CLINICAL & BASIC RESEARCH

# Knowledge and Attitudes Towards Basic Life Support Among Health Students at a Saudi Women's University

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المعرفة والنظرة تجاه الإنعاش الحيوي الأساسي بين طالبات الكليات الصحية في جامعة نسائية سعودية

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**abstract:** *Objectives:* Awareness of basic life support (BLS) is paramount to ensure the provision of essential life-saving medical care in emergency situations. This study aimed to measure knowledge of BLS and attitudes towards BLS training among female health students at a women's university in Saudi Arabia. *Methods:* This prospective cross-sectional study took place between January and April 2016 at five health colleges of the Princess Nourah bint Abdulrahman University, Riyadh, Saudi Arabia. All 2,955 students attending the health colleges were invited to participate in the study. Participants were subsequently asked to complete a validated English-language questionnaire which included 21 items assessing knowledge of BLS and six items gauging attitudes to BLS. *Results:* A total of 1,349 students completed the questionnaire (response rate: 45.7%). The mean overall knowledge score was very low (32.7 ± 13.9) and 87.9% of the participants had very poor knowledge scores. A total of 32.5% of the participants had never received any BLS training. Students who had previously received BLS training had significantly higher knowledge scores ($P$ <0.001), although their knowledge scores remained poor. Overall, 77.0% indicated a desire to receive additional BLS training and 78.5% supported mandatory BLS training. *Conclusion:* Overall knowledge about BLS among the students was very poor; however, attitudes towards BLS training were positive. These findings call for an improvement in BLS education among Saudi female health students so as to ensure appropriate responses in cardiac arrest or other emergency situations.

*Keywords:* Basic Cardiac Life Support; Health Occupations Students; Medical Education; Knowledge; Attitudes; Saudi Arabia.

الملخص: الهدف: التوعية بالإنعاش الحيوي الأساسي أمر بالغ الأهمية لضمان توفير الرعاية الطبية الأساسية المنقذة للحياة في حالات الطوارئ. هدفت هذه الدراسة إلى قياس مدى المعرفة والنظرة إلى التدريب على الإنعاش الحيوي الأساسي بين طالبات الكليات الصحية في جامعة للبنات في المملكة العربية السعودية. الطريقة: هذه دراسة مستقبلية مستعرضة أجريت في الفترة ما بين يناير وأبريل 2016 في خمس كليات صحية في جامعة الأميرة نورة بنت عبد الرحمن، الرياض، المملكة العربية السعودية. دعيت جميع طالبات الكليات الصحية 2,955 طالبة للمشاركة في الدراسة. طلب من المشاركات استكمال استبيانات باللغة الانجليزية تضمنت 21 بندا تهدف الى تقييم المعرفة بالإنعاش الحيوي الأساسي وستة بنود تقيس نظرة الطالبات تجاه الإنعاش الحيوي الأساسي. النتائج: أكمل الاستبيان 1,349 طالبة (معدل الاستجابة: 45.7%). كانت نتيجة متوسط المعرفة الشاملة منخفضة جدا (13.9 ± 32.7) وكانت نتيجة المعرفة سيئة للغاية عند 87.9%، من المشاركات. كما أن (32.5%) من المشاركات لم يتلقون أي تدريب على الإنعاش الحيوي الأساسي. كان مدى المعرفة أفضل لدى الطالبات اللاتي تلقين التدريب على الإنعاش الحيوي الأساسي سابقا (P <0.001)، على الرغم من أن مستوى معرفتهن ظل سيئا للغاية. وعموما، أبدت 77.0% من المشاركات رغبتهن في تلقي تدريب إضافي على الإنعاش الحيوي الأساسي بينما أيد 78.5% منهن جعل التدريب إلزاميا. الخلاصة: كانت المعرفة الشاملة حول الإنعاش الحيوي الأساسي بين الطالبات سيئة للغاية. ومع ذلك، كانت النظرة إلى التدريب علية إيجابية. تدعو هذه النتائج للتوسع في تعليم الإنعاش الحيوي الأساسي لطالبات الكليات الصحية السعوديات وذلك لضمان الاستجابة المناسبة لهن في حالات السكتة القلبية أو غيرها من حالات الطوارئ.

