deflation characteristics for rescue breathing, a palpable carotid pulse, and a spiral spring inside to allow chest recoil during chest compression. PPE was used according to the new BLS guidelines against COVID-19 (Bánfai et al., 2022). All equipment used in training sessions is checked and serviced at the end of each session. This includes inspecting manikins for wear and tear, verifying their functionality, and replenishing PPE. The lung of the manikin is a consumable plastic material and the most susceptible to damage. A stock of this consumable material is available to be replaced if needed after each session.

Data Collection

Data collection process is summarized in **Figure 1**.

Pretest the baseline data. Participants who fulfilled the eligibility conditions for the control and experimental groups started signing the informed consent form and filled out the demographic data and pretest within 30 minutes, which were proactive steps before the interventions. Many pretest sessions were performed depending on the nurses' availability; the response rate of the participants was 100% in the control and experimental groups. A previous study suggested that the trainees should perform a pretest before BLS training (Oermann & Gaberson, 2016). Measurement tools include research information sheets, consent forms, demographic data, and AHA's BLS, which was adopted from the previous study questionnaire.

Posttests (Acquisition phase and retention phase). Posttest-1 was performed in the acquisition phase immediately after the interventions; the response rate of the participants from both groups was 100%. Posttest-1 was carried out directly after the interventions, so no participants were dropped from this study in posttest-1. Pretest and posttests must be completed to determine the potential effect of the training program (Leighton et al., 2020).

The posttest-2 was performed three months after the intervention to evaluate knowledge and practice retention. The experimental group had 48 participants who completed posttest-2 with a response rate of 94%. Meanwhile, the control group had 45 participants who completed it with a response rate of 88%. The decrease in response rate was due to various reasons, such as participants not answering their cell phone calls, leaving the institutions, or working in different areas inside and outside the country. The researchers had anticipated a drop in the number of participants after three months. Initially, there were 36 participants in each group, but the number increased to 51 after the researchers accounted for a 30% dropout rate. To our pleasant surprise, the dropout rate for both groups was only 0.096%, a significantly lower figure than the researchers had expected.

The immediate test was performed to capture the intervention's initial impact and to assess the participants' ability to acquire knowledge and skills after the intervention, which can be called the acquisition phase. The second posttest was conducted to evaluate the retention level of knowledge or skills over time, called the retention phase. The delay of posttest 2 allowed the researchers to measure how well participants retained what they had learned. This allowed researchers to assess the long-term potential effect of the intervention beyond the immediate acquisition phase. Performing two posttests could also employ a repeated measurement statistical analysis such as ANOVA, which allowed researchers to assess the simulation-based intervention's unique effect on immediate acquisition and long-term retention.

