Awareness and attitude about basic life support among medical school students in Jeddah University, 2019: A cross-sectional study

Yousef Abdulwahab Alghamdi¹, Tariq Ahmad Alghamdi², Fahad Saleh Alghamdi², Amal Hassan Alghamdi³

¹Department of Family and Community Medicine, AlBaha University, AlBaha, ²King Fahad Armed Forces Hospital, ³Joint Program of Community Medicine and Preventive Medicine, Jeddah, Saudi Arabia

ABSTRACT

Objectives: To measure the level of knowledge and awareness towards basic life support (BLS) among students in preclinical years at Jeddah University (JU), and to determine their willingness to participate in BLS training in the near future. Subjects and Methods: A cross-sectional study was conducted among first-, second-, and third-year medical students of JU. A 27-item questionnaire measured the level of awareness and knowledge about BLS, including: 1) basic Information (seven items); 2) rescue reflex (eight items); and 3) CPR technique and process (12 items). Demographic and academic data, experience and exposure to BLS, and attitude regarding BLS are investigated. Results: One hundred and four male and female students participated and 65 (62.5%) of them were in the second academic year. The correct answers varied from 10.6% to 67.3%, with eight items having <30% correct answers; and seven items showed >50% correct answers. Mean (SD) and median (IQR) overall knowledge scores were 37.86 (13.92) and 37.04 (44.44) out of 100, respectively. Twenty-four (23.11%) participants attended a training course in BLS and 13 (12.5%) have ever performed BLS, either voluntarily or not voluntarily, and 18 (17.3%) felt that their current knowledge was sufficient. Knowledge level showed no statistically significant association with any of the investigated factors. Conclusion: There is an urgent need to integrate BLS courses to medical students to enrich their knowledge and improve resuscitation skills and ensure implementation of correct resuscitation techniques.

Keywords: Awareness, basic life support, cardiopulmonary resuscitation, knowledge, medical student, professional, Saudi Arabia

Introduction

Basic life support (BLS) is a life‑saving method that includes instant recognition of cardiac arrest, initiation of the emergency response systems, adopting adequate cardiopulmonary resuscitation (CPR), and implementing rapid defibrillation. It can be effective in reducing mortality and morbidity in several medical emergencies, notably in out‑of‑hospital cardiac arrest (OHCA), which is responsible for >49.1% of all deaths. Thus, a rapid intervention, 3–5 min after the onset of OHCA, is crucial for the outcome[1–3]

In Saudi Arabia, few studies about CPR knowledge were conducted, denoting inadequate awareness and knowledge about BLS and CPR both among healthcare workers[4–6] and in the community[7,8]

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In this context, we sought to measure the level of knowledge and awareness towards BLS among students in the pre-clinical years at JU. Moreover, this study also aimed at determining their willingness to participate in BLS training in the near future.

Subjects and Methods

Design and setting
A cross-sectional study was conducted at the Medical College of JU, Jeddah, Saudi Arabia, between 1st of July to 30th of October 2019. Previously annexed to King Abdul-Aziz University, JU is one of the recently established universities in Saudi Arabia, which was recognized as an independent institution in 2014. It contains more than ten colleges, including the Medical College, where the first graduated batch was in 2015.

Population and sampling
This study involved preclinical medical students of JU, including first, second and third year students. Students from other levels were excluded. The total number of eligible students during the study period was 108, all of them were targeted.

The names of the eligible participants were retrieved from the electronic list of the students, as provided by the Department of the Academic Affairs. All 108 students were contacted via their email and or telephone numbers and were invited to participate.

