

Basic life support awareness level among medical students in Jordan: a cross-sectional study

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Abstract: **Objective:** Performing basic life support (BLS) in patients with cardiopulmonary arrest decreases mortality and morbidity. In addition, BLS knowledge is a prerequisite for medical graduation. The present study was conducted to determine the awareness level of undergraduate medical students in Jordan regarding BLS and background knowledge.

Methods: This cross-sectional study was conducted between 17 April 2021 and 12 May 2021. A validated questionnaire was used as an online Google form and was posted in all medical student groups and Jordanian universities through various social medias. We categorized level of awareness into two groups: adequate awareness for those who got 60% or more, and inadequate awareness for those who got less than 60% in BLS test. Chi-square test was used to compare different variables.

Results: A total of 886 students with a mean age of 21.5 (\pm 2.2) years completed the survey, including 552 females (62.3%). Among participated students, only 281 (31.7%) had adequate awareness, whereas 605 (68.3%) had inadequate awareness, with a mean score of 10 (\pm 3.8) out of 20. Surprisingly, there was no statistically significant correlation ($P=0.210$) between grade point average (GPA) and awareness level among participated students. On the contrary, we detected statistically significant relationships ($P<0.001$) between various variables and awareness level.

Conclusion: Overall, we found that awareness of BLS among medical students in Jordan is not adequate. We can improve the awareness of medical students in this regard through obligating them to educate the general population, especially school students, as a volunteer campaign.

Keywords: Awareness; Basic Life Support; Cardiopulmonary Resuscitation; Jordan; Medical Students

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1. Introduction

Cardiac arrest is a lethal health problem that accounts for 15% of mortalities worldwide (1). So, performing cardiopulmonary resuscitation (CPR) and basic life support (BLS) decreases mortality and morbidity through maintaining airway and circulation in patients with cardiopulmonary arrest, regardless of their age; however, the health status of the patient prior to the arrest must be taken into account (2). BLS is done via initiating the chain of survival, which includes early event recognition, in addition to activating the emergency response system, initiating CPR, defibrillation, and further advanced medical care (3). BLS techniques must be performed correctly for better outcomes. Ideally, everyone in the community, but most importantly, the medical personnel, must be aware of BLS and also advanced cardiac life support (ACLS) (4). Doctors are expected to learn CPR techniques on patients during their clinical practice, which is hard to adjust at the time of resuscitation (5). However, since 1966, it has

been suggested that all healthcare providers in the United States take the BLS maneuver's training courses (6). And in the United Kingdom, most medical schools have obligatory advanced life support (ALS) training courses for their students (5).

In our country, Jordan, there is no sufficient information about awareness of BLS skills among medical students. Unfortunately, there are no specific workshops or courses for BLS education in Jordan. Previous Jordanian studies only included allied health university students and middle school students (7,8). Therefore, we conducted this cross-sectional study to determine the awareness level of students of more than six medical schools in Jordan regarding BLS techniques.

2. Methods

2.1. Study design and setting

We established this cross-sectional study following the guidelines of strengthening the reporting of observational

studies in epidemiology (STROBE) (9). This study was conducted between 17 April 2021 and 12 May 2021. The institutional research ethics committee approved the study design and research permission was donated. The privacy of data was maintained.

2.2. Participants

Inclusion criteria included all male and female, basic and clinical years, undergraduate medical students who were actively studying in any of the six medical schools in Jordan (University of Jordan, Jordan University of Science and Technology, Hashemite University, Mutah University, Yarmouk University, and Balqa Applied University) regardless of their nationality. All graduated or intern medical doctors or other medical school students were excluded. Any medical students studying in non-Jordanian universities were also excluded. We used a multistage stratified random sampling method for selecting the target sample; university was considered in the stratification.