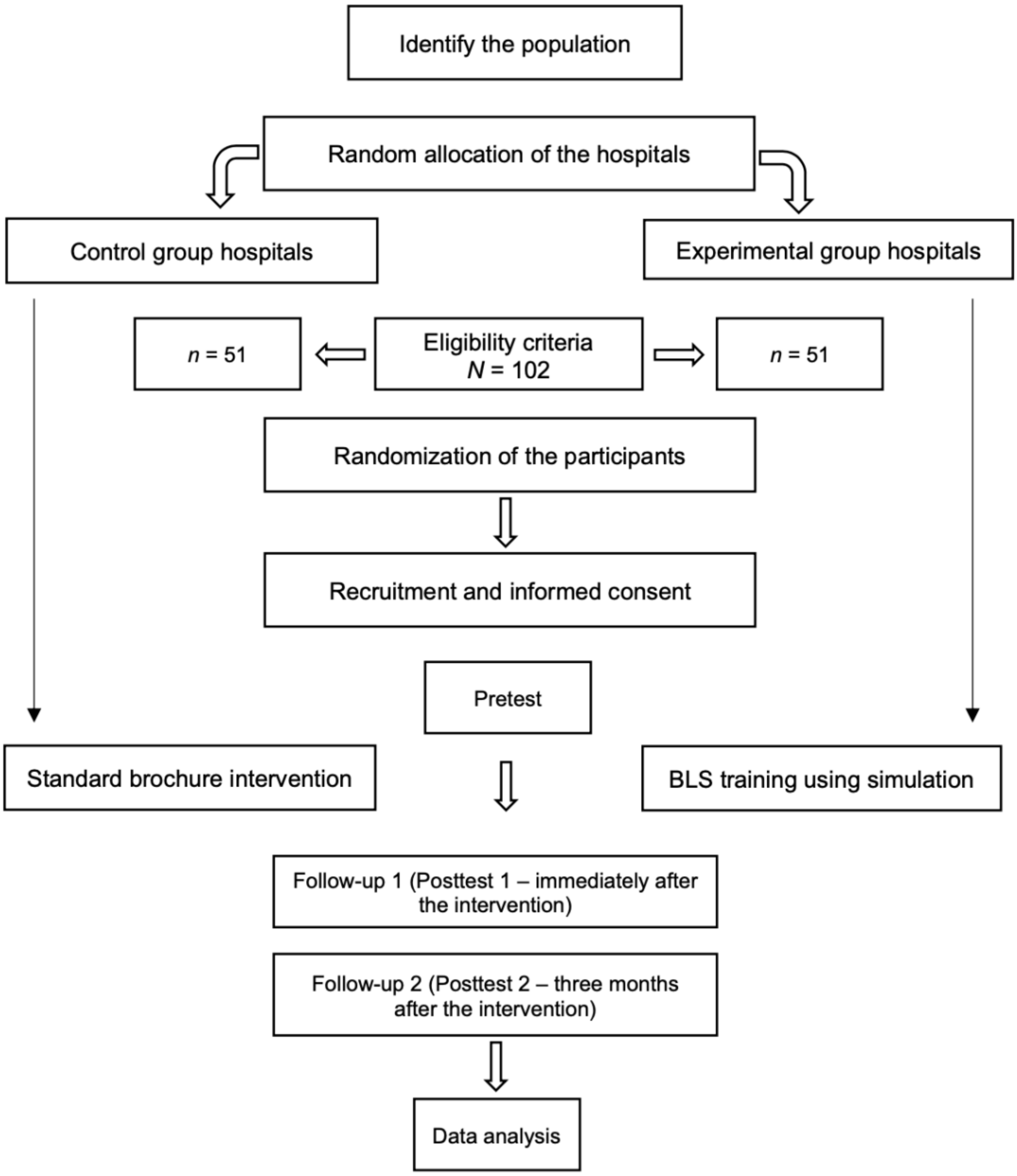

Figure 1 Study flowchart

Data Analysis

Data were analyzed using IBM SPSS version 27 for descriptive and inferential analysis. The descriptive analysis included numbers and percentages of participants' characteristics in both groups. One-Way Repeated Measures ANOVA was used to examine how similar and different the groups were on the pretest and posttest and how well the simulation worked as a BLS training intervention. In this study, the accepted p-value was <0.05; Cohen's d-effect size was calculated for each group to determine the potential effect of simulation in BLS training between the pretest and posttest. Cohen's d is interpreted as follows: small effect <0.2, moderate effect 0.2–0.8, and large effect >0.8 (La Cerra et al., 2019).

Ethical Consideration

This study was authorized by the Universiti Sains Malaysia—Human Research Ethics Committee with study protocol code USM/JEPeM/22110681, which complies with the Helsinki Declaration. The researchers discussed the study's objectives and risks before the participants voluntarily signed a hard copy of the consent form and became a part of this study. Participants' data were kept in a safe and confidential area. This study is free from hazards and medicine use and is not applicable in emergencies.

Results

Table 1 details the demographic data of participants in the control and experimental groups. Participants were predominantly aged 20-24, with 45 (44.1%) in the control group and 47 (46.1%) in the experimental group. A minority aged 25-29, with 6 (5.9%) in the control group and 4 (3.9%) in the experimental group. Gender distribution was similar, with 25 (24.5%) men and 26 (25.5%) women in the control group and 29 (28.4%) men and 22 (21.6%) women in the experimental group. Participants were homogeneous in key aspects: all hold a Bachelor's degree, most have less than one year of nursing experience, and none have received basic life support training or certification from accredited institutions, with 51 in each group for these categories.