Data collection tool
A semistructured questionnaire was designed by the authors for the purpose of this study. It contained four parts. The first part explored demographic and academic data such as age, level, parent's education, family income, etc. The second part explored experience and exposure to BLS, including any past training, whether the participant ever performed BLS, and self-assessed knowledge about BLS. The third part assessed participant's attitude regarding BLS including six items such as opinion about the necessity of BLS, attitude regarding performing mouth-to-mouth ventilation for a person of same and opposite gender, opinion about including BLS in the curriculum. The fourth part assessed the awareness and knowledge about BLS using a set of 27 multiple choice questions, which were divided into three subscales: 1) basic information, which assessed participant's awareness of some basic notions such as the meaning of the abbreviation BLS, signs of severe airway obstruction, body part where pulse check should be performed for an unconscious person, etc., (seven items); 2) rescue reflex, which assessed the participant's first response to assist a person in need of urgent assistance and his or her attitude to deal with the situation in accordance with the BLS standard guidelines (eight items); 3) CPR technique and process, which assessed knowledge about the technical aspects of BLS such as location of chest compression in adults and infants, depth of compressions in adult and infants, rates of compressions, etc., (12 items).

The questionnaire underwent content and face validity to assess relevance of all the items and clarity of the content. Further, internal consistency was analysed by calculation on Cronbach’s alpha (see Results section).

Data collection technique and ethical clearance
Responding students were invited for a face-to-face interview through a text message on their personal phones, where the objectives of the study were presented and the importance of the study was exposed. During the interview, verbal content was obtained and the interview was carried out by one of the investigators.

Data were collected in an anonymous fashion, by exclusion of any identifying item. The study protocol was approved by the institutional review board of JU and the scientific committee of the Saudi Board of Community and Family Medicine Residency Program.

Statistical methods
Statistical analysis was performed with the Statistical Package for Social Sciences version 21.0 for Windows (SPSS Inc., Chicago, IL, USA). Descriptive statistics were used to present the demographic data and patterns of answers to the different questionnaire items; categorical variables are presented as frequency and percentage, whereas numerical ones were presented as mean ± standard deviation (SD). Overall knowledge score was calculated as the sum of correct answers of all the knowledge-related items (raw score range = 0–27), and was scaled as a 0–100 score by using the following formula: scaled score = 100×raw score/27. Likewise, scaled scores were calculated for the three subscales including basic information, rescue reflex, and CPR technique (range = 0–10). Kolmogorov–Smirnov and Shapiro–Wilk tests were used to analyse the distribution of overall knowledge score. Chi-square test and independent t-test were used to analyse the factors associated with knowledge level, by comparing the percentage of adequate (overall knowledge score ≥40) versus inadequate (score <40) levels in each factor category. A P value of <0.05 was considered to reject the null hypothesis.

Results

Participants’ characteristics
One hundred and four male students agreed to participate (response rate = 96.3%); their mean (SD) age was 19.96 (0.91) and 65 (62.5%) were in the second academic year. Other sociodemographic data showed high educational level (university+) among 68.3% and 44.2% of participants’ fathers and mothers, respectively [Table 1].

Knowledge about BLS
The percentage of correct answers varied from 10.6% to 67.3%, depending on the item, with eight items having <30% correct answers, whereas only seven items showed >50% correct answers [Table 2]. Regarding overall knowledge score, distribution showed a bell shape-like graph with a
right-skewed histogram [Figure 1], and normality tests, including Kolmogorov–Smirnov (statistics = 0.174, \( P < 0.001 \)) and Shapiro–Wilk (statistics = 0.910, \( P < 0.001 \)), concluded that the variable was not normally distributed. Reliability of overall knowledge scale showed Cronbach's alpha = 0.616 (27 items). Mean, range, median and centiles of overall knowledge score as well as the three subscale scores are presented in Table 3, and confirmed low levels of knowledge notably mean (SD) and median (P75) overall knowledge score of 37.86 (13.92) and 37.04 (44.44), out of 100, respectively.

### Previous experience and attitude towards BLS

Of the total participants, only 24 (23.11%) declared that they have attended a training course in BLS and, 13 (12.5%) have ever performed BLS, either voluntarily or involuntarily, and 18 (17.3%) felt that their current knowledge about BLS was sufficient. Regarding attitude, majority (86.5%–88.5%) believed BLS is necessary and opined that BLS course should be mandatory and that BLS training should be part of the curriculum. Furthermore, 16.3% of the students declared that they were either unfavourable or hesitant in performing mouth-to-mouth ventilation for a person of same or opposite gender [Table 4].

