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RESEARCH ARTICLE

KNOWLEDGE, ATTITUDES, AND BEHAVIOR OF THE GENERAL SAUDI POPULATION REGARDING CARDIOPULMONARY RESUSCITATION: A SURVEY

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ABSTRACT

Background: Cardiopulmonary resuscitation (CPR) aims to increase the chance of survival following cardiac arrest. Approximately 80% of cardiac arrests occur out-of-hospital, with 53% witnessed by a bystander. We aimed to establish the knowledge, attitudes, and behaviors of the general Saudi society toward CPR.

Methods: This cross-sectional study was conducted between June 2016 and February 2017, using a convenience sample. Questionnaires were distributed to participants, and an online link was formulated and distributed on social media.

Results: A total of 391 men and women aged >18 years responded to the survey: 78.3% of respondents had heard of CPR, with media (44.4%) being the primary source of information, and 60.9% of respondents knew the correct hand positioning for chest compressions. Overall, 43% of respondents stated that they would refuse to perform CPR if required to—lack of knowledge (61.3%) and fear of making the situation worse (33.3%) were the most common reasons given. The main reason for not attending a CPR course was insufficient advertising (79.3%). The definition of CPR depended on the level of education.

Conclusion: CPR is an essential life-saving tool. Despite global and local efforts to enhance awareness, our study showed a general lack of knowledge about CPR.

Key words: Cardiopulmonary resuscitation, CPR, Saudi Arabia, Emergency medicine, public awareness

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INTRODUCTION

Cardiovascular diseases, which account for a high burden of morbidity and mortality in both developed and developing countries (Yusuf *et al.*, 2011), are the leading cause of mortality worldwide (Gunby, 1992). Cardiac arrest is a life-threatening condition in which emergent help is crucially needed (Eisenberg, 2008). It is defined as the sudden loss of cardiac function due to abnormalities of the heart's internal electrical system that induces and controls contractility. It occurs in individuals with underlying cardiac conditions and in those without (Moss, 1993). Cardiac arrest can result in sudden death if immediate help is not provided (Schrock *et al.*, 2011). Many potential factors, such as previous myocardial infarctions, heart failure, and the use of some illicit drugs, increase the risk of cardiac arrest, and cardiac arrest can result from trauma, drowning, or angina (Schrock *et al.*, 2011). It affects all age groups (Schrock *et al.*, 2011). During cardiac arrest, the heart stops pumping and blood flow to vital organs ceases; this can lead to death within minutes if

cardiopulmonary resuscitation (CPR) is not initiated (Al-Turki *et al.*, 2008; Vaillancourt *et al.*, 2008). Up to 80% of cardiac arrests that occur out-of-hospital cardiac arrests (OHCA); hence, family members and other bystanders have a high chance of witnessing an event that requires immediate provision of CPR (Al-Turki *et al.*, 2008). In the United States, >700,000 cardiac arrests occur annually. In Saudi Arabia, the cardiovascular-related mortality rate is 450 per 100,000 persons (Xu *et al.*, 2015; World Health Organization, 2014). According to the World Health Organization, 17 million cardiovascular-related deaths occur annually, accounting for 31% of all deaths globally (World Health Organization, 2007). Cardiac arrest is categorized according to where it occurred, either in-hospital or out-of-hospital. In the United States, OHCA occurs more commonly than in-hospital cardiac arrest; the incidence of OHCA is >350,000 and has a survival rate of only 12% (Mozaffarian *et al.*, 2013). Prevention of cardiac arrest involves controlling risk factors in high-risk individuals. When cardiac arrest does occur, though, immediate management is essential (Hearne and Cummins, 1988). CPR, an emergency lifesaving technique that aims to increase the chance of survival following cardiac arrest, and the use of an automated external defibrillator (AED) are the mainstays of management.