Table 1 Demographic data of the participants in both groups

Demographic Data	Category	Control Group	Experimental Group	Total
		***n* (%)**	***n* (%)**	***n* (%)**
Age (year)	20-24	45 (44.1)	47 (46.1)	92 (90.2)
	25-29	6 (5.9)	4(3.9)	10 (9.8)
Gender	Men	25 (24.5)	29 (28.4)	54 (52.9)
	Women	26 (25.5)	22 (21.6)	48 (47.1)
Education level	Bachelor's degree	51 (50)	51(50)	102 (100)
Years of experience in the nursing field	Less than one year	46 (45.1)	45 (44.1)	91 (89.2)
	From 1 to 2 Years	5 (4.9)	6 (5.9)	11 (10.8)
Did you receive any basic life support training in your health institutions?	No	51 (50)	51 (50)	102 (100)
Have you received basic life support certification from accredited institutions?	No	51 (50)	51 (50)	102 (100)

Table 2 presents the results of a One-Way Repeated Measures ANOVA comparing knowledge and practice scores between control and experimental groups at three different test points: pretest, immediate posttest, and posttest after three months. For knowledge scores, the analysis yielded a significant F-statistic $F_{(2,182)} = 58.514, p < 0.001$, with the experimental group showing significantly higher scores than the control group at both immediate (mean difference = 2.125, p <0.001) and three-month posttests (mean difference = 2.400, p <0.001), despite no significant difference at the pretest (mean difference = 0.306, p = 0.391).

Similarly, practice scores also demonstrated a significant F-statistic $F_{(2,182)} = 20.134, p < 0.001$, with significant improvements in the experimental group over the control group at the immediate posttest (mean difference = 1.751, p <0.001) and three-month posttest (mean difference = 1.096, p = 0.002), although pretest differences were not significant (mean difference = 0.128, p = 0.660). The multivariate normality assumption for the ANOVA was satisfied.

Table 2 Differences in knowledge and practice scores between control and experimental groups

Knowledge & Practice Scores	Control Group	Experimental Group	Pairwise Comparison	
	Mean ± SD	**Mean ± SD**	**Mean Difference**	***p***
Knowledge				
Pretest	5.56 ± 1.686	5.25 ± 1.732	0.306	0.391
Posttest-1 (Immediate)	7.67 ± 2.286	9.79 ± 1.946	2.125	<0.001*
Posttest-2 (After three months)	5.93 ± 2.049	8.33 ± 2.137	2.400	<0.001*
$F_{(2,182)} = 58.514$, p <0.001[a]				
Practice				
Pretest	4.62 ± 1.319	4.75 ± 1.466	0.128	0.660
Posttest-1 (Immediate)	5.31 ± 1.649	7.06 ± 1.779	1.751	<0.001*
Posttest-2 (After three months)	4.80 ± 1.727	5.90 ± 1.601	1.096	0.002*
$F_{(2,182)} = 20.134$, p <0.001[a]				

Note: * Significant value at 0.05 | a One-Way Repeated Measures ANOVA was applied

Figure 2 displays the mean knowledge scores for experimental and control groups, revealing a significant immediate increase post-intervention for both groups, with the experimental group maintaining higher scores over three months compared to baseline. In contrast, the control group returned to baseline levels. Similarly, **Figure 3** shows mean practice scores, indicating a parallel trend where both groups saw immediate improvements post-intervention, yet the experimental group sustained higher practice scores over the three months compared to the control group, which regressed to baseline levels. These findings highlight the lasting benefits of simulation-based BLS training, with the experimental group demonstrating superior retention of knowledge and practice skills compared to the control group over an extended duration.

