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# A national cross-sectional study on the retention of basic life support knowledge among nurses in Palestine

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## Abstract

**Background** 17.9 million deaths worldwide were attributable to cardiovascular diseases. Basic life support is one of the crucial strategies that could increase chances of cardiac arrest victims' survival rate by nurses and other healthcare providers.

**Aim** The aims of this study was to examine the retention of the BLS knowledge among nurses in Palestine.

**Methods** A descriptive cross-sectional design was used to collect data from 108 nurses between February 2022 and April 2022 from two AHA-ITCs in Palestine. The instrument consisted of two sections; demographics and knowledge test which was developed by the researcher and contain a written examination containing 25 multiple-choice questions.

**Results** Out of 160 distributed questionnaires, 108 were completed by nurses as a convenience sampling technique. Over half of the participants were male (54.6%), and the majority had a bachelor's degree in nursing (75%). Analysis identified that there was a significant difference ( $t(107) = 18.02, p < 0.001$ ) and less knowledge score in the year 2022 ( $M = 65.48, SD = 15.42$ ), compared to the year 2020 ( $M = 92.09, SD = 4.01$ ). The mean knowledge reduction was 26.61 and  $P < 0.001$ . The results showed no statistically significant differences in terms of level of BLS knowledge in all sociodemographic, except the level of education.

**Conclusions** The results of this study revealed weak retention of BLS knowledge among nurses in Palestine between the years 2020 and the year of 2022. Nurses must regularly participate in BLS training and attend frequent in-service CPR training at least every 6-months to decrease the likelihood of knowledge and skills loss over time. Blended learning BLS is one of the methods to retain more knowledge and skills of BLS.

**Keywords** BLS or Basic Life Support, CPR or Cardiopulmonary Resuscitation Healthcare providers, Nurses, Palestine, Knowledge, Retention

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## Introduction

Cardiovascular disease (CVD) is the leading cause of death worldwide with a prevalence of annual 17.3 million deaths [1]. Furthermore, WHO reported on its official website that according to estimates, 17.9 million deaths worldwide in 2019 were attributable to CVDs, representing 32% of all global fatalities, heart attack, and stroke deaths accounted for 85% of these fatalities [2]. It is noticeable that the prevalence of CVD is increasing from 2017 to 2019 which needs early management. In the United States (US), around 209,000 in-hospital cardiac arrests (IHCA) occurred in 2016 [3]. Also, each year, 450,000 people experience sudden Cardiac Arrest (CA) outside of a hospital in the US [4]. In European countries, IHCA is a major cause of death, and it causes a tremendous burden on their healthcare systems and resources [5].

In the Mediterranean region, there is a high number of CVD and CA cases as well. For instance, in Palestine, according to the annual report released by the Ministry of Health (MOH) in 2022, CVDs was the first cause of death 22.2% of all total death in 2022 [6]. The high numbers of CA cases indicated a need for training programs such as Basic Life Support (BLS) to deal with such cases and increase survival rates [7].

On one hand, Basic life support training is one of the crucial strategies that could increase the chances of cardiac arrest victims' survival rate by healthcare providers, including nurses, physicians, paramedics, and other healthcare professions [7]. On the other hand, some published studies discussed the issue of loss of BLS skills and knowledge over time [8–10]. Substantial evidence exists in the published literature on the loss of resuscitation knowledge and skills shortly following the annual competency assessment [10]. Cardiac arrest may lead to permanent brain damage and eventually death due to reduced blood flow when not properly managed [7]. Recent studies have shown that the survival rates remained low at 11.4% for outpatient cardiac arrest and 23.8% for in-hospital heart attacks, even when CPR procedures were applied [11]. In the US, approximately 209,000 hospital cardiac arrests (IHCA) occur annually with less than a 25% survival rate [3].

The decreased retention of BLS competency over time- that found in many studies-encouraged researchers to conduct studies to examine and explore this issue in depth, aiming at finding solutions, hence improving the chance of survival and patient outcome as well as healthcare providers' competency in BLS. There are many dimensions and contexts that may have devastating effects and enhance the decay of knowledge as skills.

