

# Awareness of basic life support and cardiopulmonary resuscitation among female secondary school students in government schools in Riyadh city, KSA

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## ABSTRACT

**Background and Objective:** Basic life support (BLS) and cardiopulmonary resuscitation (CPR) are urgently required and must be performed when cardiac arrest occurs. These lifesaving procedures must be learned by healthcare professionals. In developed countries, members of the public, academics, and students learn how to carry out these emergency procedures. Knowledge of these simple procedures determines successful outcome. This study was conducted to determine the level of awareness of BLS and CPR among female secondary students at governmental schools in Riyadh city, Saudi Arabia (SA). **Methods:** This cross-sectional study was conducted in five governmental secondary schools in Riyadh city, SA, between June 2015 and June 2016. Total of 1224 female students were selected randomly, and data were collected using a self-reported structured questionnaire. **Results:** A total of 1170 participants completed the questionnaire. Most of the participants (81.5%) were Saudis. More than 50% of the students (54.8%) did not have information about BLS, and 82.6% felt their knowledge about BLS was insufficient. Only 10.8% of the participants had taken a BLS course, and only 38.5% believe BLS courses should be mandatory. **Conclusion:** The level of awareness regarding BLS among female secondary school students in governmental schools in Riyadh was found to be insufficient. The introduction of BLS and CPR courses in the curriculum of governmental secondary schools in Riyadh city is highly recommended.

**Keywords:** Awareness, basic life support, female students, governmental schools, secondary school students

## Introduction

Basic life support (BLS) is a simple and effective maneuver that if performed well and in a timely manner will increase survival rate in most emergency situations.<sup>[1-3]</sup>

This indicates the need for teaching and training non-health professionals and laypersons to provide effective and safe resuscitation prior to hospital care, as outcome would improve significantly according to several published studies.<sup>[4,5]</sup>

Many studies have been conducted internationally to explore the public knowledge and attitude toward BLS among different groups. In particular, studies done on high school students showed variable knowledge and attitude toward BLS.

In a Danish study, high school students were found to have poor knowledge about BLS, and the majority were afraid of doing BLS, but knowledge and self-confidence increased significantly after conducting training sessions.<sup>[6]</sup>

Another study done in Germany found that only 29.5% of high school students performed chest compression correctly. The rate increased to 99.2% post-training and to

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99% in 4 months period.<sup>[7]</sup> With regard to attitude, a study in Norway which included 376 secondary school students showed that majority are willing to perform cardiopulmonary resuscitation (CPR).<sup>[8]</sup>

In Lublin, Poland, a study found poor knowledge of first aid, where 67% of high school students claimed that their skills are insufficient.<sup>[9]</sup> Similar findings were reported by Sosada *et al.* in another Polish study in 2002.<sup>[10]</sup> In New Zealand, a study done by Parnell *et al.* in 2006 revealed willingness and motivation among high school students toward learning CPR but poor knowledge score with a mean of 5.61 out of 18.<sup>[11]</sup> Positive attitude of secondary school students in Rivers State, Nigeria, toward learning of BLS was also reported.<sup>[12]</sup>

There is an increasing prevalence of risk factors for cardiac diseases among both youth and adults in Saudi Arabia (SA), which makes learning BLS essential for both public and healthcare professionals. The incidence of some chronic diseases, such as diabetes mellitus, hypertension, obesity, and hyperlipidemia, has increased in SA by 8%–9% in adults, and such conditions result in the urgent need to educate the population about BLS and CPR.<sup>[13-15]</sup>

In addition, children and young adults are the age groups most affected by trauma and injuries, and it is expected that a significant percentage of trauma and injuries occurs during school time since children and young adults spend a significant amount of time at school.<sup>[16]</sup>

Locally, insufficient studies are done to reveal school students' knowledge of and attitude toward BLS. A study done in Riyadh, on 580 secondary school students, found that 56% of them did not have accurate CPR information, and about 67% of all students were willing to know more about CPR.<sup>[17]</sup>