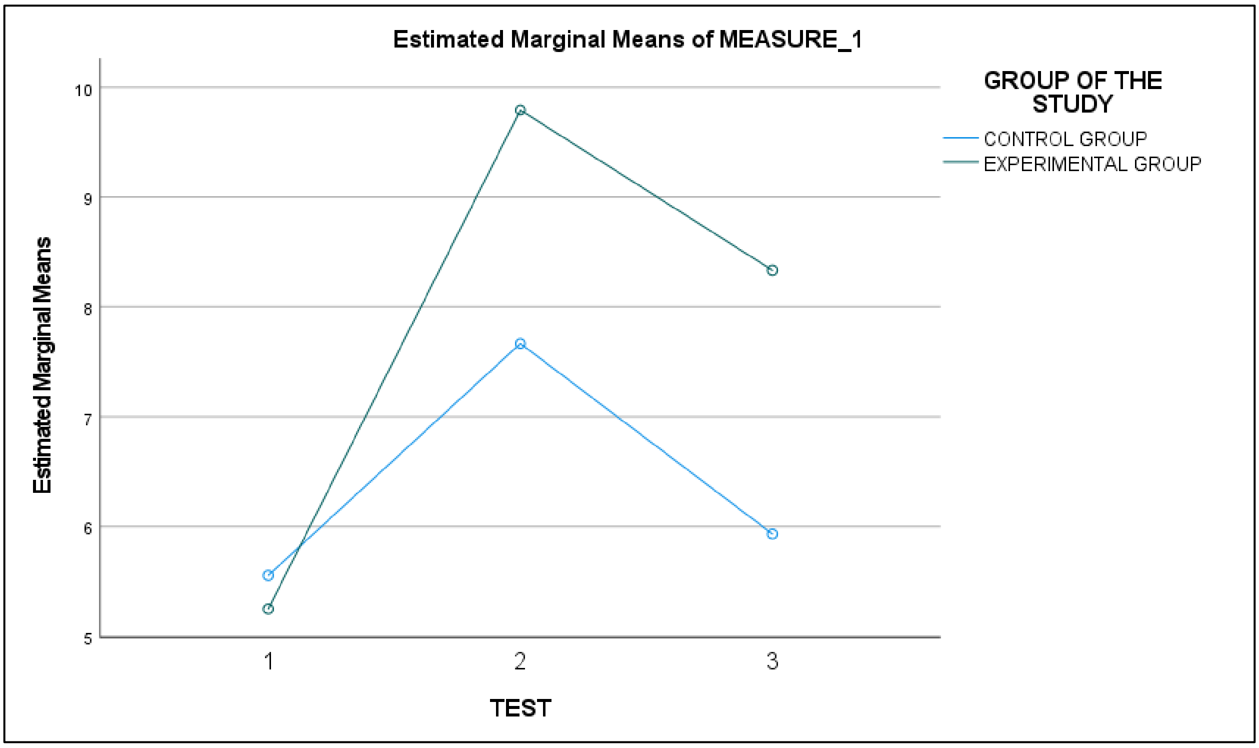

Figure 2 Knowledge mean based on group and time of measurements

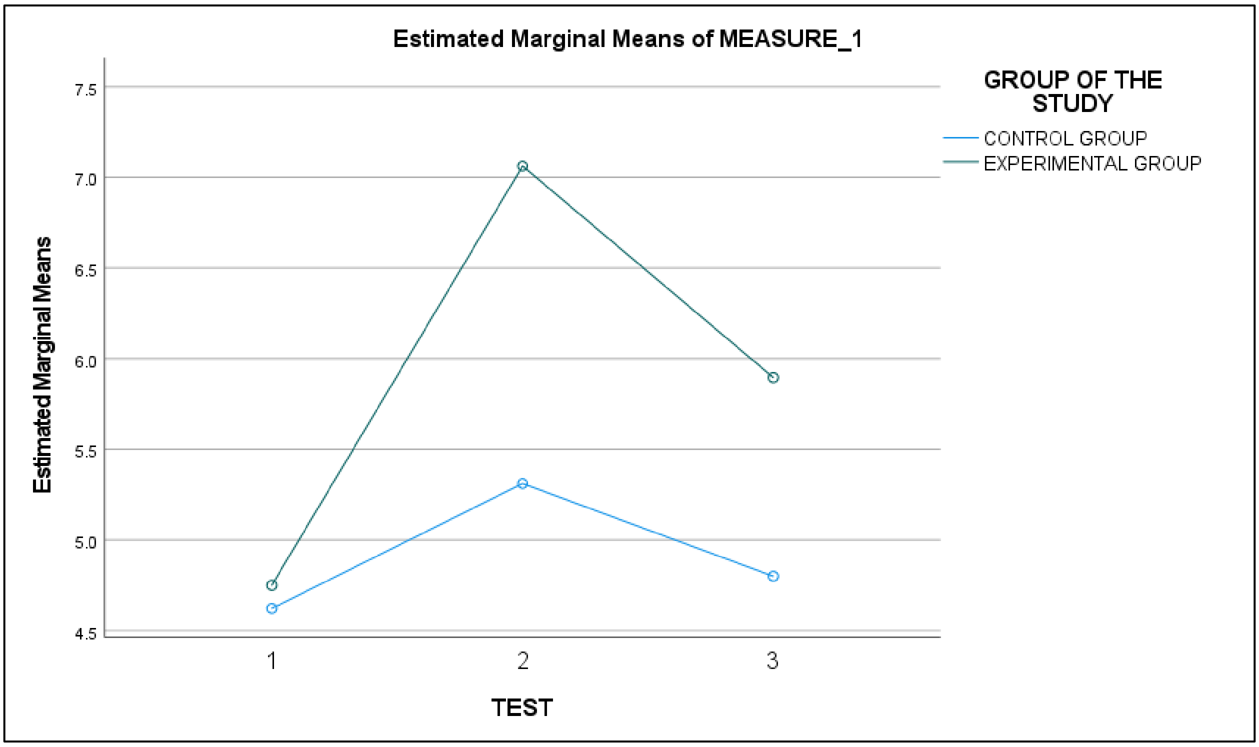

Figure 3 Practice mean based on group and time of measurements

The potential effect of simulation in BLS training was confirmed after calculating Cohen's d for the knowledge and practice domains (see **Table 3**) between pretest and posttest-2 in both groups. The value of Cohen's d reflected a "large effect" (Cohen's d = 1.568) in knowledge and a "medium effect" (Cohen's d = 0.749) in practice after the intervention. In comparison, the control group effect size results reflected a "low effect" on both knowledge and practice domains. In short, the results indicate the significant potential effect of simulation in BLS training on improving knowledge and practice among nurses.

Table 3 Effect size of the intervention in the experimental and control groups

Test Point	Knowledge				Practice			
	Experimental group		Control group		Experimental group		Control group	
	n	M ± SD	*n*	M ± SD	*n*	M ± SD	*n*	M ± SD
Pretest	51	5.25 ± 1.732	51	5.56 ± 1.686	51	4.75 ± 1.466	51	4.62 ± 1.319
Posttest-2	48	8.3 ± 2.137	45	5.93 ± 2.049	48	5.9 ± 1.601	45	4.8 ± 1.727
σ (Pooled SD)		1.945		1.876		1.534		1.536
Cohen's d		1.568		0.197		0.749		0.117
Effect level		Large effect		Low effect		Medium effect		Low effect

Discussion

The results of the current study are clear and correspond with the main objective of this study. Simulation in BLS training played a crucial role in participants' knowledge and practice development, and the training became more dynamic among participants; surprisingly, simulation in BLS training doubled participants' knowledge score from 5.25 in the pretest to 9.79 in the posttest-1 in addition to increasing participants' practice level, inspiring a