2.3. Questionnaire

We used an online (Google form) self-administrated, English survey, with 20 multiple choice questions that followed the American Heart Association (AHA) and Emergency Cardiovascular Care (ECC) guidelines (Appendix 1). The validity of the used questionnaire was established in previous studies (10-12). The questionnaire consisted of two parts: the first one asked about the demographics of the participants, including age, sex, area of residence, current studying university, grade point average (GPA), educational level and year, and nationality; the GPA (score range: 0-4) was classified as excellent: 3.50-4, very good: 3.00-3.49, good: 2.50-2.99, and pass/poor: ≤ 2.49 ; and the second one contained 20 multiple-choice questions that assessed the participants' knowledge of BLS techniques and skills (general assessment of victims who lose their consciousness, the proper method of doing CPR, dealing differently with adult and pediatric cases, use of automated external defibrillator (AED), and identifying the suspected patients with ischemic crises).

2.4. Data collection

Before starting data collection, a pilot study was conducted on 60 students to assess the feasibility and clarity of the questions. The online link was distributed through social media groups (Facebook, WhatsApp, and Twitter). Before the participants filled the survey, informed consent was obtained. We calculated the sample size using Raosoft online software with margin of error= 5%, confidence interval= 95%, and response distribution= 50%; thus, the recommended sample size was 378 medical students in Jordan, regardless of their university.

2.5. Statistical analysis

We used SPSS (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.) to

perform statistical analyses. Before we started the analysis, we checked if data were normally distributed or not. Numerical variables were reported as means and standard deviations, while categorical variables were reported as frequencies and percentages. We categorized level of awareness into two groups: adequate awareness for those who got 60% or more, and inadequate awareness for those who got less than 60% in BLS test, approved by an expert. Chi-square test was used to compare different variables and multivariate logistic regression analyses were performed to explore the association of sex, school years, and medical school, with adequate

Table 1 Baseline and demographic characteristics of the participants (n=886)

Variable	Number (%)
Gender	
Female	552 (62.3)
Male	334 (37.7)
Medical school	
University of Jordan	151 (17.0)
Jordan university of science and technology	157 (17.7)
Hashemite university	161 (18.2)
Mutah university	151 (17.0)
Yarmouk university	110 (12.4)
Balqa applied university	156 (17.6)
School years	
Basic	264 (30.0)
First	44 (5.0)
Second	119 (13.4)
Third	101 (11.4)
Clinical years	
Fourth	214 (24.2)
Fifth	168 (19.0)
Sixth	240 (27.0)
Overall Degree (GPA)	
Excellent	201 (22.7)
Very good	371 (41.9)
Good	293 (33.1)
Pass/poor	21 (2.4)
Area of residence	
Ajloun	20 (2.3)
Amman	399 (45.0)
Aqaba	5 (0.6)
Blaqa	71 (8.0)
Irbid	180 (20.3)
Jarash	33 (3.7)
Karak	38 (4.3)
Ma'an	12 (1.4)
Madaba	33 (3.7)
Mafraq	22 (2.5)
Tafilah	10 (1.1)
Zarqa	63 (7.1)
Nationality	
Jordanian	759 (85.7)
Non-Jordanian	127 (14.3)
Awareness level	
Adequate	281 (31.7)
Inadequate	605 (68.3)

GPA: Grade point average

Table 2 Correct answers to BLS knowledge questions among participating medical students

