

# Knowledge and Attitudes toward Cardiopulmonary Resuscitation and Defibrillation among Primary Health-Care Physicians in Al-Ahsa, Saudi Arabia, 2018

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## Abstract

**Background:** Early recognition of cardiac arrest in an unconscious patient, early activation of emergency medical services, early cardiopulmonary resuscitation (CPR), and early defibrillation are a vital action for the management of cardiac arrest with an increased survival rate. Primary care physicians (PCPs) can play an essential role in improving the survival rate of the out of hospital cardiac arrest with the availability of automated external defibrillator (AED) and well-trained medical staff.

**Objective:** The objective of this study was to assess the knowledge and attitudes of PCPs toward defibrillation and CPR in primary health centers in Al-Ahsa.

**Methods:** We conducted a cross-sectional study through stratified random sampling on urban PCPs in Al-Ahsa, Saudi Arabia, over the period interval from May 24<sup>th</sup> 2018 to July 11<sup>th</sup> 2018.

**Results:** The response rate was 80.7% (185/229). Basic life support trained physicians are as high as 99.5 and only 32% are advanced cardiac life support trained. 68.6% of the respondents are aware of that defibrillation which is the most important intervention in CPR situations. 76% have reported that they know how to operate the AED. Those are aged ≥35 years in addition to whose year of experience ≥10 are more likely to know how to operate AED ( $P = 0.001$  and  $P = 0.021$ , respectively). We got 88% of the physician who were willing to use an AED in their clinics, but only 19.5% of the respondents have a defibrillator in their clinic.

**Conclusions:** Most of the PCPs in Al-Ahsa, Saudi Arabia, are aware of the importance of defibrillation in CPR and willing to use the AED in their clinics. The physician with ≥10 years of practice has more knowledge about the AED.

**Keywords:** Al-Ahsa, Attitude, Automated external defibrillator, Cardiopulmonary resuscitation, Knowledge, Primary care physician, Saudi Arabia

## BACKGROUND

Cardiopulmonary resuscitation (CPR) is a lifesaving technique that consists of chest compressions and artificial ventilation; this manual effort is taken to maintain circulation of oxygenated blood and preserve brain function during cardiac arrest.<sup>[1]</sup> CPR should be performed immediately

in those who are founded unconscious and pulseless.<sup>[2]</sup> In general, the main cause of the loss of cardiac function and activity is spontaneous non-perfusion arrhythmia.<sup>[3]</sup> CPR in its most basic form, it can be done anywhere by any trained lay rescuer without any specialized equipment.<sup>[2]</sup> CPR consists of three steps: Chest compressions, securing airway, and ventilation, according to the recommended guideline of the 2015 American Heart Association (AHA).<sup>[2]</sup> Health-care provider should perform chest compressions and ventilation during CPR, while lay rescuers should perform chest compression-only CPR.<sup>[2]</sup> The AHA 2015 guidelines recommend health-care professionals to ensure the safety of the scene at the beginning before commencing to assess patient's consciousness. If the patient is found unresponsive, you should start the survival chain (early

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activation of emergency medical services [EMS], early CPR, early defibrillation, and early advanced care).<sup>[4]</sup>

Automated external defibrillator (AED) is a lightweight, battery-operated portable electronic device.<sup>[5]</sup> It is used to analyze and detect life-threatening heart rhythm and to deliver a non-synchronized shock automatically when there is shockable heart rhythm which leads to establish a normal sinus rhythm.<sup>[5]</sup> AEDs were introduced in 1979, but its use was limited by EMS.<sup>[5]</sup> Nowadays, "AED use has increased dramatically with the development of compact units, self-adhesive electrode pads, voice/text prompts, and automatic internal memory recordings to allow data retrieval."<sup>[5]</sup> Therefore, AED can be found in different public areas and can be used by bystander rescuer who is trained to use an AED.<sup>[5]</sup> The AHA recommends that AED should be used by any rescuer who has attended AED training and certified from valid CPR program.<sup>[5]</sup>

Out-of-hospital cardiac arrest (OHCA) is considered an international health issue.<sup>[6]</sup> An OHCA is defined as the loss of cardiac mechanical function that occurs outside of the hospital setting and confirmed by the absence of signs of systemic circulation.<sup>[7]</sup> Cardiac arrest victims have a great chance to survive from OHCA when a particular sequence of actions occurs as fast as possible, and this sequence of steps is called the chain of survival.<sup>[7]</sup> These actions can be implemented by bystanders or EMS providers, which includes (1) recognition and activation of the emergency response system, (2) immediate high-quality CPR, (3) early use AED, (4) rapid delivery of advanced life support, and (5) early post-resuscitative care.<sup>[6,7]</sup> Survival rates from OHCA are a continuing challenge; this challenge is emphasized by the fact that reported survival ranges are highly variable, ranging from 2% to 40% around the globe.<sup>[8]</sup> Most of OHCA patient, regardless of etiology, do not receive bystander-assisted CPR or rapid implementation of other critical interventions of survival chain that is known to increase the chance of survival to hospital discharge (e.g. defibrillation).<sup>[7]</sup> However, many OHCA patients get initial intervention by bystanders or EMS.<sup>[9]</sup> Many OHCA patients develop early symptoms several hours before the event, which may lead them to seek medical help from primary care physicians (PCPs) or other out-of-hospital ambulatory care settings where he gets a cardiac arrest.<sup>[9,10]</sup> In the United States, 2% of OHCA survival get initial management in an ambulatory clinic.<sup>[9]</sup>