### Factors associated with knowledge about BLS

Knowledge level showed no statistically significant association with any of the investigated sociodemographic factors; however, although not statistically significant, we observed a higher percentage of adequate knowledge level among third year students (44.4% versus 32.4%), nonsmokers (40.6% versus 28.6%), and those from high-income households (42.0%–46.7% versus 25.6%) compared to their counterparts, respectively. On the other hand, 50.0% of the students who attended BLS training had adequate knowledge, versus 31.6% of those who have never attended such training but the comparison was not statistically significant (\( P = 0.101 \)) [Table 5].

### Discussion

Sudden cardiac death (SCD) is the leading cause of 15%–20% of all deaths worldwide,[9,10] in which out-of-hospital SCDs are responsible for >49.1% of all deaths.[2] One of the major issues with SCD is, majority of OHCA occurs in patients as first clinical presentation of the underlying disease or who is already identified but categorized as low risk. Globally, around 250,000–300,000 patients experience an OHCA per year.[11] However, survival rates among OHCA patients receiving bystander-initiated CPR have a better chance of survival than those who do not. Approximately, 350,000 people in Europe die each year because of OHCA.[12] In the United States, >96,000 people die of OHCA,[13] and it is predicted to increase in the upcoming years. In Saudi Arabia, cardiovascular diseases represent the major causes of death, accounting for 37% of all mortalities in 2016.[14] Coronary heart disease constitutes one of the main health problems in Saudi Arabia, representing the third most common cause of hospital-based mortality second to accident and senility.[15]

Thus, basic knowledge of emergency care is a necessary skill for every medical student and graduate to manage emergency situations effectively. This would help to maintain the viability
of the cardiopulmonary system before it could be fully resuscitated. In the present study, we showed that medical students in Jeddah had low knowledge levels regarding BLS as indicated by an overall score of 37.04 and percentages of correct answers ranging between 10.6%–67.3% for different domains. While a small proportion of medical students (23.1%) had attended a BLS-related training course, the majority of them declared that they have marked deficiencies in their personal knowledge (82.7%) and that implementing a specialized course is necessary as a part of the curriculum (86.5%–88.5%).

The outcomes of the current study were in agreement with other national and international investigations. On the international level, poor knowledge levels were apparent in Iran,[16] India,[17] Egypt,[18] and the United Kingdom.[19] Locally, similar to the mean score obtained in our study (37.9 ± 13.9), female medical