remarkable improvement in BLS among participants. The current study's positive research findings on knowledge and practice scores agree with similar previous studies that used simulation in BLS training (Kose et al., 2019; Lee et al., 2021; Oermann & Gaberson, 2016; Umuhoza et al., 2021).

Two posttests were conducted to evaluate the impact of the intervention. The first posttest assessed the participants' ability to acquire knowledge and skills, while the second one evaluated the retention level of knowledge and skills over time. This approach allowed researchers to measure the intervention's immediate and long-term potential effects. This assessment method is similar to previous studies that conducted an immediate test after training to measure the level of knowledge acquisition (Bukiran et al., 2014; Qalawa et al., 2020). Moreover, the second posttest was conducted after six months to assess the knowledge retention level (Umuhoza et al., 2021).

Cohen's d indicates the potential effect and suitability of the simulation in the BLS training module as an educational method. Many earlier studies used the effect size to identify the potential effect of CPR training (McKelvin & McKelvin, 2020; Otero Agra et al., 2020; Sarvan & Efe, 2022). Cohen's d result in the practice domain was one of the anticipated findings as a medium effect because those participants during training mentioned that they were not satisfied due to online training during the COVID-19 pandemic for the last two years in the study period, and they had never been involved in any clinical training. Similar previous studies in Jordan during COVID-19 found that many students preferred face-to-face training with their clinical instructor and were unhappy with online clinical training (Barakat et al., 2022; Muflih et al., 2021).