To ensure that CA cases receive optimal resuscitation care, nurses must retain adequate level of knowledge and skills of BLS [12]. It is known that nurses are the largest

healthcare body in the healthcare system either internationally or here in Palestine and they are usually the frontline and first direct contact with cardiac arrest victims in health facilities [6]. For this reason, nurses were recruited as a sample for the purpose of this study. It is essential to examine the level of knowledge and skills retention among healthcare providers including nurses who are the first and early direct contact with CA victims, thus knowing the items or aspects of knowledge decay and improving them. This may increase the survival rates from CA and improving the quality of life.

In Palestine, few studies were conducted regarding BLS. Up to the researcher's knowledge, only two studies were found that studied the BLS training program. One examined the knowledge of nursing students, and the other assessed schoolteacher's knowledge and attitude regarding BLS [13, 14], and non-of them examined the BLS retention of knowledge. It is essential to build baseline data in Palestine about BLS among nurses in terms of knowledge. This may help in guiding the healthcare system to pursue a strategy to improve the survival rate among CA cases. Therefore, the main purpose of conducting the current study was to examine the retention of BLS knowledge among Nurses who learned the BLS course in 2020 in Palestine.

## Method

### Design

A quantitative descriptive cross-sectional design was used for the purpose of this study. In a descriptive cross-sectional design, data are collected at one point of time. The reason behind using this design is that this design fits the purpose of this study to answer the research questions. BLS training is an AHA standardized course that aims to improve people's awareness, competency, and attitudes regarding CPR and the use of AED. In the research field, to address the retention of knowledge of participants like nurses in this study, a descriptive cross-sectional study is needed to measure nurses' retention at one point of time. Also, due to the researcher's intention to evaluate the retention of knowledge, nurses who already have valid BLS certificates are available and could be reached and approached through a cross-sectional design. The study design fits into the research purpose because it describes the main variables of the study at a fixed point of time without manipulation of the independent variable, randomization into groups, or control [15].

### Settings

There are four primary areas that make up the Palestinian health system: the government sector (the Palestinian Ministry of Health and Military Medical Services), the United Nations Relief and Works Agency, non-governmental organizations, and the commercial sector. These

several industries are involved in providing citizens with health care services at all levels: primary, secondary, and tertiary. The continuity of the Palestinian healthcare system and the provision of high-quality, all-inclusive healthcare to all Palestinians are priorities for the Palestinian Ministry of Health. According to the health annual report of the Palestinian Ministry of Health, there were 14,593 nurses in Palestine in 2021 and distributed to 10,557 and 4036 in West Bank and Gaza, respectively. Nurses are the largest health human resources in Palestine compared to physicians, dentists, pharmacists, and midwives. For this reason, the sample of this study was nurses as well as they are usually the frontline and first direct contact with cardiac arrest victims in health facilities [6].

In Palestine, there are six main international-AHA training centers: Arab American University Palestine (AAUP) Heart Center in Jenin City, An Najah University Life Support Training Center in Nablus City, The Modern University College Heart Center (MUC-Life Support Center) and Juzoor for Health & Social Development Heart Center, both in Ramallah city, Life Support Center of Al-Quds University (LSC-A-Quds University) in Abu Dis- Jerusalem, and Bethlehem University - Clinical Simulation Center in Bethlehem city. Arab American University Palestine (AAUP) Heart Center from Jenin City, and An Najah University Life Support Training Center from Nablus City, were the only two included settings in this study due to some reasons. First, they were established before the year 2020, when the researcher started to collect the data retrospectively from 2020 and above for BLS certificate holders. In addition, they gave their approval to the researcher to collect the data. Finally, they are large ITC-AHA in Palestine compared to other ITCs, and according to the search record they are training many candidates inside the University for students and staff, and outside the University for healthcare providers and non-healthcare providers.

Each AHA international training center has a data set for all their candidates who hold a valid BLS certificate. In this data set, they have full information about their BLS providers including nurses. The mentioned information includes their full names, valid e-mail address, phone numbers, place of residence, and the final score of their written exams that measured the knowledge level and all formats (paperwork) that measure each participant's skills. This recording system facilitated researcher accessibility to the participants and the required data after obtaining the required ethical approval.