| Subscale                  | Items                                                                 | Correct answer                                                                 | Correctness rate |
|---------------------------|----------------------------------------------------------------------|--------------------------------------------------------------------------------|------------------|
| **Basic information**     | 11. What does the abbreviation BLS stand for?                       | Basic life support                                                            | 67               |
|                           | 27. What does abbreviation AED stands for?                          | Automated external defibrillator                                               | 15               |
|                           | 28. What does abbreviation EMS stands for?                          | Emergency medical services                                                     | 50               |
|                           | 37. The 5 links in the adult chain of survival include all of the following EXCEPT | Advanced airway placement                                                     | 32               |
|                           | 40. Where should you attempt to perform a pulse check in adult?      | Carotid                                                                        | 53               |
|                           | 44. Signs of severe airway obstruction include all of the following EXCEPT | May wheeze between coughs                                                     | 19               |
|                           | 46. The critical characteristics of high-quality CPR include which of the following | All of the above                                                              | 61               |
| **Rescue reflex**         | 18. When you find someone unresponsive in the middle of the road, what will be your first response? (Note: You are alone there) | Look for safety                                                               | 49               |
|                           | 19. If you confirm somebody is not responding to you even after shaking and shouting at him, what will be your immediate action? | Activate EMS                                                                  | 15               |
|                           | 20. If you and your friend are having food in a canteen and suddenly your friend starts expressing symptoms of choking but responsive, what will be your first response? | Confirm foreign body aspiration by talking to him                             | 16               |
|                           | 39. The initial basic life support (BLS) steps for adults are        | Assess the victim, activate EMS and get AED, check pulse and start CPR        | 58               |
|                           | 47. 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 | 39               |
|                           | 48. 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? | Keep him in recovery position                                                  | 11               |
|                           | 49. 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? | Possibly stroke, he may require thrombolysis and hence activate emergency medical services | 35               |
|                           | 50. 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 | 56               |
| **CPR technique and process** | 20. What is the location for chest compression?                     | Centre of the chest on lower half of breast bone                              | 70               |
|                           | 21. What is the location for chest compression in infants?          | One finger breadth below the nipple line                                       | 40               |
|                           | 22. How do you give rescue breathing in infants?                    | Mouth-to-mouth and nose                                                       | 50               |
|                           | 23. Depth of compression in adults during CPR                       | At least 2 in                                                                 | 37               |
|                           | 24. Depth of compression in Children during CPR                     | 2 in                                                                          | 25               |
|                           | 25. Depth of compression in neonates during CPR                     | Approximately 1½ in                                                          | 34               |
|                           | 26. Rate of chest compression in adult and children during CPR      | 100-120/min                                                                  | 55               |
|                           | 38. How often should rescuers switch roles when performing 2-rescuer CPR? | After 5 cycles                                                                | 40               |
|                           | 39. The compression to ventilation ratio for the lone rescuer giving CPR to victims of ANY age is | 30:2                                                                          | 24               |
|                           | 40. The proper steps for operating an AED are                       | On the AED, attach electrode pads, analyze the rhythm, clear the patient and deliver shock | 30               |
|                           | 43. The 2010 AHA Guidelines for CPR recommended BLS sequences of steps are | Chest compressions, airway, breathing                                           | 41               |
|                           | 45. In an adult with an advanced airway in place during 2-rescuer CPR, breaths should be administered how often? | Every 6-8 s                                                                   | 41               |
students at Princess Nourah bint Abdulrahman University had a mean knowledge score of 34.3 ± 14.1, and the knowledge level was <50% among 87.4% of them. Likewise, 60.8% of medical students at Tabuk University scored less than 5 (out of 17), and their knowledge levels were judged as “insufficient”. In addition, although medical students have achieved higher knowledge scores than those of other allied health colleges at Qassim University, the average score of all grades in the medical college was 10.4 (out of 20). Medical students at Jazan University had higher scores (10.8 out of 14), and having previous CPR training was significantly associated with higher knowledge scores. Almost half of medical students had poor knowledge about first aid in Abha and Riyadh, and in an online survey targeting Saudi medical students across the Kingdom.

The reported findings indicate low knowledge levels in our settings, even when compared with other local universities. This can be explained by multiple reasons. First, there is a lack of BLS training at our medical college and other national institutions. The problem is more significant among students of the preclinical years of study; only 23.1% of our students declared that they had previously received a BLS training. Actually, BLS training was deficient despite the critical role of these approaches in saving lives, particularly in a country with a high frequency of injuries due to road traffic accidents. Ultimately, knowledge acquisition is significantly affected. Second, it seems that there are significant problems in knowledge retention (educational reinforcement), which should be addressed to promote the knowledge of medical students. Third, significant gender-based

| Table 3: Overall and specific knowledge about BLS |
|-----------------------------------------------|
| Subscale                                    | Scale | Range    | Mean   | SD     | Median  | P75    | P95    |
|-----------------------------------------------|-------|----------|--------|--------|---------|--------|--------|
| Overall knowledge score                      | 100   | 11.11,81.48 | 37.86  | 13.92  | 37.04   | 44.44  | 70.37  |
| Basic information score                      | 10    | 0.00,10.00 | 4.08   | 1.94   | 4.29    | 5.71   | 7.14   |
| Rescue reflex score                          | 10    | 0.00,10.00 | 3.35   | 2.01   | 2.50    | 3.75   | 8.44   |
| CPR technique Score                          | 10    | 0.00,7.50  | 3.90   | 1.77   | 4.17    | 5.00   | 6.67   |