الكلمات المفتاحية: الإنعاش القلبي الحيوي الأساسي؛ طلاب المهن الصحية؛ التعليم الطبي؛ المعرفه؛ التوجه؛ المملكة العربية السعودية.

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### Advances in Knowledge

- *To the best of the author's knowledge, this is the largest study to investigate knowledge and attitudes towards basic life support (BLS) among women in Saudi Arabia.*

- *The findings of this study revealed that the majority of Saudi female health students had positive attitudes towards BLS but poor BLS knowledge.*

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Adequate awareness of basic life support (BLS) and cardiopulmonary resuscitation (CPR) is an important global issue to ensure that individuals can provide necessary life-saving care in emergency situations.[1–3] In Saudi Arabia, there is a lack of data regarding awareness and attitudes towards BLS; however, current evidence suggests that individuals in Saudi Arabia have low levels of BLS knowledge, but positive attitudes towards BLS training.[4–8] Although several studies have highlighted this important issue, they are subject to several limitations, including small sample sizes, a lack of validated tools to assess BLS knowledge, infrequent exploration of attitudes towards BLS training and imprecise definitions of factors associated with low BLS knowledge levels.[5–7] Furthermore, there is currently no detailed information regarding BLS knowledge and attitudes among women in Saudi Arabia, as either gender was not specified or female participants were underrepresented in previously published studies.[5–7] Female health students represent a primary target for BLS education in the community.[9–12] This study therefore aimed to evaluate knowledge and attitudes towards BLS among Saudi female health students at the Princess Nourah bint Abdulrahman University (PNU) in Riyadh, the largest female-only university in Saudi Arabia. In particular, BLS knowledge was compared according to college and year of study and the effects of prior BLS training on BLS knowledge and attitudes towards training was investigated.

## Methods

This prospective, cross-sectional study took place between January and April 2016 and involved all 2,955 students attending the five health colleges (Medicine, Dentistry, Nursing, Pharmacy and Health & Rehabilitation Sciences) at PNU. These colleges share a common preparatory year known as the basic health sciences year. Previous research has indicated average BLS knowledge scores of 38–45% among allied health medical students; as such, the minimum required sample size was calculated to be 614 using a test value of 45% with a 5% margin of error, 95% confidence level ($\alpha = 0.05$), beta value of 0.20 and 80% power.[6]

Previously validated questionnaires to assess knowledge of CPR and BLS were updated according to recent American Heart Association guidelines,

where appropriate.[9,13,14] Attitudes towards BLS were evaluated using another previously validated questionnaire.[3] As such, the final self-administered questionnaire contained 27 questions assessing BLS knowledge and skills (21 multiple choice questions) and attitudes towards BLS (six multiple choice questions). As the majority of courses at PNU are taught in English, the questionnaire was distributed in its original English-language format. The final questionnaire was pilot-tested among a group of 30 female health students which resulted in an overall Cronbach's alpha value of 0.81 (0.76 for the knowledge section and 0.74 for the attitudes section). No changes were made to the questionnaire as a result of the pilot study. Subsequently, the questionnaire was distributed to all female health students at PNU by two research coordinators during class at the end of scheduled lectures. The importance of the study for improving BLS education at PNU was explained verbally during distribution of the questionnaire. The participants who had previously taken part in the pilot study were subsequently included in the main study.