In Taif, SA, a cross-sectional study was done on 360 male secondary school students to assess the awareness of secondary school students regarding first aid and BLS. The mean score of the students' knowledge was 64.8%, and the trained students (79.6%) reported both better first aid knowledge and skills than untrained students (53.7%). This study emphasized the necessity for integrating the subject into the core curriculum of schools, which could help in disseminating the culture of emergency care in the general population.<sup>[18]</sup>

At the level of school teachers, a cross-sectional study was done and enrolled 118 female staff from different schools of both governmental and private sectors in Jeddah City, SA, and examined the readiness of primary school staff and students to respond to emergency situations, such as cardiac arrest. It was found that the participants had insufficient knowledge about CPR. However, participants' attitude toward first aid training was positive, and such training was desired among the participants.<sup>[19]</sup> A similar study was done in Riyadh, which showed similar results.<sup>[20]</sup>

Since there are only few published studies done in SA about this topic, we conducted this study focusing on female students in governmental secondary schools in Riyadh, SA, to explore BLS and CPR awareness level and related factors.

## Methodology

This a cross-sectional study conducted in Riyadh, SA, between June 2015 and June 2016. The study targeted female students, Saudis, and non-Saudis in government secondary schools from grades 10, 11, and 12. To our knowledge, two studies had been conducted in SA to assess the knowledge of BLS and CPR among secondary school students. The first one, published 2015, was done in Taif, SA, among boy students with a sample size of 360 students.<sup>[12]</sup> The other study was conducted in 2013 with a sample size of 580 for both male and female secondary school students in Riyadh, SA.<sup>[13]</sup> We choose to do this study among female students with larger sample size for comparison with previous local studies. We also choose female students to investigate the assumption that female students may be less oriented than males in a country like SA due to less exposure of females to situations that need BLS.

Riyadh's population of secondary girl schools reached to 81,076 female students. The study's sample size was calculated assuming 50% anticipated prevalence (proportion), 95% confidence interval, and 5% error and was found to be 377 participants. Clustered stratified sampling was chosen, and Riyadh schools were divided into five female secondary school strata. The preliminary sample size was multiplied by the design effect, which equals 3.245, and the required sample size becomes 1,224 secondary school students. The list of all female governmental schools was obtained from the Ministry of Education in Riyadh, and the schools were distributed, as per geographical distribution of Riyadh provinces, into five main clusters (North, South, West, Central, and East). Then, using cluster sampling to account for the percentage of each school from the total population (81,067), the distribution of the sample size was allocated as follows: South area =  $24.5\% \times 1,224 \approx 299$ , North area =  $21.2\% \times 1,224 \approx 260$ , West area =  $19.5\% \times 1,224 \approx 239$ , Center area =  $16.0\% \times 1,224 \approx 196$ , and East area =  $18.8\% \times 1,224 = 230$  students. One school was chosen randomly to represent each geographical area in a clustered stratified sampling with two phases and a random technique.

Data were collected using a self-administered structured questionnaire that was administered to female students in class with explanation, and agreement to participate was considered as an informed consent.

The questionnaire was self-structured and modified with the help of a previous, similar study questionnaire.<sup>[21]</sup> The questionnaire was validated by three expert consultants and reliability was ensured after consulting a biostatistician and piloting. The questionnaire consisted of two main parts. The first part contained sociodemographic data (age, level of education, nationality, parent's level of education,

parent's occupation, and family income). The second part contained questions about BLS and CPR awareness levels. The questionnaire was developed initially in English and then it was translated into Arabic language. Translation was verified by two experts.

After collection, data were coded with a 1 for "Yes" answers and a 2 for "No" answers. Multiple-choice questions were awarded numbers from 1 to 6, depending on the number of options provided. Data were then entered into Statistical Package for Social Sciences (SPSS) for Windows, version 21.0 (SPSS Inc., Armonk, New York, USA). Categorical data were presented as percentage and frequency. The association between different variables was calculated using Chi-squared test of association. *P* value less than 0.05 was considered to be statistically significant.

Ethical approval for the study was obtained from the Ethical Committee, Prince Sultan Military Medical City, and from the Ministry of Education, SA. Privacy and confidentiality were maintained during data collection. The age group of students ranged from 15 to 18 years old (grades 10, 11, and 12 secondary school). SA rules considered age above 14 years as an adult and competent to consent without a need for parental consent. The authors report no conflict of interest.