### Sampling and Sample

It is known that nurses are the largest healthcare body in the healthcare system either internationally or here in Palestine. For this reason, nurses were recruited as a

sample for the purpose of this study and to answer the research questions. The target population in this study was all nurses in Palestine. The accessible population is the nurses who already have BLS certification in the AHA training centers in Palestine after 2020. This study utilized a convenience sampling technique to recruit the study sample. There was an eligibility criterion for nurses who were included in this study. First, any nurse who had a valid BLS certificate from Heart Centers in Palestine and fulfill the eligibility criteria has been invited to participate in this study. This study included any nurse who has at least 6 months' clinical experience after university graduation. They should have the BLS certificate from 2020 to 2021. This period is targeted due to the update that AHA releases every five years and the old version of material and exams was from 2015 to 2019, therefore, the 2020 written exam is the last updated material and exams. The researcher planned to recruit nurses from the six AHA training centers in Palestine in an attempt to measure and compare the retention of BLS knowledge, but only two ITCs were included due to some challenges such as newly developed ITCs and the difficulty to obtain approval to access data from some of them.

### Sample size

Regarding the sample size, G\*power program 3 was used to calculate the minimum required sample size [16], the minimum needed sample size for a paired sample's t-test, with a power of 0.80, a medium effect size (Cohen's  $d=0.25$ ), and alpha of 0.05, the required sample size was 128. All nurses from Arab American University Palestine (AAUP) Heart Center from Jenin City and An Najah University Life Support Training Center from Nablus City and have taken the BLS course in 2020, were included as a sample in this study. A total of 350 participants were enrolled to take the BLS course in 2020 in both centers and have been found in the record system of both ITCs. After refining these data sets, a total number of 170 BLS holders were found to be non-nurses, such as physicians, laboratory technicians, radiology technicians, and nurses' students, therefore, they were excluded. The rest were 180 nurses who were approached and included in this study. Of the 180 nurses, 108 responded and agreed to participate in this study. Hence, the sample size in this study and who were entered in the analysis were 108 nurses. Therefore, the response rate of participants was 60%.

The researcher gets the roasters from the administrators of both ITCs and these roasters contained full information about BLS providers who took the course of BLS. The participants' information includes the name of the participant, their email address, their phone number, and their knowledge score of the BLS written exam out of 100%. The researcher communicated to each

participant via either e-mail or mobile phone at a suitable time and introduced the researcher's self as PhD student from the Nursing program at The University of Jordan and explained the purpose of the study. Moreover, the researcher stated that the participation is voluntary, and all collected data will be confidential and anonymous, and the data will be secured and private.

### Measurements

This study has two main instrument packages which were developed by authors (found in the supplementary file). Demographics is the first one, which included sex, age, year of experience in nursing, practice area (Department or unit where the participant is working), academic qualification, and previous exposure to cardiac-arrest cases, and previous exposure to BLS materials in colleges or voluntary training, and when exactly (the month) they take the BLS certificate in the year 2020 (Appendix C).

The second instrument is the knowledge instrument for BLS which was developed by a researcher based on recent literature and a panel of experts (Appendix D). The Knowledge instrument is an instrument that measures nurses' knowledge of BLS, that is a written examination containing 25 multiple-choice questions with a single best answer for each, and a minimum score of 21 (84%) is required to pass the examination. The researcher has planned to use the AHA BLS written exam, which is a standardized test developed by AHA in the updated version of 2020 (AHA, 2020), but the AHA refused to give permission (Appendix B). Therefore, a new Knowledge written exam was developed that is parallel in the number of questions of the AHA exam (25 MCQ) and almost close to the kind of AHA questions. The researcher did that to make a comparison between the two times in 2020 and 2022. Face validity was done to the questions by presenting the questions to a panel of experts in both the academic emergency nursing field and clinical emergency nursing field. Two emergency nursing specialists examined the questions and highlighted some points of view