Data were analysed using the Statistical Analysis System software, Version 9.4 (SAS Institute Inc., Cary, North Carolina, USA). Categorical variables were reported as numbers and percentages while continuous variables were expressed as means and standard deviations. Responses to knowledge questions were analysed according to an answer key developed from the original questionnaires; subsequently, the percentage of accurate responses for each multiple choice question was calculated.[9,13,14] The overall knowledge score for the entire sample was expressed as the percentage of correct answers out of all 21 knowledge questions. Accordingly, knowledge levels were classified as excellent (90–100%), very good (80–89%), good (70–79%), acceptable (60–69%), poor (50–59%) or very poor (<50%). Associations were calculated using analysis of variance, Fisher's exact, Chi-squared or Tukey's multiple comparison tests, as appropriate. A *P* value of ≤0.050 was considered statistically significant.

Ethical approval for this study was obtained from the Institutional Review Board of PNU before data collection (IRB #08121504). The study was conducted in accordance with the principles of the Declaration of Helsinki. All of the participants gave informed verbal consent and were assured that completion of the questionnaire was voluntary and anonymous.

**Table 1:** Characteristics of health students attending a women's university in Saudi Arabia (N = 1,349)

| Characteristic | n (%) |
|---|---|
| **Year of study** | |
| Basic health sciences* | 362 (26.8) |
| 1st year | 237 (17.6) |
| 2nd year | 242 (17.9) |
| 3rd year | 260 (19.3) |
| 4th year | 197 (14.6) |
| 5th year | 51 (3.8) |
| **College** | |
| Medicine | 231 (17.1) |
| Dentistry | 129 (9.6) |
| Nursing | 159 (11.8) |
| Pharmacy | 208 (15.4) |
| Health & Rehabilitation Sciences | 260 (19.3) |

*A common preparatory year for students in all health colleges.*

## Results

A total of 1,349 students returned completed questionnaires (response rate: 45.7%). The response rates from the individual colleges were 56.4%, 83.4%, 83.2%, 40.1%, 34.3% and 29.6% for the Basic Health Sciences, Medicine, Dentistry, Nursing, Pharmacy and Health & Rehabilitation Sciences colleges, respectively. The mean age was 20.2 ± 1.5 years. The distribution of the participants according to college and year of study is shown in Table 1. Overall, the mean knowledge score for the entire cohort was very low (32.7 ± 13.9; 95% confidence interval: 32.0–33.4) and the majority of participants (87.9%) demonstrated very low BLS knowledge levels. When analysed by year of study, basic health sciences students had a mean knowledge score of 27.1 ± 13.2, which was significantly lower than the mean scores of the first-, second-, third-, fourth- and fifth-year students (34.5 ± 14.4, 38.8 ± 12.5, 31.6 ± 12.6, 34.2 ± 14.6 and 35.6 ± 12.4, respectively; *P* <0.001). Second-year students had significantly higher scores compared to students in other years (*P* <0.010), with the exception

**Table 2:** Basic life support knowledge levels and scores according to college and year of study among health students attending a women's university in Saudi Arabia (N = 1,349)