There are several possible explanations for why the current study has yielded positive results, which could be attributed to, firstly, the AHA-BLS-2020 guidelines, secondly, the learning strategies used concurrently with the integration of two theoretical models in training: Miller's Pyramid and Kolb's Cycle; too, newly employed nurses were highly motivated to learn and adapt in their new work; and finally, the facilitator's educational level and his experience in the same field of study. AHA is the most prominent organization that nourishes the BLS and ACLS with updates through evidence-based practice and according to new circumstances (Kose et al., 2019). In 2015, the AHA changed the 2005 CPR guidelines from (ABC) airway, breathing, and circulation to CAB (Sé et al., 2019). The new modification of AHA BLS in 2020 was due to the COVID-19 pandemic and minimizing the spread of infection (Kei & Mebust, 2021; Laco & Stuart, 2022). A second possible explanation for positive results in knowledge and practice scores in the simulation in the BLS training group was the learning strategy used and the theoretical models that guided this study: Miller's Pyramid and Kolb's Cycle. WHO recommended these models as guidance in BLS training using simulation; WHO explained that these two models maximize knowledge and practice among nurses (Martins et al., 2018). Training requires unique learning theories to integrate simulation into nursing education (Briese et al., 2020).

The first level of Miller's pyramid is "KNOW," which considers acquiring the foundation and building block concepts before integrating the trainees in practice to achieve the desired outcomes (Nash et al., 2019). In the current study, the researchers presented BLS knowledge concepts through a PowerPoint presentation, consistent with a previous study (Chowdhary et al., 2020). Miller's pyramid has only one phase focused on knowledge and three phases focused on training and applying the knowledge learned previously in the Know phase; the three phases include know-how, show-how, and does. The second level, "know-how," relies on the facilitator, who teaches BLS practice using simulation and shows the learners how to perform CPR. BLS facilitators should have AHA certifications (Abelsson et al., 2020; Etlidawati & Milinia, 2021; Greif et al., 2021; Lee et al., 2021) and have enough experience in intensive care units, expertise in education, training, and communication skills (Greif et al., 2021). The higher education level of the facilitator is the easiest way for the learners to understand the BLS. All these characteristics were matched with the facilitator in this study. The third level of the Miller pyramid is "show-how." In the current study, the learners perform what they learned about BLS using simulation and focus on repeating training until they eliminate mistakes and difficulties. Repeating BLS training until errors and difficulties are eliminated was suggested in a previous study (Kose et al., 2019).

The facilitator of BLS is responsible for correcting the practice performance of the participants (Stærk et al., 2021). Once the learners have completed their training, the facilitators move to the "Observation and Reflection" step; this step is based on a previous study emphasizing the importance of allowing learners to reflect on their experience after simulation training (Nash et al., 2019). At the third level of training, the trainer receives feedback from the learners, and the facilitator focuses on formalizing the BLS concept through debriefing. Debriefing aims to increase understanding and retention of clinical training. Minimizing errors, participants' reflection, and debriefing are aligned with Kolb's Cycle model, which is integrated into the third phase of Miller's pyramid. Many previous studies and international institutions like AHA recommended using debriefing after simulation training for future educational strategy development and increased motivation (Laco & Stuart, 2022; Panchal et al., 2020; Wyckoff et al., 2022). When the learners finish the current BLS scenario, the facilitator will guide them to the fourth step in Kolb's Cycle and repeat Miller's Pyramid and Kolb's Cycle levels to complete all BLS new scenarios. The "Does" step in Miller's Pyramid indicates that the learners can apply BLS independently. Many previous studies confirmed that learners can independently perform BLS after training (Sarvan & Efe, 2022; Shrestha et al., 2020).

Another explanation that could enhance the current study's positive result is a high level of motivation among newly employed nurses to adapt to the new job. Previous studies mention that novice HCPs are highly motivated to build good knowledge and practice and adapt to new work (Umuhoza et al., 2021). The facilitator in this study explained the BLS training objective, method, and possible benefits to the participants. The participants were informed that they would receive completion certifications at the end of the study due to their participation. This idea was derived from a previous study that used certification rewards to increase learners' motivation (Giacalone, 2017). Moreover, simulation training increases learners' motivation; this idea aligns with a previous study that reported that simulation in training improved motivation toward training (Martins et al., 2018).