Question	Correct answer	Number (%)
1-What does the abbreviation BLS stands for?	Basic Life Support	778 (87.8)
2-When you find someone unresponsive in the middle of the road, what should your first response be? (Note: you are alone)	Look for safety	620 (70.0)
3-If you confirm somebody is not responding to you even after shaking and shouting at him, what should your immediate action be?	Activate EMS	358 (40.4)
4-What is the location for chest compression?	Mid chest	535 (60.4)
5-What is the location of chest compression in an infant?	One finger breadth below the nipple line	416 (47.0)
6-If you don't want to give mouth-mouth CPR, which of the following is NOT an appropriate course of action?	No CPR	581 (65.6)
7-How do you give rescue breaths to infants?	Mouth-to-mouth and nose	364 (41.1)
8-What is the correct depth of chest compression in adults?	1½ – 2 inches	215 (24.3)
9-What is the correct depth of compression for children?	One half to one-third depth of chest	379 (42.8)
10-What is the correct depth of compression for neonates?	One half to one-third depth of chest	383 (43.2)
11-What is the correct rate of chest compression for adults and children?	100/min	423 (47.7)
12-What is the correct ratio of CPR for an adult when there is single rescuer?	30:2	571 (64.4)
13-What is the correct chest compression:ventilation ratio for a neonate?	3:1	169 (19.1)
14-What does the abbreviation AED stands for?	Automated External Defibrillator	366 (41.3)
15-What does the abbreviation EMS stands for?	Emergency Medical Services	660 (74.5)
16-If you and your friend are having food in a canteen and your friend suddenly starts choking, what should your first response be?	Confirm foreign body aspiration by talking to him	287 (32.4)
17-You witness an infant who suddenly starts to choke while playing with a toy. You have confirmed that he is unable to cry and/or cough, what should your first response be?	Back blows and chest compression of five cycles each then open the mouth and remove foreign body only when it is seen	462 (52.1)
18-You witness an adult unresponsive who has been just removed from submersion in fresh water. He has spontaneous breathing but unresponsive. What should your first response be?	Keep him in recovery position	255 (28.8)
19-You notice your colleague has suddenly developed slurring of speech and weakness of the right upper limb, which one of the following should be done?	Possibly stroke, he may require thrombolysis and hence activate emergency medical services	416 (47.0)
20-A 50-year-old gentleman presents with retrosternal chest discomfort, profuse sweating and vomiting. What is the most appropriate course of action?	Probably myocardial infarction, hence, activates EMS, give an aspirin tablet and allow him to rest	615 (69.4)

AED: Automated external defibrillator; BLS: Basic life support; CPR: Cardiopulmonary resuscitation; EMS: Emergency medical service

awareness level as predictor, and we used inadequate level as reference. Also, Pearson correlation test was done for testing the significance of the relationship between the total score and age.

3. Results

3.1. Baseline and demographic characteristic of participants

A total of 886 students completed the survey, including 552 females (62.3%) and 334 males (37.7%), with a mean age of 21.5 (\pm 2.2) years. The majority of participants were studying in clinical years (622 (70%)), lived in Amman (399 (45%)), and had very good GPA (371 (41.9%)), while only 127 (14.3%) were non-Jordanian students. The distribution of respondents across the six universities and the detailed characteristics are summarized in table 1.

3.2. Basic life support awareness level

Among participating students, only 281 (31.7%) had adequate awareness, whereas 605 (68.3%) had inadequate awareness, with a mean score of 10 (\pm 3.8) out of 20. The correct chest compression: ventilation ratio for neonate and correct depth of chest compression in adults was correctly indicated only by 169 (19.1%) and 215 (24.3%), respectively. Only 255 (28.8%) answered 'Keep him in recovery position' while seeing the adult victim had spontaneous breathing but was unresponsive. Furthermore, 778 (87.8%) and 660 (74.5%) of participants selected the correct meaning of the abbreviation of BLS and emergency medical services (EMS), respectively. Table 2 consists of detailed participant answers.

3.3. Association between baseline characteristics and awareness level

Surprisingly, there was no statistically significant relationship ($P=0.216$) between GPA and awareness level among partici-

Table 3 The difference between BLS awareness levels of students based on demographic data according to chi-square test