that were taken into consideration to give more clear and relevant questions that measure nurses' knowledge of BLS. Also, two nursing academics who hold PhD degrees in nursing and have BLS instructor certificates refined the 25-MCQ by suggesting omitting and adding some little questions, and their recommendation were taken into account. For example, they suggest adding questions regarding rescue breathing which was added (question number 6 in Appendix D), and question number 13 in appendix D about team dynamic and communication during BLS. The 25-MCQs were based on the following four sources: American Heart Association Guidelines for CPR and ECC-Part 3: Adult basic and advanced life support 2020 [17], BLS Pretest Questions and Answers Online, 2021 [18], four valid BLS AHA instructors, and [19]. The 25-MCQ could be divided into seven categories, each category measured an aspect of BLS. These categories are presented in Table 1, and each category has a number of questions that measure BLS aspect.

The questionnaire was built online on Microsoft Teams and sent to participants via either email or WhatsApp.

### Data Collection Procedure

When the ethical approvals were obtained from the required agencies, the researcher started the data collection. Data collection had two main phases. In the first phase, the researcher referred to the data set of each AHA center (called the roasters) to extract the nurses who already have valid BLS certificates between 2020 and 2021, as in the roasters, all healthcare providers including nurses are written in the same roaster without identification of their job title. Because of the previous issue, the researcher phoned and introduced himself to each certified BLS in 2020 and ask if he/she is a nurse or not. After obtaining their names and their contact information such as phone numbers and email they were contacted and informed about the study and were asked if they wish to be a part of this study, which is voluntary. An arrangement with all nurses who agreed to participate in this study for a meeting or call in the second phase.

In the second phase, the researcher contacted each participant by phone at a suitable time for him/her after responding to a text message. In this phone call, a full explanation of the study's purposes was introduced and either a WhatsApp or email was documented and saved for participants. And the questionnaire was sent via one of these two electronic methods, and they were asked to fill in the forms at their suitable time. A consent form which was on the cover page- signed by each participant who wants to be engaged in this study. Participants were asked to fill out the study package. Finally, the researcher appreciated and thanked all the participants for their participation and contribution to the success of this study. Participants were told and ensured that the privacy and

**Table 1** The 25-Multiple choice question for basic life support knowledge test (25-Questions)

No.	Question Category	Number of question/s	Question number in Appendix D
1.	Adult chain of survival	1 question	1
2.	Steps and sequence of BLS	4 questions	2,3, 5, and 14
3.	High-Quality CPR	9 questions	4, 8, 9, 11, 12, 15, 21, 24, and 25
4.	Breathing	2 questions	6 and 7
5.	AED	3 questions	10, 20, and 23
6.	Team Dynamic Communication	2 questions	13 and 22
7.	Choking for adult and infant	4 questions	16, 17, 18, and 19

confidentiality of participation was preserved, and each participant who needs a copy of the results will be given upon request. The period of data collection was between February 2022 and April 2022. Since the study involves analyzing data collected from 2020 and comparing it with data from 2022, it is classified as a cross-sectional study. This design allows us to examine historical data to identify trends, associations, or outcomes over time, utilizing pre-existing information rather than tracking participants prospectively. Missing data were addressed by excluding the affected cases from the analysis to ensure the integrity and accuracy of the results.

### Ethical considerations

Approval from the Scientific Research Committee at the School of Nursing-The University of Jordan was obtained (NO. 90/2020/152). In addition, approval from the Ethical Committee at the selected AHA Heart Centers in Palestine was gained before data collection. Procedures were strictly aligned with applicable standards and laws, including the Declaration of Helsinki. Informed consent to participate was obtained from all of the participants in the study. A self-reported questionnaire was used to collect data. The participants' permission was gained after communicating with them. The researcher explained to the participants about the study's purpose and the subjects' rights that will be preserved. They informed that participation in this study is voluntary, and the researcher will protect the confidentiality of the participants by using coding the data collection package and separating the master list that has participants' information. Moreover, detailed information about the objectives of the study, and the needed time to fill in the questionnaire was included in a cover letter, which was attached at the beginning of the instrument. The questionnaires were collected by the researcher himself from each participant. Each participant was appreciated and thanked for participating in this study. Only the researcher and the academic supervisor have access to questionnaires, and after five years, all questionnaires will be shredded.