Nevertheless, general practitioners have great opportunity to play an important role in the management of OHCA and improve survival rate.<sup>[11]</sup> General practitioners may attend a cardiac arrest case in primary health-care clinics or during a home visit, and immediate defibrillation by general practitioners has an important impact in survival

and improving the outcomes of OHCA.<sup>[11]</sup> It has been reported that OHCA survival can be as high as 34% in patients treated initially by PCPs who are equipped with defibrillators.<sup>[9]</sup> Unfortunately, in many countries, there are limited recommendations toward resuscitation training which is required for the maintenance of confidence and competence or recommendations that mandate resuscitation equipment and supplies within medical clinics that are not hospitals or EMSs.<sup>[9]</sup> Programs were created for all health-care providers including general practitioners to train them using defibrillators and participate in appropriate and effective resuscitation.<sup>[11]</sup> In Saudi Arabia, CPR and AED training courses are held over a wide range at the governmental and private level of health-care facilities; health-care providers are required to attend these course to renew or issue their certification for licensure by Saudi Commission for Health Specialties(SCHS).<sup>[6]</sup> Skills of CPR and the use of AED are the basic training components in all life-support courses including basic life support (BLS).<sup>[6]</sup>

In Saudi Arabia, there are no data regarding knowledge and attitude toward CPR and defibrillation among PCPs on research in the literature review.

General practitioners have more contacts with patients in number than other physicians in the hospital because patients have readily easy accessibility to primary care clinic in urban and rural areas.<sup>[12]</sup> Moreover, their role in OHCA management has been ignored or get little attention compared with hospital-based resuscitation and management.<sup>[12]</sup> Even more, PCPs are very insufficiently equipped with defibrillators, which can affect their performance in CPR or maintain the required skills.<sup>[12]</sup> We should raise the attention toward the role of PCPs in OHCA and their impact on the resuscitation outcomes and take all the needed measures to raise these issue. By conducting this study, it will be the first study in Saudi Arabia which focus on PCPs and their knowledge and attitude toward CPR and AED. So we can create an epidemiological data and measure the preparedness of PCPs in Al-Ahsa City, in dealing with cardiac arrest patients and proper CPR and AED intervention. The study result can also enhance further studies and attention toward this issue.

## Objectives

### *The aim of the study*

The aim of this study was to assess the awareness of PCPs toward the role of AED in CPR at the Primary Health-Care Setting in Al-Ahsa, Eastern Province, Saudi Arabia.

### **Specific objectives**

The specific objectives of this study are as follows:

- To assess the knowledge of PCPs toward the AED.
- To assess the attitude of PCPs toward the AED.

- To assess the association between respondent's characteristics with knowledge and attitude toward the use of AED.

## Study Design and Methods

### Study design

A cross-sectional study was conducted in Al-Ahsa city, Saudi Arabia, at primary health centers (PHCs) belonging to the Public Health Department of the Ministry of Health, during the period from May to July 2018.

### Study Population

All PCP employees belonging to the Ministry of Health (governmental sector) in Al-Ahsa urban areas are eligible to be enrolled as participants in our study. There are 70 PHCs divided into three sectors (Al Omran sector, Hofuf sector, and Mubarraz sector).<sup>[13]</sup>

### Sample Size

The total population of PCPs who practice in PHCs in Al-Ahsa is 361 physicians.<sup>[13]</sup> After modifying the total number of staff physicians who work in PHCs by excluding those who work in rural areas or in study leaves and those who resigned recently, the targeted total population of our study is 229. By considering a 95% confidence interval and a 5% margin of error, the most appropriate estimated sample size is 144 participants.

### Data collection and Sampling Technique

Participants were invited to participate through phone call or face-to-face interview. All participants were requested to fill out an internet-based English questionnaire which has been validated in a previous study.<sup>[11]</sup> This survey questionnaire is permitted for non-commercial use by the original author. The sample was obtained through stratified random sampling technique. The total population is divided into three strata (Al Omran sector, Al Hofuf sector, and Al Mubarraz sector) that administrate 70 PHCs distributed geographically over Al-Ahsa. According to the Public Health Administration, the total number of PCPs in Omran sector is 67, Hofuf sector is 85, and Al Mubarraz sector is 77, and the number of each stratum was calculated as follows:

- Omran sector  $67/229=29\%$ .  $144*29\%=43$  PCPs
- Hofuf sector  $85/229=37\%$ .  $144*37\%=54$  PCPs
- Mubarraz sector  $77/229=33\%$ .  $144*33\%=49$  PCPs

The number of PCPs is obtained from each stratum by simple random technique.

An internet-based questionnaire consisted of 29 questions,<sup>[11]</sup> involving items covering demographic characteristics of respondent and knowledge and attitudes toward AED and CPR.