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CPR is one of four links in the chain of survival, a sequence of time-dependent interventions that result in an increased chance of survival, as explained by the American Heart Association (Jacobs *et al.*, 2001; Cummins *et al.*, 1991). In 2009, a systematic review and meta-analysis identified key predictors for surviving an OHCA; survival to hospital discharge was 6.4–13.5% when the OHCA was witnessed by a bystander, and was 3.9–16.1% if a bystander provided CPR. Survival to hospital discharge increased among those who received CPR, reflecting the importance of immediate CPR. The study also showed that 53% of OHCA were witnessed by bystanders, yet only 32% of cases received bystander CPR (Sasson *et al.*, 2009). Many reasons are given for bystander unwillingness to take action and perform CPR (Hoekstra, 1990). A study conducted in 2008 at King Saud University, Riyadh, assessed the knowledge and attitude of students ($n = 2,250$) toward CPR. Overall, 31% of the students had no prior knowledge of CPR, and 85% of those with prior knowledge felt that their level of knowledge was inadequate. Furthermore, of the 12.7% of students who had encountered a situation requiring CPR, only 14% had actually performed CPR. The most common reason for inaction was a lack of knowledge (Al-Turki *et al.*, 2008). Given that the provision of bystander CPR and early defibrillation increases survival rates from 10% to 50% (Malta Hansen *et al.*, 2017; Nichol *et al.*, 2008; Ringh *et al.*, 2015), adequate knowledge of CPR is critical to enable bystanders to perform CPR, thereby potentially saving a victim of OHCA. Saudi Arabia has no national data regarding either the incidence of OHCA or the survival rates related to OHCA; this was the rationale for conducting this study. Previous studies assessing the knowledge and behavior toward CPR in Saudi Arabia have been limited to university students. The present study aimed to establish the knowledge, attitude, and behavior toward CPR of the general Saudi society, incorporating people from a wide range of cultures, age groups, and educational levels. This knowledge, we believe, will act as an impetus for further studies into the improvement of CPR knowledge, especially with the emerging governmental and societal desire to eliminate CPR illiteracy through various new educational and promotional programs.

MATERIALS AND METHODS

Study population

This cross-sectional study was conducted from June 2016 through February 2017. It employed a convenience sampling technique. The study aimed to assess the knowledge, attitude, and behavior towards CPR of individuals in both the general population and in the medical field. Questionnaires were distributed to men and women older than 18 years with excluding medical professionals, both in hand and as an online link that was formulated and promoted on social media. The survey was sent to 1,000 individuals, 310 of whom responded (response rate, 31%). The purpose of the study was explained to each respondent, and they were assured of confidentiality.

Questionnaire

The questionnaire was developed by the researchers and evaluated by 10 experienced emergency medicine consultants. It was originally formulated in English, translated to Arabic, then translated back to English by a certified translation office, and was distributed in both English and Arabic. A pilot study was conducted involving 40 individuals from the general

population; thereafter, some adjustments were made to the questionnaire. The questionnaire comprised 26 questions, 25 of which included multiple choices. It measured three components: knowledge, attitude, and behavior towards CPR. In addition, the questionnaire contained general information about the respondents, including country of residence, age, sex, and level of education.

Ethics

Ethical approval for this study was granted by the King Abdullah International Medical Research Center (KAIMRC), Riyadh, Saudi Arabia. Informed consent was not required as the questionnaires were anonymous; willingness to complete the questionnaire was considered a proxy to consenting to participation in the survey.

Statistical methods

The data were entered and coded in a Microsoft Excel spreadsheet. The analysis was performed using IBM SPSS Statistics for Windows, Version 22.0 (Armonk, NY: IBM Corp.) Numerical data are described as the mean and standard deviation, and the chi-square test was used to compare different variables. AP -value <0.05 was considered significant.

RESULTS AND DISCUSSION

CPR is an essential life-saving tool and global efforts are being made to enhance and enrich the CPR knowledge and skills among bystanders, including secondary school students (Malta Hansen *et al.*, 2017; Salvatierra *et al.*, 2016). Given this, we investigated a sample of the Saudi population's knowledge about CPR, and examined their opinions and how would they behave in certain cases of emergency. This study was conducted as a hybrid of an online and a paper-based questionnaire, as the aim was to gather data from a wide spectrum of society, from youth active on social media to old citizens. This method resulted in collecting data from 391 respondents, 190 (48.6%) men and 201 (51.4%) women, after excluding respondents in the medical field. The majority of respondents were of Saudi nationality ($n = 384$ (98.2%)). Most respondents resided in Riyadh ($n = 333$ (85.2%)); the others resided in Jeddah ($n = 3$ (0.8%)), Sharqiyah ($n = 4$ (1%)), elsewhere within Saudi ($n = 49$ (12.5%)), and outside of Saudi ($n = 2$ (0.5%)). Different age groups were represented as follows: 223 (57%) were 18–30 years, 146 (37.3%) were 31–50 years, and 22 (5.6%) were >50 years old.