## Results

Of 1224, 1170 participants completed the questionnaire with a response rate of 95.5%. As shown in Table 1, most of the participants (81.5%) were Saudis. With regard to school grades, students were distributed to grades 10, 11, and 12 with a percentage of 37.2%, 33.0%, and 29.8%, respectively.

Regarding participants' educational backgrounds, 38.6% of the students' fathers had postgraduate degrees, while just 2.8% of the students' fathers had no education. Similarly, 31.4% of the students' mothers had postgraduate degrees, while 6.8% of the students' mothers had no education. Most of the fathers (87.5%) were employed, while most of the mothers (69.8%) were not.

The level of BLS and CPR knowledge as reported by participants themselves and their perception of sufficiency of their knowledge are presented in Table 2. The results showed that 54.8% of participants considered themselves not having information about BLS, only 10.8% had taken a BLS course, 82.6% think they have insufficient knowledge about BLS, and 38.5% thought BLS courses should be mandatory in school curriculum. With regard to participants, CPR knowledge results showed that 42.6% did not know what CPR means, 10.7% had encountered a situation that requires CPR, and 90.9% of them conducted the resuscitation process.

The association between students' educational levels and nationality with BLS awareness is presented in Table 3. The results showed a statistically significant association between grade 12 level and taking BLS course ( $P = 0.056$ ). There was

**Table 1: Sociodemographic characteristics of participants (n=1170)**

Variable	n (%)
Nationality	
Saudi	955 (81.6)
Non-Saudi	215 (18.4)
Educational level	
G10	435 (37.2)
G11	386 (33.0)
G12	349 (29.8)
Participants' secondary school	
North of Riyadh	241 (20.6)
South of Riyadh	286 (24.4)
East of Riyadh	227 (19.4)
West of Riyadh	234 (20.0)
Central Riyadh	182 (15.6)
Fathers' education	
Not educated	33 (2.8)
Primary school	62 (5.3)
Secondary school	294 (25.1)
University	329 (28.1)
Postgraduate	452 (38.6)
Mothers' education	
Not educated	80 (6.8)
Primary school	106 (9.1)
Secondary school	253 (21.6)
University	364 (31.1)
Postgraduate	367 (31.4)
Fathers' employment status	
Yes	1024 (87.5)
No	146 (12.5)
Mothers' employment status	
Yes	353 (30.2)
No	817 (69.8)
Family income per month (SR)	
<5000	112 (9.6)
5001-10,000	302 (25.8)
10,001-15,000	451 (38.5)
15,001-20,000	305 (26.1)

also an association between grade 10 students and sufficient BLS knowledge ( $P = 0.001$ ). Grade 12 students believed that BLS courses should be mandatory ( $P = 0.001$ ).

No significant association was found between participants' BLS knowledge and their nationality. As shown in Table 4, there was an association between family monthly income and BLS awareness. Students with a high income took BLS courses more than students with a low income ( $P = 0.026$ ), and students with moderate-to-high income had more BLS information than students with low income ( $P = 0.003$ ). With regard to association between school location within Riyadh and BLS awareness, southern area's school students have more information about BLS than other areas, followed by the Eastern area, and the least student awareness was in the Northern area ( $P = 0.001$ ). Furthermore, Southern area's school students were more interested in having BLS courses as a mandatory subject in their

curriculum when compared with other areas ( $P = 0.012$ ).

Figure 1 shows that majority of the students had obtained their BLS knowledge from the Internet, followed by information from their schools, while TV and radio presented the least source of

**Table 2: Perception, attitude, and practice of participants about basic life support and cardiopulmonary resuscitation (n=1170)**

Information	n (%)
Do you have information about BLS?	
Yes	529 (45.2)
No	641 (54.8)
Have you ever taken a BLS course?	
Yes	126 (10.8)
No	1044 (89.2)
Do you think a BLS course should be mandatory?	
Yes	451 (38.5)
No	690 (59.0)
Should be optional	29 (2.5)
Do you feel your knowledge about BLS is sufficient?	
Yes	204 (17.4)
No	966 (82.6)
Do you know CPR?	
Yes	672 (57.4)
No	498 (42.6)
Have you ever encountered a situation that requires CPR?	
Yes	125 (10.7)
No	860 (73.6)
Not sure	185 (15.7)
Did you resuscitate the person needing CPR?	
Yes	106 (90.9)
No	19 (9.1)