### Data Analysis

All statistical procedures were analyzed using Statistical Package of Social Science (SPSS, Chicago, IL, USA) [20] version 26.0. Missing data were treated according to the condition, and there will be two methods of treating the missing value. The first method is to replace the missing value by means, such as age. But in some cases, the questionnaire should be deleted if many items were missed [15]. In this study we preferred to omit any missing data from analysis and results. The assumptions for each test were checked before carrying out the test. The data was in a Microsoft Teams online form and transferred to an SPSS file meticulously to prevent any missing data.

Descriptive statistics were conducted to calculate the mean, standard deviation (SD), and frequencies of the study variables. The ANOVA test used to determine whether a statistically significant difference in the means of three or more groups. Also, the Paired sample t test was used to examine the mean difference of BLS knowledge in 2020 and 2022. Since the data were normally distributed and met the assumptions for parametric tests, we used parametric methods in the data analysis.

### Pilot study

Before conducting this study, the researcher distributed the tool package of the two-section including the demographics and knowledge instrument to 15 nurses to test the clarity of items and their language. The instruments were clear, and no changes were made, and those 15 nurses were excluded from the study analysis.

## Results

### Nurses' socio-demographic variables

Out of 160 distributed questionnaires, 108 were completed by nurses giving a response rate of 68%. The sample characteristics were analyzed by descriptive statistics (Table 2). Over half of the participants were male (54.6%), and the majority had a bachelor's degree in nursing (75%). The majority of participants' age group was 20–29 years old (76.9%). More than half of nurses (67.6%) had 1–5 years of experience in nursing. The most area of practice for the participants was specialized units (38%). The majority of nurses had bachelor's degree in nursing, exposed to cardiac arrest cases, and claimed they have guidelines in the area of practice to deal with cardiac arrest (75%, 84.3%, 77.8%), respectively.

### Knowledge Retention of BLS

Table 3 shows the 25 knowledge questions answered by participants with their percentages of correct answers. The results illustrated that the highest three correct items according to the participants' answers were items number 12, 14, and 8 which represent the area of compression (95.4%) when starting CPR (95.4%), and the correct rate of chest compression for adults and children (91.7%), respectively. On the other hand, the correct depth of compression for children, the step that is not a part of the five steps in the Adult Chain of Survival, and the recommended Basic life support (BLS) sequence for 2020 the International Liaison Committee on Resuscitation (ILCOR) guidelines, were the lowest correct answers, ( $n=29$ , 26.9%), ( $n=32$ , 29.6%), and ( $n=50$ , 46.3%), respectively.

### Knowledge of BLS in year 2020 compared to year 2022

Table 4 revealed the results of comparing participants' BLS knowledge scores between the years 2020 and the

**Table 2** Socio-demographic characteristics of the nurses (N = 108)

Variables	n	%
Sex		
Male	59	54.6
Female	49	45.4
Age groups		
20–29	83	76.9
30 and above	25	23.1
Level of education		
Diploma	8	7.4
Bachelor's degree	81	75.0
Higher education	19	17.6
Years of experience in nursing		
less than 1 year	5	4.6
1–5 years	73	67.6
6 years and above	30	27.8
Average of care for patients with cardiac arrest		
Never	15	13.9
Once a year	35	32.4
Once a month	28	25.9
Once a week	22	20.4
Every day	8	7.4
Area of practice		
Intensive Care	31	28.7
Emergency	12	11.1
Medical Surgical (specialized units)	24	22.2
(specialized units)	41	38.0
Previous exposure and dealing with cardiac arrest		
Yes	91	84.3
No	17	15.7
Have specific guidelines in the unit to deal with cardiac arrest.		
Yes	84	77.8
No	24	22.2
The month of basic life support certificate in 2020		
January – April	42	38.9
May-August	36	33.3
September-December	30	27.8

year of 2022, using a paired-sample t-test was conducted. The analysis identified there was a significant difference ( $t(107) = 18.02, p < 0.001$ ) and less knowledge score in the year 2022 ( $M = 65.48, SD = 15.42$ ), and in the year 2020 ( $M = 92.09, SD = 4.01$ ).