Variables	Awareness		P-value*
	Inadequate (n=605)	Adequate (n=281)	
	Number (%)		
Gender			
Female	345 (62.5)	207 (37.5)	<0.001
Male	260 (77.8)	74 (22.2)	
Medical school			
University of Jordan	105 (69.5)	46 (30.5)	<0.001
Jordan university of science and technology	129 (82.2)	28 (17.8)	
Hashemite university	123 (76.4)	38 (23.6)	
Mutah university	86 (57.0)	65 (43.0)	
Yarmouk university	49 (44.5)	61 (55.5)	
Balqa applied university	113 (72.4)	43 (27.6)	
School years			
Basic years	210 (79.5)	54 (20.5)	<0.001
Clinical years	395 (63.5)	227 (36.5)	
Grade point average			
Poor	17 (81.0)	4 (19.0)	0.218
Good	190 (64.8)	103 (35.2)	
Very good	263 (70.9)	108 (29.1)	
Excellent	135 (67.2)	66 (32.8)	
Area of residence			
Irbid	140 (77.8)	40 (22.2)	<0.001
Ajloun	5 (25.0)	15 (75.0)	
Jarash	15 (45.5)	18 (54.5)	
Mafraq	18 (81.8)	4 (18.2)	
Blaqa	47 (66.2)	24 (33.8)	
Amman	289 (72.4)	110 (27.6)	
Zarqa	42 (66.7)	21 (33.3)	
Madaba	15 (45.5)	18 (54.5)	
Karak	24 (63.2)	14 (36.8)	
Ma'an	2 (16.7)	10 (83.3)	
Tafilah	4 (40.0)	6 (60.0)	
Aqaba	4 (80.0)	1 (20.0)	

Table 4 Multivariate logistic regression of predictors for adequate awareness

Variables	Odds ratio (95% CI)	P-value
Gender		
Female	1.86 (1.34-2.58)	<0.001
Male	Reference	
School years		
Clinical	2.61 (1.80-3.78)	<0.001
Basic	Reference	
Grade point average		
Excellent	2.41 (0.74-7.79)	0.140
Very good	1.51 (0.48-4.78)	0.478
Good	1.80 (0.57-5.72)	0.316
Poor	Reference	
Medical school		
University of Jordan	0.98 (0.59-1.65)	0.959
Jordan university of science and technology	0.54 (0.31-0.95)	0.030
Hashemite university	0.73 (0.43-1.24)	0.250
Mutah university	1.97 (1.20-3.22)	0.010
Yarmouk university	2.88 (1.69-4.91)	<0.001
Balqa applied university	Reference	

*Reference: inadequate awareness

pated students. On the contrary, we detected a statistically significant ($P<0.001$) correlation between various variables

and level of awareness based on the results of chi-square test (Table 3). We found that the general awareness level about

BLS was low in all universities except for Yarmouk university, whose students had slightly higher knowledge. Students in both basic and clinical years had low awareness about BLS. Area of residence also showed no significant association with the level of awareness. Medical students in most areas of residence had a significantly low knowledge of BLS. However, Pearson correlation test showed that there was a significant correlation between age and awareness level ($P=0.001$); yet, it was a very weak positive correlation ($r=0.111$). Multivariate logistic regression was done to test the effect of various factors on the level of awareness. The model could only predict 15.4% of cases, because the Nagelkerke R^2 was 0.154. Table 4 shows that a high odds ratio was detected in the medical school groups compared to Balqa applied university group.

4. Discussion

Our study showed that more than two-thirds of medical students in Jordan have insufficient awareness of BLS skills. Medical students in both Yarmouk and Mutah universities had a higher chance of having adequate level of awareness with an odds ratio of 2.88 and 1.97, respectively. In terms of saving time and acting efficiently during resuscitation in emergency cases, activation of EMS is considered to be the first step for initiating the chain of survival (3). Thus, BLS providers should be aware of and familiar with the emergency abbreviations, especially EMS and AED. The majority of our participants could correctly identify the abbreviation of basic life support and would look for safety first when there is an unresponsive victim on the road. However, more than 50% did not know the correct full term of AED, while 74% chose the right full term of EMS. Furthermore, less than 50% of students could accurately recognize the first step of initiating the chain of survival, which is activating EMS. Delaying the initiation of the chain of survival will decrease the survival rate by up to 10% for each minute (13). So, CPR techniques and quality play a crucial role in saving a life, especially outside the hospital. Being aware of the precise location, rate, depth, and ratio of chest compression and ventilation increases the rate of survival (14,15). Surprisingly, only 19% of participated students knew the right chest compression: ventilation ratio for neonates, whereas more than 50% knew the right ratio for adults. In addition, 75% failed to identify the precise depth of chest compression for adults, and 57% and 56% for children and neonates, respectively. For infant rescue breath technique, only 41% were aware that it is mouth to mouth and nose, not like the adult technique. Critical situations like foreign body aspiration need rapid confirmation and direct intervention through proper maneuver rather than neglecting the victim complaining from asphyxia. In the case of a victim who loses his consciousness but is still breathing, only 28.8% would keep him in a recovery position. Moreover, two-thirds did not know how to confirm airway obstruction via the foreign body in a choking person by talking to him and only half knew how to resuscitate