| | Mean total score ± SD | *P* value* | Median score (IQR) | Range | Knowledge levels, n (%) | | | | *P* value* |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Good | Acceptable | Poor | Very poor | |
| **College** | | | | | | | | | |
| Medicine | 34.3 ± 14.1† | | 33.3 (23.8–42.9) | 0.0–71.4 | 1 (0.4) | 9 (3.9) | 19 (8.2) | 202 (87.4) | |
| Dentistry | 33.6 ± 13.0† | | 33.3 (23.8–38.1) | 4.8–71.4 | 1 (0.8) | 4 (3.1) | 10 (7.8) | 114 (88.4) | |
| Nursing | 35.9 ± 13.8† | <0.001‡ | 33.3 (28.6–42.9) | 4.8–66.7 | 0 (0.0) | 10 (6.3) | 19 (11.9) | 130 (81.8) | <0.001 |
| Pharmacy | 35.6 ± 12.5† | | 35.7 (28.6–42.9) | 4.8–66.7 | 0 (0.0) | 6 (2.9) | 25 (12.0) | 177 (85.1) | |
| HRS | 34.4 ± 14.4† | | 33.3 (23.8–47.6) | 4.8–66.7 | 0 (0.0) | 9 (3.5) | 32 (12.3) | 219 (84.2) | |
| **Year of study** | | | | | | | | | |
| BHS§ | 27.1 ± 13.2¶ | | 28.6 (19.0–38.1) | 0.0–66.7 | 0 (0.0) | 3 (0.8) | 15 (4.1) | 344 (95.0) | |
| 1st year | 34.5 ± 14.4‖ | | 33.3 (23.8–42.9) | 0.0–66.7 | 0 (0.0) | 8 (3.4) | 31 (13.1) | 198 (83.5) | |
| 2nd year | 38.8 ± 12.5 | | 38.1 (28.6–47.6) | 4.8–61.9 | 0 (0.0) | 10 (4.1) | 40 (16.5) | 192 (79.3) | |
| 3rd year | 31.6 ± 12.6§ | <0.001 | 28.6 (23.8–38.1) | 4.8–66.7 | 0 (0.0) | 7 (2.7) | 14 (5.4) | 239 (91.9) | <0.001 |
| 4th year | 34.2 ± 14.6§ | | 33.3 (23.8–42.9) | 4.8–71.4 | 2 (1.0) | 12 (6.1) | 14 (7.1) | 168 (85.7) | |
| 5th year | 35.6 ± 12.4 | | 33.3 (26.2–47.6) | 14.3–61.9 | 0 (0.0) | 1 (1.9) | 6 (11.5) | 45 (86.5) | |
| **Total** | **32.7 ± 13.9** | - | **33.3 (23.8–42.9)** | **0.0–71.4** | **2 (0.1)** | **41 (3.0)** | **120 (8.9)** | **1,186 (87.9)** | - |

*SD = standard deviation; IQR = interquartile range; HRS = Health & Rehabilitation Sciences; BHS = basic health sciences.*

*\*P values are based on an analysis of variance test for continuous scores and Fisher's exact test for categorical scores. †P = 0.491 for comparison among the five groups. ‡P <0.001 for comparison between the five groups. §A common preparatory year for students in all health colleges. ¶P <0.001 in comparison with the other five groups individually in paired comparisons. ‖P <0.010 in comparison with second-year students. No statistically significant difference was observed between second- and fifth-year students based on Tukey's multiple comparison test (P = 0.626).*

**Table 3:** Frequency of correct responses to questionnaire items assessing basic life support knowledge among health students attending a women's university in Saudi Arabia (N = 1,349)

| Correct response | n (%) |
|---|---|
| EMS stands for emergency medical services | 672 (49.8) |
| CPR stands for cardiopulmonary resuscitation | 905 (67.1) |
| If a 50-year-old man complains of retrosternal chest pain and nausea, contact EMS, administer aspirin and allow him to rest | 513 (38.0) |
| If a colleague displays slurring of speech and right upper limb weakness, it could be a stroke which would require thrombolysis, so you should contact EMS | 342 (25.4) |
| If you see a person collapse on the road, check if he is conscious, breathing and has a pulse | 1,012 (75.0) |
| To find out if a person is unconscious, shake them and shout at them | 244 (18.1) |
| To find a person's carotid pulse, feel their neck | 743 (55.1) |
| After confirming that a person is unconscious, not breathing and has no pulse, you should contact EMS | 162 (12.0) |
| The phone number for EMS is 997 | 969 (71.8) |
| The location of chest compressions in CPR is the mid-chest | 659 (48.9) |
| The correct rate of chest compressions for adults and children is 100–120 times/minute | 249 (18.5) |
| The correct depth of chest compressions for adults is 5–6 cm | 285 (21.1) |
| The correct ratio of chest compressions to rescue breaths is 30:2 | 503 (37.3) |
| The correct depth of chest compressions for children and infants is at least two-thirds of the depth of the chest | 60 (4.4) |
| The correct location for chest compressions for infants is one finger breadth below the nipple line | 393 (29.1) |
| Rescue breathing in infants is given mouth-to-mouth and mouth-to-nose | 340 (25.2) |
| If you do not want to give mouth-to-mouth CPR, not administering CPR is not an appropriate course of action | 346 (25.6) |
| The chance of survival for individuals experiencing an out-of-hospital cardiac arrest increases two-fold if the patient receives sufficient BLS before the arrival of EMS personnel | 90 (6.7) |
| If you come across an unresponsive adult who has been removed from fresh water and is breathing spontaneously, keep him in the recovery position | 109 (8.1) |
| If someone appears to be choking, confirm foreign body aspiration by talking to them | 131 (9.7) |
| If an infant shows symptoms of foreign body aspiration and you have confirmed that they are unable to cry/cough, perform back blows and chest compressions of five cycles each, then open the mouth and remove the foreign body only if it can be seen | 536 (39.7) |