BLS retention is the ability to recall knowledge and apply practice effectively during CPR (Lee et al., 2021). In the current study, the second follow-up three months after the interventions was considered beneficial for furthering evidence and understanding the worth of the simulation in BLS training as an efficient educational method to improve knowledge and practice among nurses. The knowledge and practice scores decreased after three months but were higher than the pretest, and the participants could perform BLS independently. Conversely, posttest-2 scores in the control group returned near the pretest baseline, reflecting that the standard intervention was ineffective. Many studies stated that the BLS competencies decreased three to six months after simulation training but were still higher than the baseline (Dick-Smith et al., 2021; Laco & Stuart, 2022; Paliatsiou et al., 2021; Umuhoza et al., 2021; Zhou et al., 2020). The main factor that led to decreased knowledge and practice scores was the infrequent BLS training, especially in the department that rarely performs CPR (Lee et al., 2021). The researchers in this study recommended that the HCP perform frequent short-period BLS refreshing training to keep up-to-date with the new changes and retain BLS competencies. Many earlier studies recommended frequent short-period BLS sessions (Knipe et al., 2020), and others recommended performing BLS training every two years, the same as the AHA recommendation (Nusser, 2021; Semeraro et al., 2021).

Many theories focus on frequent training to retain the knowledge and practice level, including (i) Cognitive Theory: According to Cognitivism, frequent retraining accelerates neural pathway processing in the brain, leading to enhanced information retention. (ii) Behavior Theory: Behaviorism focuses on repeated training to retain and reinforce practice. Cognitivism and behaviorism were previously discussed in an earlier study as potential methods for retaining BLS competencies (Greif et al., 2021). (iii) The Decay theory, derived from the muscle strength theory, "use it or lose it," explains the forgetting process and mentions that the information becomes weak over time if not practiced (McEwen & Wills, 2019).

Implications for Nursing Practice and Policy

The positive results of this study suggest that BLS simulation training is highly effective in enhancing the knowledge and practice skills of newly employed nurses. For nursing practice, this implies that incorporating regular BLS simulation training sessions into the ongoing education and training programs can significantly improve nurses' ability to perform CPR effectively. This improvement is crucial for patient outcomes during cardiopulmonary arrest situations. From a policy perspective, healthcare institutions should consider making BLS simulation training a mandatory component of the initial training for newly employed nurses. Additionally, policies should be developed to ensure that nurses receive regular refresher courses to maintain their competencies over time. Implementing these policies can lead to a more competent nursing workforce, better preparation for emergencies, and improved patient care standards.

Limitations

There are limitations during this study: 1) five governmental hospitals from 121 hospitals in Jordan; 2) the use of standardized questionnaires in all measurement intervals assisted the participants in memorizing the previous questions and their answers in the next assessment.

Conclusion

The results of our study are clear and correspond with the main objective: Simulation in BLS training played a crucial role in participants' knowledge and practice development, significantly improving their BLS competencies. The study found that BLS simulation training doubled participants' knowledge scores and significantly enhanced their practice levels. These findings are consistent with previous research, demonstrating the effectiveness of simulation-based training in nursing education. By using the AHA-BLS-2020 guidelines and integrating theoretical models such as Miller's Pyramid and Kolb's Cycle, the training program effectively improved immediate knowledge and skills acquisition as well as knowledge retention over time. Given the evidence, it is recommended that BLS simulation training be integrated into standard nursing curricula and ongoing professional development to ensure nurses are well-prepared for real-life emergencies, thereby enhancing patient care and outcomes.

Declaration of Conflicting Interest

The authors declared that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Authors' Contributions

Yousef Abu-Wardeh: conceptualization, formal analysis, investigation, methodology, project administration, resources, software, validation, visualization, writing—original draft preparation, writing—review and editing, final approval of the version to be submitted. **Wan Muhamad Amir W. Ahmad**: conceptualization, data curation, formal analysis, methodology, resources, validation, writing—review and editing, final approval of the version to be submitted. **Mohd Shaharudin Shah Che Hamzah**: conceptualization, formal analysis, methodology, visualization, writing—original draft preparation, writing—review and editing, final approval of the version to be submitted. **Yahya W. Najjar**: conceptualization, formal analysis, investigation, methodology, software, validation, writing—review and editing, final approval of the version to be submitted. **Intan Idiana Hassan**: conceptualization, formal analysis, investigation, methodology, project administration, resources, supervision, validation, visualization, writing—original draft preparation, writing—review and editing, final approval of the version to be submitted.

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Data Availability

Data will be made available by the authors upon request.

Declaration of Use of AI in Scientific Writing

The study did not use generative AI in the writing process of this article.

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