BLS: basic life support; CPR: cardiopulmonary resuscitation

information. Figure 2 describes the participants' main reasons for taking a BLS course. The majority of the participants attended BLS course for personal benefit, while the remaining attended the course due to past experiences. Figure 3 shows that 82.50% participants believed that they have insufficient BLS knowledge. As shown in Figure 4, 57.40% of participants believed that they had CPR knowledge. Figure 5 shows that in an emergency, most of the participants (45.60%) would begin CPR, 32.30% would call an ambulance, and 22.10% would take victims to the hospital.

Figure 6 shows the participants' reactions to CPR situations. The majority of participants (45.5%) would first check the airways for breathing, while 25.9% would first do chest compressions, and 6.60% would first give mouth-to-mouth breathing.

### Discussion

This study comprised a relatively large sample size of female secondary school students (a total of 1224 with a response rate

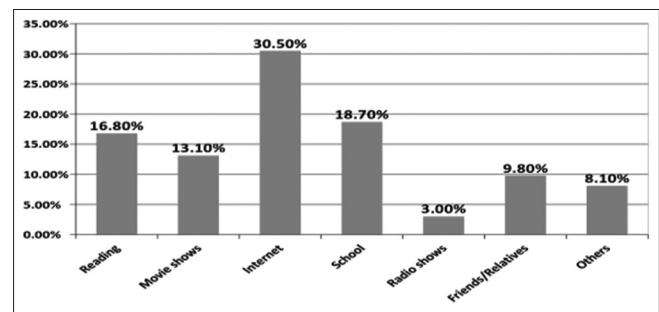


Figure 1: Source of basic life support information

**Table 3: Association between education level and nationality with perception, attitude, and practice of basic life support/cardiopulmonary resuscitation (n=1170)**

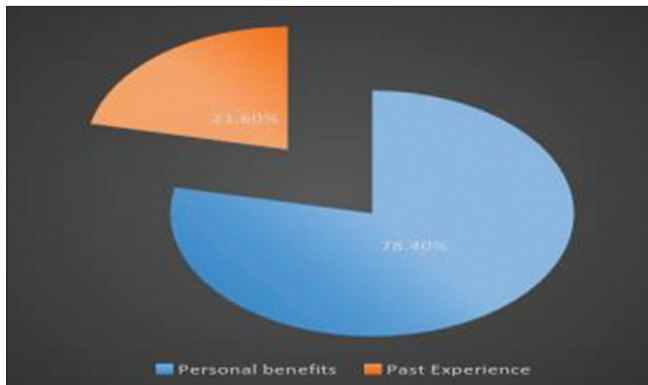
	Education level					Participants' nationality			
	Grade 10	Grade 11	Grade 12	$\chi^2$	$P^*$	Saudi	Non-Saudi	$\chi^2$	$P^*$
Do you have information about BLS?									
Yes	210	170	149	2.36	0.307	431	98	0.1	0.940
No	227	216	198			534	117		
Have you ever taken a BLS course?									
Yes	37	41	48	5.76	0.056	105	21	0.25	0.715
No	399	345	299			850	193		
Do you feel your knowledge about BLS is sufficient?									
Yes	104	58	42	22.68	0.001	171	33	1.03	0.600
No	333	327	305			783	182		
Not sure	0	1	0			1	0		
Do you think a BLS course should be mandatory?									
Yes	148	138	165	18.04	0.001	378	73	3.06	0.216
No	275	239	176			552	138		
Optional	14	9	6			25	4		
Have you ever encountered a situation that requires CPR?									
Yes	45	39	41	5.50	0.240	105	20	1.48	0.478
No	310	290	260			704	156		
Not sure	82	56	46			145	39		

\*P is considered significant if  $<0.05$ . BLS: basic life support; CPR: cardiopulmonary resuscitation

**Table 4: Association between family’s income and school location with perception, attitude, and practice of basic life support/cardiopulmonary resuscitation (n=1170)**