*EMS = emergency medical services; CPR = cardiopulmonary resuscitation; BLS = basic life support.*

**Table 4:** Frequency and attitudes towards basic life support training among health students attending a women's university in Saudi Arabia (N = 1,349)

| Questionnaire item | n (%) |
|---|---|
| **Have you had previous BLS training?** | |
| Yes, in college | 293 (21.7) |
| Yes, outside college | 154 (11.4) |
| Yes, both in and outside college | 119 (8.8) |
| No | 438 (32.5) |
| I don't know | 345 (25.6) |
| **Do you want more BLS training?** | |
| Yes | 1,039 (77.0) |
| No | 81 (6.0) |
| I don't know | 229 (17.0) |
| **If yes, why do you want more BLS training?*** | |
| A family history of heart disease | 52 (5.0) |
| Avoiding unnecessary deaths in the community | 446 (42.9) |
| Important for my future work | 369 (35.5) |
| Other reasons | 78 (7.5) |
| No answer | 94 (9.0) |
| **If you have had no BLS training outside of college, what was the reason?†** | |
| Little interest | 20 (1.9) |
| Little time | 312 (29.0) |
| Not sure where courses are held | 346 (32.2) |
| Cost | 77 (7.2) |
| No answer | 321 (29.8) |
| **Do you think BLS training should be mandatory and, if so, where should it be provided?** | |
| Yes, in health colleges only | 100 (7.4) |
| Yes, in all colleges | 456 (33.8) |
| Yes, in all workplaces regardless of occupation | 503 (37.3) |
| No, BLS training should be optional | 42 (3.1) |
| I don't know | 248 (18.4) |
| **When do you think BLS training should first be provided?** | |
| High school | 562 (41.7) |
| 1st year of college | 318 (23.6) |
| 3rd year of college | 115 (8.5) |
| Just before graduation | 127 (9.4) |
| I don't know | 227 (16.8) |

*BLS = basic life support.*

*\*Total dataset for this variable was 1,039 as the question was targeted only at those students who wanted more BLS training.*

*†Total dataset for this variable was 1,076 as the question was targeted only at those students who had not previously received BLS training outside of college.*

**Table 5:** Basic life support knowledge levels and scores according to previous training history among female health students attending a women's university in Saudi Arabia (N = 1,349)

| Previous training | Mean total score ± SD | P value* | Median score (IQR) | Range | Knowledge levels, n (%) | | | | P value* |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Good | Acceptable | Poor | Very poor | |
| None | 32.7 ± 13.1[†] | | 33.3 (23.8–38.1) | 0.0–61.9 | 0 (0.0) | 13 (3.0) | 40 (9.1) | 385 (87.9) | |
| In college | 41.7 ± 13.0 | <0.001 | 42.9 (33.3–52.4) | 4.8–71.4 | 1 (0.3) | 23 (7.8) | 54 (18.4) | 215 (73.4) | <0.001 |
| Outside college | 32.4 ± 10.9[†] | | 33.3 (23.8–38.1) | 4.8–71.4 | 1 (0.6) | 2 (1.3) | 3 (1.9) | 148 (96.1) | |
| Both in and outside college | 33.3 ± 12.6[†] | | 33.3 (23.8–42.9) | 9.5–66.7 | 0 (0.0) | 2 (1.7) | 14 (11.8) | 103 (86.6) | |