**Table 3** Knowledge of Basic Life Support among Nurse in Palestine (N = 108)

No.	Knowledge Items	n (%) of correct answers
12.	Area of compressions	103 (95.4)
14.	When to start Cardiopulmonary resuscitation (CPR)?	103 (95.4)
8.	Rate of chest compression for adults and children	99 (91.7)
18.	Choking infant	96 (88.9)
10.	Steps to deal with an AED	87 (80.6)
4.	High-quality CPR	85 (78.7)
19.	The movement of the fist during abdominal first	85 (78.7)
20.	Benefit of defibrillation	84 (77.8)
13.	Team dynamic (Roles and responsibilities)	82 (75.9)
16.	The universal sign that appears when choking happens	79 (73.1)
24.	When should rescuers change positions	78 (72.2)
25.	Action that supports 2-rescuer CPR (Alternating compression role every two minutes)	76 (70.4)
6.	What to do if a person has a pulse, but does not have breathing	73 (67.6)
21.	Characteristics of chest compression in high-quality child CPR	65 (60.2)
2.	Steps of BLS	64 (59.3)
15.	The compression-to-breath ratio for single-rescue infant CPR?	64 (59.3)
5.	Action in the case of confirming somebody is not responding after shaking and shouting at him	60 (55.6)
23.	Unique circumstances consideration before using an AED (Hairy chest)	58 (53.7)
9.	Depth of chest compression for adults	56 (51.9)
7.	How to open the airway in a head trauma victim	54 (50.0)
17.	Dealing with a victim having a foreign-body airway obstruction becomes unresponsive	53 (49.1)
22.	Team dynamic (constructive intervention)	53 (49.1)
3.	BLS sequence for 2020 the International Liaison Committee on Resuscitation	50 (46.3)
1.	Adult Chain of Survival	32 (29.6)
11.	Depth of compression for children	29 (26.9)

Abbreviations: BLS: Basic Life Support, CPR: Cardiopulmonary Resuscitation, AED: Automated External Defibrillator

**Differences of BLS Knowledge in 2022 based on demographics**

Table 5 shows the differences in the BLS knowledge mean score of nurses in 2022 based on their socio-demographic characteristics. The Independent t-test and One Way ANOVA was used to assess the differences among variables. The results showed no statistically significant differences in all variables, except the level of education. A statistically significant difference

**Table 4** Comparison of BLS Mean knowledge score between 2020 and 2022

Variable	Knowledge 2020		Knowledge 2022		Mean Differecne M (SD)	CI 95%		t(df)	P	r
	M	SD	M	SD		Lower-Upper				
Knowledge	92.09	4.01	65.48	15.42	26.16 (15.35)	23.69–29.54		18.02(107)	0.00	0.15

M: mean; SD: standared deviation; CI: Confidence Interval; t:paired t test value; df: degree of freedom, p: 2-tailed significance; r: correlation