an infant with foreign body aspiration. Additionally, 69% of students chose the appropriate action in the case of patients with myocardial infarction symptoms, while less than 50% correctly recognized stroke symptoms.

Previous studies conducted in India, the Kingdom of Saudi Arabia, and Egypt showed a significantly poor awareness of BLS among different faculties, especially medical schools, and provided different recommendations to promote BLS awareness among different faculties (10-12). Ghanem et al. (12) concluded that in Egypt, being in clinical years, previous BLS training, or practical experience were significantly associated with higher BLS knowledge scores ($P<0.001$). They detected a statistically significant association between sex and the overall score ($P<0.001$), with females achieving significantly higher scores than males. No statistically significant association ($P=0.072$) was found between the overall score and place of residence (rural/urban). In the USA and Europe, the rate of mortality due to out-of-hospital cardiac arrest remains high with 276,000 and 350,000 deaths per year, respectively (16). Therefore, BLS awareness is necessary for all bystanders, especially medical students, to provide the initial step of maintaining circulation and breathing until definitive care will be given. Activation of the chain of survival as soon as possible increases the rate of survival up to 70% and it is mandatory for each medical worker to have adequate awareness of BLS (17). Breckwoldt et al. found that medical students teaching BLS to school children as a mandatory duty had superior practical skills compared to those who underwent traditional teaching (18). Accordingly, we recommend that all Jordanian universities introduce a required element for medical graduation, which obligates all medical students to share BLS awareness by holding training courses for school students around the country.

5. Limitations

Although our study is the first study that assesses BLS awareness level among medical students and has a relatively large sample size and multi-centric design, our study has a few limitations. The students' practical skills cannot be determined through a questionnaire-based study. Our study only assessed the awareness of medical students. In addition, the slight difference in the educational programs across universities has served as a confounding factor. Future studies should assess BLS awareness level and practical skills among medical doctors in different hospitals in Jordan.

6. Conclusion

The overall awareness of medical students in Jordan regarding BLS is low. We can improve the awareness of medical students in this regard through obligating them to educate the general population, especially school students, around the country. This is the best method to improve the awareness of both the medical students and the general public. Additional assessments for the practical skills are also required.

Furthermore, we need to assess awareness level and practical skills among medical doctors in Jordan.

7. Declarations

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7.2. Authors' contribution

EA: research question, data collection, statistical analysis, manuscript writing, and final editing; MALN: research question, data collection, and manuscript writing; LA: data collection and manuscript writing; AA: data collection and manuscript writing; MALB: data collection and manuscript writing; TA: data collection and manuscript writing. AAS: supervising the research team and final editing.

7.3. Conflict of interest

The authors declare no conflict of interests.

7.4. Funding

None to declare.

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Appendix 1 Questionnaire (correct answers marked with "►")

1. What does the abbreviation BLS stand for?

- a. Best Life Support
- b. Basic Life Support
- c. Basic Lung Support
- d. Basic Life Services

2. When you find someone unresponsive in the middle of the road, what should your first response be? (Note: You are alone)

- a. Open airway
- b. Start chest compression
- c. Look for safety
- d. Give two breathings

3. If you confirm somebody is not responding to you even after shaking and shouting at him, what should your immediate action be?