| Table 4: Previous exposure and attitude regarding BLS |
|--------------------------------------------------------|
| Item                                                   | Response                  | n  | %  |
| Previous exposure                                       |                          |    |    |
| Did you attend any training course in basic life support? | Yes                      | 24 | 23.1|
|                                                      | No                       | 79 | 76.0|
| When was the training course?                          | 1.00                     | 12 | 11.5|
|                                                      | 2.00                     | 8  | 7.7 |
|                                                      | 3.00                     | 2  | 1.9 |
|                                                      | 4.00                     | 1  | 1.0 |
| Where was the training course held?                    | Specialized centre       | 4  | 3.8 |
|                                                      | Hospital                 | 9  | 8.7 |
| Have you ever voluntarily performed BLS?               | Yes                      | 9  | 8.7 |
|                                                      | No                       | 91 | 87.5|
|                                                      | Yes, but not voluntarily | 4  | 3.8 |
| Do you feel your knowledge about BLS is sufficient?    | Yes                      | 18 | 17.3|
|                                                      | No                       | 86 | 82.7|
| Attitude                                              |                          |    |    |
| Do you think a BLS course should be mandatory?         | Yes                      | 92 | 88.5|
|                                                      | No                       | 12 | 11.5|
| Do you think BLS is necessary?                         | Yes                      | 92 | 88.5|
|                                                      | No                       | 10 | 9.6 |
|                                                      | Cannot say or not sure   | 2  | 1.9 |
| Would you perform mouth to mouth ventilation for person of same gender? | Yes                      | 87 | 83.7|
|                                                      | No                       | 11 | 10.6|
|                                                      | Hesitant                 | 6  | 5.8 |
| Would you perform mouth to mouth ventilation for person of opposite gender? | Yes                      | 87 | 83.7|
|                                                      | No                       | 4  | 3.8 |
|                                                      | Hesitant                 | 13 | 12.5|
| Would you like to undergo BLS training in a workshop/center with hands on practice under supervision? | Yes                      | 95 | 91.3|
|                                                      | No                       | 6  | 5.8 |
|                                                      | Not sure                 | 2  | 1.9 |
| Do you think that BLS training should be part of your curriculum? | Yes                      | 90 | 86.5|
|                                                      | No                       | 10 | 9.6 |
|                                                      | Not sure                 | 4  | 3.8 |

Because of missing data, all frequencies do not sum up to the total.
Table 5: Factors associated with knowledge about BLS

| Factor                          | Category          | Knowledge level (score) | P     |
|--------------------------------|-------------------|-------------------------|-------|
|                                |                   | Inadequate (<40)        | Adequate (≥40) |
|                                |                   | n     | %    | n     | %    |       |
| Age (years)                    | Mean, SD          | 19.91 | 0.91 | 20.05 | 0.93 | 0.443 |
| Level                          | 1 or 2            | 46    | 67.6 | 22    | 32.4 |       |
|                                | 3                 | 20    | 55.6 | 16    | 44.4 | 0.223 |
| Current smoking status         | Current Smoker    | 25    | 71.4 | 10    | 28.6 |       |
|                                | Non-smoker        | 41    | 59.4 | 28    | 40.6 | 0.229 |
| Father’s educational level     | Up to secondary   | 18    | 54.5 | 15    | 45.5 | 0.198 |
|                                | University+       | 48    | 67.6 | 23    | 32.4 |       |
| Mother’s educational level     | Up to secondary   | 39    | 67.2 | 19    | 32.8 | 0.369 |
|                                | University+       | 27    | 58.7 | 19    | 41.3 |       |
| Mother’s professional status   | Employed          | 25    | 58.1 | 18    | 41.9 |       |
|                                | Unemployed        | 41    | 67.2 | 20    | 32.8 | 0.344 |
| Household income               | Up to 10k         | 29    | 74.4 | 10    | 25.6 |       |
|                                | >10k-20k          | 29    | 58.0 | 21    | 42.0 |       |
|                                | >20k              | 8     | 53.3 | 7     | 46.7 | 0.192 |
| Ever attended BLS training?    | Yes               | 12    | 50.0 | 12    | 50.0 |       |
|                                | No                | 54    | 68.4 | 25    | 31.6 | 0.101 |
| Self-assessed knowledge about BLS | Sufficient        | 10    | 55.6 | 8     | 44.4 |       |
|                                | Insufficient      | 56    | 65.1 | 30    | 34.9 | 0.444 |

Because of missing data, all frequencies do not sum up to the total.