*SD = standard deviation; IQR = interquartile range.*

*\*P values are based on an analysis of variance test for continuous scores and Fisher's exact test for categorical scores. [†]P = 0.856 for comparison between the three groups.*

of fifth-year students (*P* = 0.626) [Table 2]. The frequency of correct responses to all of the knowledge questions is displayed in Table 3.

A total of 32.5% of the students had never received any BLS training. Overall, attitudes towards BLS were positive; most participants reported that they wanted more BLS training (77.0%) and supported mandatory BLS training (78.5%) [Table 4]. Students who had previously received BLS training in college had significantly greater BLS knowledge scores compared to those who had received BLS training outside college, those who had received BLS training both in and outside college and those who never

received BLS training (41.7 ± 13.0 versus 32.4 ± 10.9, 33.3 ± 12.6 and 32.7 ± 13.1, respectively; *P* < 0.001). There was no significant difference in knowledge scores between those who had never received BLS training before and those who had received training outside college or both in and outside college (*P* = 0.856) [Table 5].

According to their previous history of BLS training, 98.3% of students with no prior BLS training wanted further BLS training in comparison to 87.9% of the students who had prior BLS training (*P* <0.001). In addition, students without prior training also favoured earlier BLS training (i.e. training provided in high

**Table 6:** Attitudes to basic life support training according to previous training history among health students attending a women's university in Saudi Arabia (N = 1,349)

| | Previous training, n (%) | | | | | P value* | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | None (n = 438) | Any previous training (n = 566) | In college (n = 293) | Outside college (n=154) | Both in and outside college (n = 119) | P1[†] | P2[‡] | P3[§] | P4[¶] | P5[\\] | P6[**] |
| **Do you want more BLS training?** | | | | | | | | | | | |
| Yes | 398 (98.3) | 437 (87.9) | 260 (91.2) | 99 (90.8) | 78 (75.7) | <0.001 | <0.001 | <0.001 | 0.900 | <0.001 | <0.001 |
| No | 7 (1.7) | 60 (12.1) | 25 (8.8) | 10 (9.2) | 25 (24.3) | | | | | | |
| **Do you think BLS training should be mandatory?** | | | | | | | | | | | |
| Yes | 389 (97.7) | 506 (94.6) | 281 (97.6) | 125 (89.9) | 100 (92.6) | <0.001 | 0.885 | 0.008 | <0.001 | 0.021 | 0.016 |
| No | 9 (2.3) | 29 (5.4) | 7 (2.4) | 14 (10.1) | 8 (7.4) | | | | | | |
| **When do you think BLS training should first be provided?** | | | | | | | | | | | |
| High school or 1st year of college | 348 (82.5) | 392 (73.1) | 217 (75.6) | 87 (62.1) | 88 (80.7) | <0.001 | 0.026 | 0.674 | 0.004 | 0.279 | <0.001 |
| 3rd year of college or just before graduation | 74 (17.5) | 144 (26.9) | 70 (24.4) | 53 (37.9) | 21 (19.3) | | | | | | |

*BLS = basic life support.*

*\*P values are based on Chi-squared or Fisher's exact tests, as appropriate. [†]Comparison among all four groups. [‡]Comparison between no training and in college training. [§]Comparison between no training and both in and outside college training. [¶]Comparison between in college training and outside college training. [\\]Comparison between in college training and both in and outside college training. [**]Comparison between no training and any previous training.*

school or first year of college) more frequently than those with any prior training ($P$ <0.001). A significantly larger percentage of students without prior training supported mandatory training compared with students who had received training outside of college or both in and outside of college (97.7% versus 89.9% and 92.6%, respectively; $P$ = 0.008); however, they did not support mandatory training significantly more than students who had received training in college (97.7% versus 97.6%; $P$ = 0.885) [Table 6].