The population aged 18–30 years comprised 57% of the study sample; this was expected as this age group represents the majority of the Saudi population. Regarding level of education, 66 (16.9%) participants had completed higher studies, 190 (48.6%) had graduated college, 95 (24.3%) were college students, 27 (6.9%) were high school graduates, and 13 (3.3%) had achieved an educational level of high school or less. Most (78.3%) respondents had heard about CPR; 44.4% had heard about it from the media. When asked for the definition of CPR, 86.4% answered correctly. Most (40.7%) felt neutral regarding whether their knowledge of CPR was adequate, and only 20.5% thought their knowledge was adequate. When asked about the importance of CPR, 94.1% believed it to be important, and 74.2% thought that all adults should be able to perform CPR, provided that they had sufficient information. Most respondents (83.9%) identified chest compression as

being the most important component of CPR, but only 60.9% knew the correct hand positioning to provide chest compressions. In addition, 43% answered that they would not perform CPR if faced with a situation where it was needed; the majority of these respondents (61.3%) gave as a reason for refusal the fact that they did not know how to perform CPR. Overall, 11% of respondents had witnessed a situation in which CPR was needed. Age was associated with the source of CPR knowledge ($P = 0.01$) (Table 1) and with self-assessed competence to perform CPR ($P = 0.05$) (Table 2). In addition, the respondents' level of education was significantly associated with the source of obtaining knowledge ($P = 0.01$) (Table 3) and with satisfaction about their knowledge to perform CPR ($P = 0.05$) (Table 4). A sizable proportion of respondents (38.6%) felt neutral about their ability to perform CPR, while 38.4% thought that they were able to perform it.

This finding contrasts with a local study conducted in 2008 that demonstrated that approximately 30% of university students did not know the Saudi Red Crescent number (Moss, 1993). This may imply that level of education is associated with CPR knowledge. In terms of group comparisons, sex was associated with knowing the Red Crescent number: More men than women knew the number (73.2% vs. 48.8%, respectively, $P = 0.01$). This could be because men have more exposure to motor vehicle accidents than women. In addition, knowing the Red Crescent number was significantly associated with having previously called the number ($P = 0.01$) (Table 5). Of those who had called the number (22.8% of respondents), the main reason for calling was a loss of consciousness event occurring at home (55.1%). Finally, respondents were asked if they had heard about AEDs; only 14.8% had.

Table. 1

Question 2		Age		
		18–30 years	31–50 years	>50 years
Have you ever heard of CPR? Where?	School / College	n (%)	n (%)	n (%)
	Work Sessions	52 (29.2)	10 (9.3)	2 (10.0)
	Training Course	3 (1.7)	11 (10.2)	1 (5.0)
	Media	23 (12.9)	12 (11.1)	4 (20.0)
	Self-education	68 (38.2)	63 (58.3)	5 (25.0)
	Friends	17 (9.6)	6 (5.6)	4 (20.0)
	Family	12 (6.7)	6 (5.6)	3 (15.0)
	Others	2 (1.1)		1 (5.0)
Total		178 (100.0)	108 (100.0)	20 (100.0)
Chi-square (χ^2)			47.324	
P-value			<0.001	

CPR, cardiopulmonary resuscitation

Table. 2

Question 4		Age					
		18–30 years		31–50 years		>50 years	
		n	(%)	n	(%)	n	(%)
I feel that I have adequate knowledge about performing CPR	Strongly Disagree	25	(11.2)	18	(12.3)	1	(4.5)
	Disagree	67	(30.0)	37	(25.3)	4	(18.2)
	Neutral	75	(33.6)	72	(49.3)	12	(54.5)
	Agree	35	(15.7)	13	(8.9)	2	(9.1)
	Strongly Agree	21	(9.4)	6	(4.1)	3	(13.6)
Total		223	(100.0)	146	(100.0)	22	(100.0)
Chi-Square (χ^2)				16.681			
P-value				0.034			