**Table 5** Differences of knowledge among Palestinian nurses based on demographics in 2022 ( $N=108$ )

Variables	<i>n</i>	Mean	SD	Statistical value	<i>P</i> -value
Sex					
Male	59	66.64	15.10	T=0.858	0.393
Female	49	64.08	15.84	df=106	
Age groups					
20–29	83	64.24	14.86	T=1.532	0.128
30 and above	25	69.60	16.81	df=106	
Level of education					
Diploma	8	56.00	15.71	F=3.692	0.028*
Bachelor's degree	81	64.79	15.06	df=2	
Higher education*	19	72.42	14.72		
Years of experience in nursing					
less than 1 year	5	68.80	12.77		0.651
1–5 years	73	64.54	14.76	F=0.431	
6 years and above	30	67.20	17.52	df=2	
Average of care for patients with cardiac arrest					
Never	15	65.60	16.82	F=1.996	0.101
Once a year	35	60.91	16.66	df=4	
Once a month	28	66.71	13.11		
Once a week	22	72.18	11.21		
Every day	8	62.50	20.50		
Area of practice					
Intensive Care	31	66.70	15.94	F=1.218	0.307
Emergency	12	71.66	11.49	df=3	
Medical Surgical	24	65.83	15.15		
Specialized units (Others)	41	62.53	15.99		
Previous exposure and dealing with cardiac arrest					
Yes	91	65.80	15.32	T=0.498	0.619
No	17	63.76	16.33	df=106	
Have specific guidelines in the unit to deal with cardiac arrest.					
Yes	84	66.47	15.53	T=1.257	0.211
No	24	62.00	14.82	df=106	
Month of basic life support certificate in 2020					
January – April	42	67.04	14.59	F=0.854	0.429
May–August	36	66.22	13.46	df=2	
September–December	30	62.40	18.54		

\*Significant at  $p \leq 0.05$ , Independent t test and One Way ANOVA

**Table 6** Knowledge Retention of Basic Life support among participants as pass of fail ( $N=108$ )

Pass/Fail	<i>n</i>	%
Fail	92	85.2
Pass	16	14.8
Total	108	100

between levels of education was found ( $F(2, 105)=2.761$ ,  $p=0.028$ ) between nurses. According to the Bonferroni post-hoc test, nurses who have higher education ( $M=72.42$ ,  $SD=14.72$ ) have higher mean scores than

nurses who have a diploma ( $M=56.00$ ,  $SD=15.71$ ). In terms of knowledge passing and failing, Table 6 shows the number and percentage of participants who fail and who pass the BLS knowledge test in 2022 considering that the score of 84% or answering 21 MCQs correctly is the passing score. Most participated nurses failed the knowledge test (85.2%,  $n=92$ ).

## Discussion

Although many worldwide studies were conducted to examine the retention of BLS nursing knowledge, up to the researcher's knowledge and search, this is the first study that has been conducted in Palestine to assess knowledge retention of BLS among nurses. In general, the results of this study revealed weak retention of BLS knowledge among nurses in Palestine between the years 2020 and the year of 2022. The results showed a dramatic decline in the mean score of BLS knowledge from 92/100 in 2020 to a mean score of 65/100 in the year 2022, which represents a remarkable deterioration of nurses' knowledge regarding this concern.

In comparing the results of our study to the results of nearby countries and developing countries, our results were consistent with many published works. For instance, a study conducted in Yemen by Alkubati [21] to assess the level of BLS nurses' knowledge revealed that about half of the participants had inadequate knowledge total scores. In addition, a study to assess the retention of BLS knowledge among nurses in Botswana showed a reduction in the level of nurses' knowledge by 14.5% from the baseline after 6 months [22]. Moreover, a Turkish longitudinal study conducted by Bukiran [23] to examine the pretest BLS nurse's knowledge, immediately after training BLS, 6 months after training, and 12 months after training presented a decrease in mean scores of correct answers of total 25 MCQ from 21.9 to 18.8 to 16.7 for immediately post-test, after 6-month, and after 12-months, respectively. Furthermore, Hamilton [24] stated that according to several multidisciplinary studies of retention of BLS knowledge and skills, skills and knowledge in resuscitation deteriorate within three to six months after receiving lecture-style training. This decline in knowledge of BLS may be due to less practice of CPR in the clinical areas and the variation in different units and departments [25].

Besides, according to Umhuza and colleagues in 2021, who assessed the impact of a modified paediatric basic life support (BLS) training on paediatric nurses' knowledge and skills, revealed that although the BLS knowledge score increased for nurses from 58.3% in the pretest to 83.3% after training, it declined to 76% 6 months after training [26]. This was congruent with the results of our study. Therefore, it seems that the level of BLS knowledge is decreased over time, particularly after 6 months of training and some studies showed dramatic knowledge

loss after 1 year of training [27, 28], which is consistent with our study results. Hence, regular BLS refresher courses of at least 6-months after training are crucial to retaining nurses' knowledge. This action could have a beneficial effect on patients' outcomes by increasing the survival rate of cardiac arrest victims. Thus, we have to strive to know which aspects exactly have the highest percentages of BLS knowledge retention.