## Discussion

To the best of the author's knowledge, this is the largest study to evaluate BLS knowledge and attitudes towards training among Saudi women. Unfortunately, although the results of the study indicated that female health students had overall positive attitudes towards BLS training, the majority of the students were severely deficient in BLS knowledge. These findings are in agreement with those of previous research from Saudi Arabia, which have consistently shown poor BLS awareness but favourable attitudes towards BLS training.[4,5,8] In addition, the knowledge scores observed in the current study were similar to those reported among dental students in Riyadh; however, the current cohort more frequently demonstrated very poor knowledge levels in comparison to two other studies from Saudi Arabia (87.9% versus 49.6% and 67%, respectively).[6–8] The lower scores observed in the present sample may be due to the lack of BLS training in the PNU colleges' curricula, even though BLS education is strongly encouraged. In contrast, Alotaibi *et al.* found that female students achieved significantly higher scores than male students when comparing BLS knowledge levels by gender among Saudi dental students.[8] Reddy *et al.* similarly observed higher mean knowledge scores among female dental students compared to their male counterparts.[15] Interestingly, Alotaibi *et al.* have also shown that Saudi men are more reluctant to perform CPR on a stranger in comparison to women; however, this factor was not evaluated in the present study.[8]

Poor BLS knowledge scores among health students have been reported in many countries.[9,16–20] Perceived barriers to BLS competency—including a lack of adequate education (i.e. knowledge acquisition) and educational reinforcement (i.e. knowledge reten-tion)—should be addressed in order to improve BLS knowledge and skills among healthcare trainees. In the current study, internal BLS training performed in college resulted in better outcomes than external training, including better knowledge scores and more favourable attitudes towards BLS. Therefore,

integrating a BLS training programme into the undergraduate curricula could be beneficial; this recommendation has been previously advocated in order to improve students' resuscitation skills.[16] Early exposure to BLS training in college with subsequent refresher courses for reinforcement is essential to improve BLS knowledge acquisition and retention among students.[10,13,21] Another proposed recommendation to improve BLS knowledge among Saudi female health students is to simplify BLS training to be more appropriate and cost-effective.[13] For example, poorly executed and inefficient chest compressions and rescue breaths prevent effective CPR, whereas high-quality standard CPR produces 25–33% of normal cardiac output and oxygen delivery; as such, competency in these two basic skills is vital.[14,22,23] In the present study, only 18.5% of the students knew the correct rate of chest compressions and 21.1% were aware of the recommended chest compression depth. This observation is alarming considering the simple, yet critical, value of chest compression skills.[14] Peer-led training may also serve to increase the number of female BLS educators at PNU, which could further disseminate BLS knowledge in both the university itself and the wider community.[24]

There are several limitations to this study. While this study measured BLS knowledge and attitudes, it did not evaluate actual BLS skills among the students. As many of the participants had not previously received BLS training and the majority had poor knowledge levels, their practical BLS skills are expected to be poor. Further research evaluating students' BLS skills in practice is required but should accompany effective BLS educational programmes. In addition, although the number of participants was large, there was a low response rate from some of the colleges. This may be because the questionnaires were manually distributed after lectures when some of the senior students and interns may have been based in teaching hospitals for their practical training. Consequently, future studies should consider distributing questionnaires by e-mail in order to reach a larger cohort.

## Conclusion

The findings from this study suggest that more BLS training is necessary among Saudi female health college students at PNU. Despite having very positive attitudes towards BLS training, many of the students had never received BLS training; moreover, very poor BLS knowledge levels were observed, even amongst the trained students. As students who had received BLS training in college had higher knowledge scores, it is advised that BLS training be incorporated into the

university curricula, preferably for first-year students and with refresher courses offered in subsequent years.

## References

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