- a. Start CPR
- b. Activate EMS
- c. Put him in recovery position
- d. Observe

4. What is the location for chest compressions?

- a. Left side of the chest
- b. Right side of the chest
- c. Mid chest
- d. Xiphisternum

5. What is the location for chest compressions in an infant?

- a. One finger breadth below the nipple line
- b. One finger breadth above the nipple line
- c. At the intermammary line
- d. At Xiphisternum

6. If you do not want to give mouth-to-mouth CPR, which of the following is NOT an appropriate course of action?

- a. Mouth-mask ventilation and chest compression
- b. Chest compression only
- c. Bag mask ventilation with chest compression
- d. No CPR

7. How do you give rescue breaths to infants?

- a. Mouth-to-mouth with nose pinched
- b. Mouth-to-mouth and nose
- c. Mouth-to-nose only
- d. Mouth-to-mouth without nose pinched

8. What is the correct depth of chest compression for adults?

- a. 1½ – 2 inches
- b. 2½ – 3 inches
- c. 1 – 1½ inches
- d. ½ – 1 inch

9. What is the correct depth of compression for children?

- a. 1½ – 2 inches
- b. 2½ – 3 inches
- c. One half to one-third depth of chest
- d. ½ – 1 CM

10. What is the correct depth of compression for neonates?

- a. 1½ – 2 inches
- b. 2½ – 3 inches
- c. ½ – 1 CM
- d. One half to one-third depth of chest

11. What is the correct rate of chest compression for adults and children?

- a. 100/min
- b. 120/min
- c. 80/min
- d. 70/min

12. What is the correct ratio of CPR for an adult when there is a single rescuer?

- a. 15:2
- b. 5:1
- c. 30:2
- d. 15:1

Appendix 1 Questionnaire (correct answers marked with "►") (continued)

13. What is the correct chest compression: ventilation ratio for a neonate?

- a. 15:2
- b. 5:1
- c. 30:2
- d. 3:1

14. What does the abbreviation AED stand for?

- a. Automated External Defibrillator
- b. Automated Electrical Defibrillator
- c. Advanced Electrical Defibrillator
- d. Advanced External Defibrillator

15. What does the abbreviation EMS stand for?

- a. Effective Medical Services
- b. Emergency Management Services
- c. Emergency Medical Services
- d. External Medical Support

16. If you and your friend are having food in a canteen and your friend suddenly starts expressing symptoms of choking, what should your first response be?

- a. Give abdominal thrusts
- b. Give chest compression
- c. Confirm foreign body aspiration by talking to him
- d. Give back blows

17. You witness an infant who suddenly starts to choke while playing with a toy. You have confirmed that he is unable to cry and/or cough. What should your first response be?

- a. Start CPR immediately
- b. Try to remove the suspected foreign body using a blind finger sweeping technique
- c. Back blows and chest compression of five cycles each then open the mouth and remove foreign body only when it is seen
- d. Give water to the infant

18. You witness an adult unresponsive victim who has just been removed from submersion in fresh water. He has spontaneous breathing, but is unresponsive. What should your first response be?

- a. CPR for 2 minutes and inform EMS
- b. CPR for 1 minute and inform EMS
- c. Compress the abdomen to remove the water
- d. Keep him in recovery position

19. You notice that your colleague has suddenly developed slurring of speech and weakness of the right upper limb. Which one of the following should be done?

- a. Offer him some drinks, probably hypoglycemia
- b. Possibly stroke, get him to the nearest clinic
- c. Possibly stroke, he may require thrombolysis and hence activate emergency medical services
- d. May be due to sleep deprivation, make him sleep

20. A 50-year-old gentleman presents with retrosternal chest discomfort, profuse sweating and vomiting. What is the most appropriate course of action?

- a. Probably myocardial infarction, hence activates EMS, give an aspirin tablet and allow him to rest
- b. Probably acid peptic disease, give antacid and Ranitidine
- c. Probably indigestion, hence give soda
- d. Walk him to the nearest clinic