In terms of more specific items of knowledge, the results in this study revealed that the depth of chest compression had the lowest mean score among participants, which is consistent with Zhou [28] who reported that the depth of chest compression tends to be poorly retained for prolonged time. In addition, Charlier [29] concluded in their observational study that retention of chest compression depth is poor. This suggests health policymakers create and adopt methods that could improve retention of the depth of chest compression either in BLS training or in refresher and in-service courses. Combining knowledge and psychomotor skills in training have benefits over separating them, Pearson correlation found a strong correlation between knowledge and skills immediately posttest and 3-months after BLS training to acquire and retain CPR knowledge and skills in many dimensions such as chest compression depth, rate of compression, and ventilation [29]. Another suggestion is to use feedback devices in BLS training and frequent engagement in real CPR practice that could have good retention of knowledge and skills of the depth of the chest while performing CPR [30, 31]. Furthermore, research indicates that simulation training can enhance critical skills retention and improve confidence among healthcare providers when responding to real-life emergencies, additionally, the implementation of low-dose, high-frequency training has been shown to reinforce learning and maintain skill competency over time [32–34].

Regarding the highest BLS knowledge correct participants' answers in this study, they reported good knowledge retention in the area on the chest where to do compression, the rate of chest compression in adults and children, and when to start cardiopulmonary resuscitation. The results of this study were congruent with a study conducted by Umuhoza [26]. This study has some limitations. For instance, the small sample size may affect the generalizability of the results. Therefore, we recommend that future researchers conduct studies with different designs and larger sample sizes to enhance the robustness of the findings. This approach may also help reduce the potential for response bias. In addition, We encountered a lack of an institutional AHA ITC documentation system to identify the profession of BLS candidates, such as nurses, physicians, and other healthcare providers. This gap made it challenging and time-consuming to classify BLS certificate holders by profession.

We recommend that AHA ITCs establish a policy requiring candidates to specify their profession, which would improve documentation, streamline filing, and support future research efforts.

## Conclusions

This study highlights the importance of regular BLS and CPR training for nurses to maintain essential resuscitation skills. Healthcare institutions should implement semiannual refresher courses and utilize simulation-based strategies to improve knowledge retention and patient care quality. Additionally, incorporating blended and simulation-based learning methods may enhance training effectiveness and reduce costs [35–37]. Nursing faculties and students are encouraged to foster a positive attitude toward ongoing BLS education [38–40], which supports resilience and well-being, potentially mitigating burnout and enhancing skill retention [41].

## Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12912-024-02502-x>.

Supplementary Material 1

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## Author contributions

• Conception and design of study: A A and MD; acquisition of data: A A and MD; analysis and/or interpretation of data: A A and MD. • Drafting the manuscript: A A and MD; revising the manuscript critically for important intellectual content: A A and MD. • Approval of the version of the manuscript to be published: A A and MD.

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## Data availability

The datasets used or analyzed during the current study are available from the corresponding author upon reasonable request. The data are not publicly available due to privacy and ethical restrictions.

## Declarations

### Ethics approval and consent to participate

Approval from the Scientific Research Committee at the School of Nursing-The University of Jordan was obtained (NO. 90/2020/152). In addition, approval from the Ethical Committee at the selected AHA Heart Centers in Palestine was gained before data collection and complied with the requirements of the Helsinki Declaration. Procedures were strictly aligned with applicable standards and laws, including the Declaration of Helsinki. Informed consent to participate was obtained from all of the participants in the study. A self-reported questionnaire was used to collect data. The participants' permission was gained after communicating with them. Before data collection, the objectives and methods of the research were explained to the participants. Participants were assured that their information and responses would be kept confidential and anonymous. They were assured that participation in the study was voluntary. Written informed consent was obtained from the participants before completing the questionnaire.



**Consent for publication**

Not applicable.

**Competing interests**

The authors declare no competing interests.

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