CPR, cardiopulmonary resuscitation

Table. 3

Q2. Have you heard of CPR? Where did you hear about it?	Level of education										
	Higher Studies		Graduated college		College Student		High school graduate		High school student or less		
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	
School / College	11	(20.8)	16	(10.8)	35	(45.5)	2	(10.5)			
Work Sessions	1	(1.9)	14	(9.5)							
Training Course	7	(13.2)	21	(14.2)	10	(13.0)	1	(5.3)			
Media	25	(47.2)	75	(50.7)	21	(27.3)	12	(63.2)	3	(33.3)	
Self-education	7	(13.2)	10	(6.8)	6	(7.8)	2	(10.5)	2	(22.2)	
Friends	2	(3.8)	11	(7.4)	3	(3.9)	2	(10.5)	3	(33.3)	
Family			1	(0.7)	1	(1.3)					
Other					1	(1.3)			1	(11.1)	
Total	53	(100)	148	(100)	77	(100)	19	(100)	9	(100)	
Chi-square (χ^2)						88.353					
P-value						<0.001					

CPR, cardiopulmonary resuscitation.

Nonetheless, 80.6% stated a preference for calling the Red Crescent before starting CPR. Although 60.6% of respondents claimed to know the telephone number of the Red Crescent, only 81.9% of these respondents gave the correct number. Thus, only 49.6% of all survey participants knew the correct number.

knew its purpose (Gonzalez *et al.*, 2015). This gap shows the urgent need for education about AEDs in Saudi Arabia. In our sample, 88.2% of respondents had no objection to having CPR provided to them by a non-medical person, if needed, and 85.5% agreed to provide CPR to the opposite sex if needed.

Table 4

Q4. I feel that I have adequate knowledge about performing CPR.	Level of education									
	Higher Studies		Graduated College		College Student		High school graduate		High school student or less	
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)
Strongly Disagree	12	(18.2)	21	(11.1)	4	(4.2)	3	(11.1)	4	(30.8)
Disagree	21	(31.8)	51	(26.8)	28	(29.5)	6	(22.2)	2	(15.4)
Neutral	20	(30.3)	89	(46.8)	33	(34.7)	12	(44.4)	5	(38.5)
Agree	4	(6.1)	21	(11.1)	19	(20.0)	4	(14.8)	2	(15.4)
Strongly Agree	9	(13.6)	8	(4.2)	11	(11.6)	2	7.4		
Total	66	(100)	190	(100)	95	(100)	27	(100)	13	(100)
Chi-square (χ^2)	33.157									
P-value	0.007									

CPR, cardiopulmonary resuscitation

Table 5

Q24. Have you ever called the Saudi Red Crescent?							
		Yes		No		Total	
		n	(%)	n	(%)	n	(%)
Q22. Do you know the Saudi Red Crescent number	Yes	74	(83.1)	163	(54.0)	237	(60.6)
	No	15	(16.9)	139	(46.0)	154	(39.4)
	Total	89	(100.0)	302	(100.0)	391	(100.0)
Chi-square (χ^2)	24.505						
P-value	<0.001						

Only 28.9% had attended a CPR or emergency first aid course, and 91% of those who had not attended a course wanted to. Overall, 79.3% of respondents believed that such courses are not well advertised and 56.3% thought that attending first aid or CPR training should be mandatory for all students. This study demonstrated a general lack of awareness of CPR in the Saudi population, similar to two previous local studies targeting health care students and secondary school teachers (Moss, 1993; Al Enizi *et al.*, 2016). Given that approximately 80% of the sample stated that they had heard of CPR but >85% of these respondents explained CPR correctly makes us question the validity of their answer to this question, especially as 40% identified the “upper part of abdomen” or “left side of chest” as being the correct location for providing chest compressions. Sources such as media and radio might be a reason that people have a notion of CPR; however, misconceptions and inaccurate or incorrect knowledge obtained from unreliable sources likely contribute to identifying the location for chest compressions incorrectly. The more valid measure of respondents’ familiarity regarding CPR was the question “Do you feel that you have adequate knowledge to perform CPR?”; only 20.5% of respondents stated “agree” or “strongly agree”. The question “Do you think CPR can save lives?” was identified as being a leading question and, as thus expected, 94.1% of respondents answered “yes”. The same principle applied to the question “What is more important in CPR”; >80% said “chest compressions” and 16% mentioned “mouth-to-mouth” breathing. Regarding the Saudi peoples’ attitude toward CPR, we asked if respondents would perform CPR if faced with the need to do so; 57% stated they would. Asked a similar question, 75% of bystanders in a Chinese study that stated they would (Chen *et al.*, 2017). We explored reasons why the other 43% of respondents in the present study were unwilling to perform CPR and found that the most common reason was not knowing how to perform CPR. Surprisingly, only 2.4% refused to perform CPR due to fear of legal issues, in contrast to 53% of respondents in the Chinese study who were hesitant to perform CPR because of legal issues (Chen *et al.*, 2017). Another interesting comparison is that when we asked the respondents if they would allow a layperson to perform CPR on them, 88.2% of them answered “yes”, whereas only 54% of the Chinese population answered “yes”; the others wished to be rescued by medical staff only.