	Family’s monthly income						Location of the school in Riyadh						
	<5	5-10	10-15	>15	$\chi^2$	P*	North	South	East	West	Centre	$\chi^2$	P*
Do you have information about BLS?													
Yes	48	111	214	156	14.22	0.003	32	153	131	114	99	128.81	<0.001
No	64	191	237	149			209	133	96	120	83		
Have you ever taken a BLS course?													
Yes	18	26	40	42	9.25	0.026	24	37	17	24	24	5.26	0.262
No	94	275	411	263			217	249	210	209	158		
Do you feel your knowledge about BLS is sufficient?													
Yes	28	52	77	47	6.96	0.325	36	53	36	46	33	5.66	0.685
No	84	250	373	258			205	232	191	188	149		
Not sure	0	0	1	0			0	1	0	0	0		
Do you think a BLS course should be mandatory?													
Yes	50	106	177	118	5.90	0.435	108	110	83	75	75	19.65	0.012
No	59	186	267	178			132	171	133	150	104		
Should be optional	3	10	7	9			1	5	11	9	3		
Have you ever encountered a situation that requires CPR?													
Yes	17	36	41	31	7.02	0.319	25	36	22	22	20	2.80	0.950
No	84	220	335	221			182	202	167	176	133		
Not sure	11	46	74	53			34	47	38	36	29		

\*P is considered significant if <0.05. BLS: basic life support; CPR: cardiopulmonary resuscitation

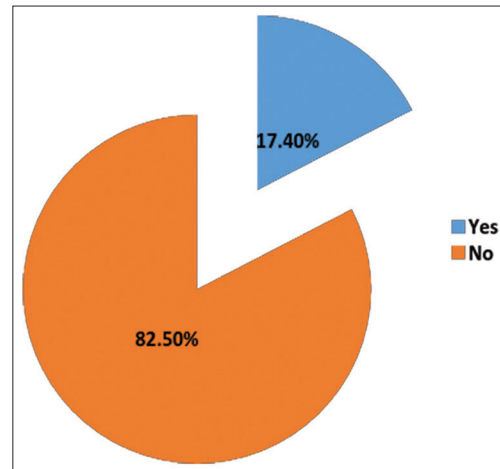


**Figure 2: Reasons for taking a basic life support course**

of 95.5%) compared with prior local studies, and this may enable investigator toward more generalizability.

The majority of students were Saudis, and this is expected since the governmental schools by law accept non-Saudis in a small proportion. The level of education and employment status of parents reflect the usual trends in Saudi community where both males and females have the same opportunity of higher education, but employment status is different. This finding was also documented in the study by Mobarak *et al.*<sup>[18]</sup>

In our study, we found poor level of awareness about BLS and CPR as perceived by the participants; 54.8% reported not having information about BLS and 42.6% did not know CPR. In comparison, this is similar to the study by Alanazi *et al.* where they found that only 58.1% and 58% for female and male students, respectively, have proper information about CPR.<sup>[17]</sup>