In the current study, 16.3% of male medical students were hesitant to perform mouth-to-mouth breathing, which is an essential element of BLS to support ventilation. Indeed, mouth-to-mouth and nose resuscitation is a vital BLS approach in infants, where there is a narrow space between the mouth and the nose. However, it seems that preclinical students had some concerns about fear of infection while performing such a technique; these concerns were previously reported among school teachers in Riyadh.\[36\] Besides, the majority of medical students may lack the knowledge regarding the alternative technique to the mouth-to-mouth CPR.\[4,28\]

In Saudi Arabia, the national CPR guidelines are regularly updated by the Saudi Heart Association, targeting healthcare providers and instructors as well as community members through specific skillful programs.\[31\] These evidence-based guidelines should be emphasized in the provided undergraduate programs to encourage students to depend on reliable resources. This is because some students may acquire inaccurate information from other sources, leading to medical errors and decreased self-confidence.\[32\] In addition, education in preclinical years seems to be highly effective given the initial low levels of basic knowledge that the students possess. On the other hand, there are significant barriers after graduation, such as lack of resources and time constraints due to busy residency schedules, which inhibit effective education to acquire resuscitation skills. Although doctors can still have the capacity to learn BLS skills in the clinical practice, they would not be able to correct faulty techniques.\[33\]

Based on all the aforementioned factors, and the fact that a significant proportion of junior doctors are not efficient in conducting CPR,\[34\] students in the current study have largely acknowledged the importance of BLS courses during preclinical years. The students believed that their cognitive perceptions and time can still allow receiving educative materials pertinent to CPR. Therefore, the integration of organized BLS courses should be a standardized and mandatory element of undergraduate academic curricula in all Saudi medical colleges. Such courses could be additionally supported by other undergraduate resuscitation courses, such as basic trauma life support as well as advanced neurologic, pediatric and cardiac life support. The acquired basic and advanced resuscitation skills via these courses may need to be regularly refreshed as indicated by Cooper \textit{et al.} who have found high levels of knowledge and significantly improved resuscitation skills among healthcare professionals who have completed BLS courses six months after an earlier immediate life support course. Another proposed solution is to implement peer-led BLS training (by senior medical students), which has proven as equally effective as professional-led training.\[35\] Finally, a special emphasis on the quality, simplicity and cost-effectiveness of training should be warranted. These would improve students’ perceptions, ensure high efficacy of training and yield high technical competency.

The present study had some limitations. Although, we investigated BLS knowledge and the willingness of medical students regarding BLS training, we could not assess the basic skills required to implement their techniques. The obtained self-reported data did not allow definitive confirmation of the level of knowledge and
skills. Future studies are required to evaluate BLS training and its prospective effects on the real skills. Noteworthy, only male medical students were investigated, a matter which could be resolved in future surveys. The inherent limitations of the survey design, such as the variation in understanding and interpretation, may reduce the reliability of the obtained outcomes and thus explain lack of significant differences in BLS knowledge in students who have attended educational courses.

Conclusion

In conclusion, medical students studying in preclinical years had low levels of BLS knowledge as a small proportion of them had attended relevant training. However, majority of them had positive attitudes regarding the requirement to integrate the BLS basic knowledge in the academic curricula. There is an urgent need to integrate BLS courses as educative materials to medical students to enrich their knowledge and improve resuscitation skills, update their acquired knowledge on a regular basis and ensure the implementation of correct resuscitation techniques. This would ultimately improve the future practice of medical students during emergencies and help mitigate the burden of OHCA deaths. More research is required to assess knowledge levels on a large scale in the Kingdom, considering the involvement of both male and female medical students in preclinical years to obtain deep insights into the possible factors that could be further used to set appropriate and efficient BLS course designs.

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Conflicts of interest

There are no conflicts of interest.

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