Therefore, although 88% of Saudis in this survey would not mind being rescued by a bystander, only 50% would provide bystander CPR, mostly due to lack of knowledge. This highlights the need for structured education around CPR. Regarding the Saudi peoples’ attitude toward CPR, 74.2% thought that all adults, “if educated”, could perform CPR, while 9% thought that CPR should be exclusively performed by those in the medical field. Only 16.9% correctly identified as true the statement that “everyone, including kindergarten children, can perform CPR if educated”. This concept indicates that CPR is genuinely an easy technique and does not need to be performed by a health care specialist. It also emphasizes the need for structured CPR education. To better understand people’s knowledge regarding when CPR is needed, we provided four different scenarios: 85.2% of respondents agreed that CPR is needed in cases of “drowning with loss of consciousness”, ~50% agreed that CPR is needed in the scenario of a “a person involved in a motor vehicle accident who sustains loss of consciousness” and “a person who has fainted”, while 95% of respondents indicated that CPR is not needed for “a person involved in a motor vehicle accident who does not sustain loss of consciousness”.

This indicated that the respondents recognized a connection between level of consciousness and the requirement for CPR. Although 71% of respondents had never attended a scientific session about CPR, 91% expressed a desire to do so, demonstrating a positive response toward learning how to perform CPR. Despite this, the majority had not engaged in any CPR course and their reasoning was mainly that CPR courses are not advertised well enough. Both this study and the Chinese study showed that nearly a quarter of participants had enrolled in a CPR training course (Chen *et al.*, 2017). CPR training was seen more in some developed countries like Slovenia, where CPR training is a mandatory part of the driver’s license examination (Rajapakse *et al.*, 2010). We asked respondents for their opinion regarding CPR education; 73% thought it should form part of the structured curriculum at school or college level, and 47% thought that structured curricular education would surpass media advertisement, awareness campaigns, and other educational methods. The study identified some interesting findings and contradictions. Specifically, 50% of respondents did not know the Saudi Red Crescent telephone number, and 10% thought they knew it but

they gave the wrong number (such as that for the traffic police or fire department). Furthermore, there was a statistically significant association between knowing the number and having called it in an emergency ($P = 0.01$). Another contradiction found was that high school and college students had significantly better knowledge regarding the meaning of CPR than did graduates and those with higher education ($P = 0.02$), indicating that the source of CPR awareness is not coming from school education but rather from other sources, such as the media (identified by 44% of respondents as their source of CPR knowledge). The findings of the present study imply that Saudi society is open and welcoming to the idea of CPR education, yet their general knowledge pertaining to CPR is minimal, potentially leading to limited action being taken during an emergency in which initiating CPR is crucial. It is extremely important to unify all emergency numbers in the country to simplify access to help. It is highly recommended that schools and universities take the initiative in implementing CPR training as part of their curricula, mandating it as a structured educational program. Extensive efforts are needed by all governmental institutions and media to spread the culture and the importance of CPR and CPR training across all age and educational groups. Further studies are needed to determine impact of increasing knowledge and awareness of CPR on behavior and attitudes toward CPR.

Conclusion

Provision of CPR and the use of an AED, the cornerstones of treating cardiac arrest, decrease cardiac-related mortality rates. To enrich society's knowledge and attitudes toward CPR, we recommend mandatory and structured school education focusing on CPR. Moreover, the media plays as a major role in delivering CPR knowledge, so qualitative and efficient media participation should be encouraged and supervised. Combining emergency numbers in Saudi Arabia into one emergency number can help people to remember the correct number to call, and removes the confusion arising from multiple numbers. Further research to determine the progress of the above-mentioned recommendations is encouraged.

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• Ethical Approval

King Abdullah International Medical Research Center

• Questionnaire board of experts

- Dr. Yasser Alaska
- Dr. Khaled Alrajhi
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