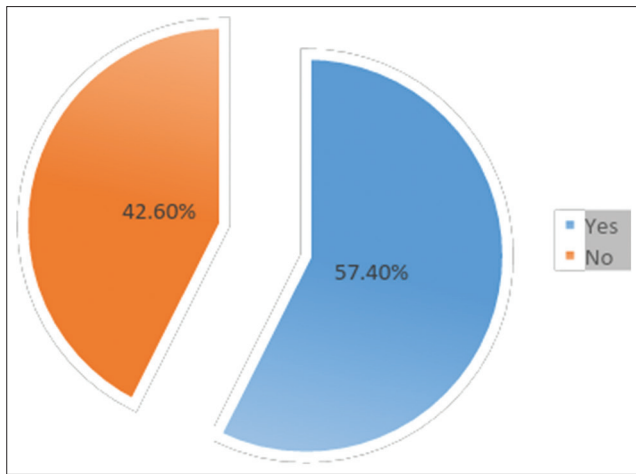


**Figure 3: Do you feel your knowledge about basic life support is sufficient?**

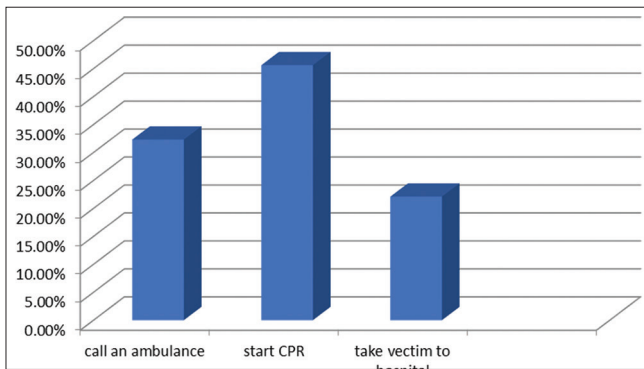
This is also comparable to the findings of other study done in Taif, SA, where the mean participants’ first aid knowledge score was 64.8%.<sup>[18]</sup>

If compared to international study, New Zealand high school students showed poor theoretical CPR knowledge, with a mean score of 5.61 out of a maximum score of 18,<sup>[11]</sup> and in Denmark, only 28% students knew how to correctly recognize normal breathing.<sup>[6]</sup>

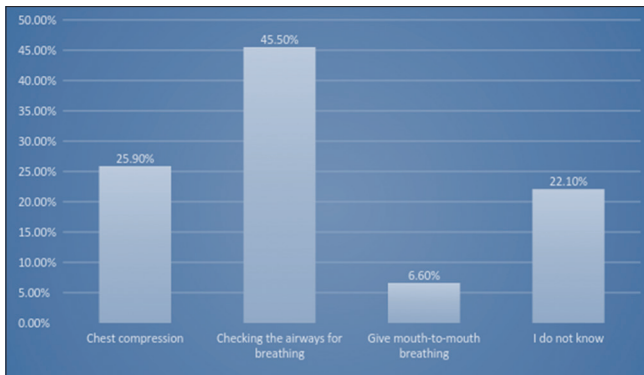
The finding of poor BLS and CPR knowledge in our study can be contributed to lack of structured educational and training course of first aid in public schools in SA. The school curriculum contains simple instruction for first aid measures like safety measures at home, but there are no structured courses of BLS, neither for teachers nor for students. Unfortunately, poor



**Figure 4:** Do you feel your knowledge about cardiopulmonary resuscitation is sufficient?



**Figure 5:** Participants' reaction to BLS situation



**Figure 6:** Participants' reaction to a CPR situation

knowledge on BLS extended to university students. In a local study done to evaluate BLS knowledge among health students at a Saudi Women's University, 87.9% of the participants had very poor knowledge scores in BLS.<sup>[22]</sup>

With regard to the number of students who had attended BLS courses, only 10.8% reported taking BLS course and this was found more among grade 12 students and students of families with high income. The correlation of BLS course attendance with high grade is expected assuming students become more

aware about importance of BLS as they grow, while correlating with high income may be explained by the fact that most of the organized BLS courses are not free in this country.

A similar finding was reported by Mobarak *et al.*,<sup>[18]</sup> and less to what was reported by the other local study where 35% of male and female high school students have some training in CPR.<sup>[17]</sup> The international figures are variable. For example, 63% of the Danish high school students had participated in prior BLS training,<sup>[21]</sup> 89% of high school students in Norway had BLS training,<sup>[6]</sup> 59% among Japanese students,<sup>[23]</sup> and one-third of students had attended a first aid course in a study done in Germany.<sup>[7]</sup>

Several reasons may contribute to poor attendance to BLS courses in our population, but at the top of the list may be the lack of awareness among decision-makers in the field of education about the importance of BLS/CPR and that secondary schools' curriculum in SA does not include BLS/CPR training. Secondary school students may not recognize well the importance of this life-saving measure by themselves, despite the fact schools are the ideal setting to educate and train for BLS.

Every member of the community should have excellent BLS knowledge and practice, and the best strategy to reach to this goal would begin by educating the community's future leaders: school students. Once the initiatives have been taken by decision-makers, it is expected that students will be well-oriented and will have the chance to be trained on BLS/CPR in well-organized and free short courses in a protected time at school. An evidence-based educational pathway with educational goals concerning learning first aid for each age group is available.<sup>[24,25]</sup> This may be used to include first aid training in school curricula. It was shown that students will gain more knowledge and skills and be more confident in performing CPR if they attended BLS courses even if trained by school teachers not by health professionals.<sup>[26-28]</sup> Barriers should be considered in planning for structured BLS for school students such as large population, cost, and lack of instructors,<sup>[29]</sup> and other alternatives should also be considered such as video presentation, slide show, and software game platforms.<sup>[30]</sup>

Only 38.5% of students in this study thought BLS courses should be mandatory in school curriculum, and this was again found to be more among grade 12 students, which may reflect maturity of thinking and better awareness with time. This low percentage actually is worrisome and may be explained by the poor knowledge and awareness of BLS among the students themselves. If we compare this to international studies, the majority of school students in Croatia, for instance, have positive attitude toward BLS training even in primary schools.<sup>[31]</sup>

With regard to readiness of students to perform CPR, the findings of this study indicate that participants' readiness is also low, where less than half (45.6%) stated they would start CPR immediately in a requiring situation, 32.3% would call an ambulance rather than starting CPR, and 20.1% prefer to take the victim immediately to the hospital. In the study by Alanazi

*et al.*, almost similar finding was obtained where 67% of students would be willing to perform CPR on a member of their families or relatives, but only one-third of them would be willing to perform it on strangers.<sup>[17]</sup> When compared to international findings, only 27% of high school students in Japan reported willingness to perform CPR<sup>[23]</sup> and it reached to 83% among students in Norway.<sup>[8]</sup>

There are certain factors that may negatively influence students with regard to BLS training and condition. This may include fear of failure as rescuer, fear of injuring victim, fear of dealing with strangers, fear of disease transmission, and fear of being in contact with victim secretions.<sup>[22,31]</sup> Addressing these concerns should be part of any future course of BLS/CPR. It was shown clearly that if students are trained and educated well about BLS, their concerns will be less and their readiness and willingness to perform CPR will improve.<sup>[6]</sup>

In our study, although only 10.7% had encountered a situation that requires CPR, 90.9% of them conducted the resuscitation process and that may reflect positive attitude toward BLS.

Southern area's school students were found to have more information about BLS and were more interested in having BLS courses as a mandatory subject. Although in Riyadh city there are certain social and financial characteristics that differentiate southern area from other areas, it is not fully understood how that difference affects knowledge and attitude of students toward BLS. The findings reflect unequal awareness between the different areas and schools and this would encourage authors to recommend adding BLS courses as a mandatory subject in the curriculum, and hence, awareness will be generalized and equalized among everyone.

Regarding source of information about BLS, almost one-third of participants had got their information from the Internet, followed by schools. This clearly shows that role of school in providing students with information about BLS is lacking and stresses the need for the Ministry of Education to include this vital information and such life-saving topics in the curriculum. Adding BLS to the secondary school curriculum will advance BLS knowledge in those parts of the country where Internet service is unavailable. In comparison to the other local study, findings are different where the main source of information about first aid was TV for 56.4% of participants, followed by parents (43.4%), books (39.2%), and teachers (33.6%).<sup>[12]</sup> This difference of findings may be due to different settings and population in both studies.

## Conclusion

This study highlighted female secondary school students' poor knowledge and awareness of BLS and CPR; therefore, this issue needs to be promptly addressed. To do this, BLS and CPR skills should be included in curriculum, the Ministry of Education must raise BLS awareness campaigns, and CPR training should

be increased. Furthermore, it is recommended that BLS course should not only be incorporated in the curriculum but also regular refresher courses are necessary and should be designed to provide hands-on experience. Nowadays, things are changing and Saudi female have become more active in community participation in different aspects, mainly education and health sectors. It is expected that female can be activists in the field of first aid and life-saving projects.

## Limitations

This study has some limitations that may partially affect the generalizability of results. The level of awareness and BLS/CPR skills in this study was based on self-report of students and not obtained through objective scoring or assessment method, and therefore, more objective methods need to be undertaken for more accurate knowledge assessment. Recall bias regarding BLS-specific questions could not be excluded from students' responses.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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