## Data Management and Analysis

Collected data were entered and analyzed using IBM SPSS version 25. Moreover, all variables were coded and checked before analysis.

Categorical variables of demographics data, knowledge, and attitudes toward the use of AED and CPR are presented as numbers and percentages.

To correlate between the demographics data and knowledge and attitude of the study population, both continuous and multinomial variables were recoded into two groups based on the following criteria. Age groups were created according to the median age ("below 35 years" and "35 years and above"); years of experience groups were created according to the median years of experience ("below 10 years" and "10 years and above"); specialist training was recategorized into "family medicine" and "other" and "general physicians (GPs)" and "other." A contingency coefficient (Pearson correlation coefficient) was used to indicate the level of association and P-values for Fisher's exact test were calculated.  $P \leq 0.05$  was considered to be statistically significant.

### Ethical Consideration

The approval from the Ethical Committee of the Public Health Department in Al-Ahsa Health Affairs Directorate was gained before conducting the study. An informed consent was obtained from all participants who agreed to participate in our study. Privacy ensured as were no personal identifiers on the questionnaires.

## RESULTS

185 physicians from the total population of 229 PCPs (response rate: 80.7%) have been completed the questionnaire. The characteristics of respondents are shown in Table 1. Of the overall, 58.9% were male physicians, the average age of the participants is 35.5 years, the mean duration for which physician has been in practice is 9.25 years, 27% of the respondents are family physicians versus 62.7% are GPs and 10.3% of other specialties. 67% of physicians are Saudis, and 31.9% are non-Saudi nationality. BLS-trained physicians are as high as 99.5% with 80% of them having a still valid BLS certificate, only 32.4% are advanced cardiac life support (ACLS) trained and 19.5% having a valid ACLS certificate, and only 19.5% have a defibrillator in their clinic. Moreover, 58.9% of physicians had ever attended cardiac arrest cases.

### Knowledge

Regarding the knowledge of the AED [Table 2]. We found that only 24.3% of the respondent physicians correctly

answered the first five questions of knowledge, whereas 2.7% of the respondents failed to answer any of them correctly. However, 68.6% of the respondents are aware that the defibrillation is the most important intervention besides CPR. Regarding the usage of an AED, 76% responded by “yes” to the item do you know how to operate an AED. Moreover, 77.3% had attended training on AEDs.

**Table 1: Characteristics of respondents**

Characteristics of respondents	Categorical	Frequency (%)
Age	(Min, Max )	(20, 60)
	Mean, SD	35.47, 8.508
Gender	Female	76/185 (41.1)
	Male	109/185 (58.9)
Nationality	Missing	2/185 (1.1)
	Non-Saudi	59/185 (31.9)
	Saudi	124/185 (67)
Sector	Hufof	64/185 (34.6)
	Mubarraz	70/185 (37.8)
	Omran	51/185 (27.6)
Year of experience?	(Min, Max)	(1,37)
	Mean, SD	9.25, 8.164
Specialist Training	Family Medicine	50/185 (27)
	GP	116/185 (62.7)
	Other	19/185 (10.3)
Are you BLS trained?	No	1/185 (0.5)
	Yes	184/185 (99.5)
If yes, certification still valid?	Missing	2/185 (1.1)
	No	35/185 (18.9)
	Yes	148/185 (80)
Are you ACLS trained?	No	125/185 (67.6)
	Yes	60/185 (32.4)
If yes, certification still valid?	Missing	70/185 (37.8)
	No	79/185 (42.7)
	Yes	36/185 (19.5)
Does your clinic have any defibrillator?	No	149/185 (80.5)
	Yes	36/185 (19.5)
Have you ever attended to cardiac arrest cases?	No	76/185 (41.1)
	Yes	109/185 (58.9)
If Yes how many?	Missing	71/185 (38.4)
	1 – 5	90/185 (48.6)
	6 – 10	14/185 (7.6)
	More than 10	10/185 (5.4)
Was the defibrillator being used for any cardiac arrest cases that were attended by you?	Missing	142/185 (76.8)
	No	26/185 (14.1)
	Not applicable	2/185 (1.1)
	Yes	15/185 (8.1)
	False	61/185 (33)
What do the abbreviations of “AED” represent?	True	124/185 (67)
Besides CPR, which intervention do you think is the most important in saving lives?	Defibrillation	127/185 (68.6)
	Giving resuscitation drugs	5/185 (2.7)
	Intubation	34/185 (18.4)
	Not sure	19/185 (10.3)

ACLS: Advanced cardiac life support, BLS: Basic cardiac life support, SD: Standard deviation. General Physician, post graduated physician who has Bachelor of Medicine and Bachelor of Surgery without specialty, GP: General physician

## Attitude

Concerning attitude [Table 3], 88% of the physicians are willing to use an AED in situations of CPR in case it is available. Moreover, 87% agreed that all clinics should be equipped with an AED. Consistently, 84.3% support legislation to make defibrillators compulsory equipment for all clinics. 75.7% of the respondents are willing to attend an AED training course at their expenses, and 85.9% would support/participate in community CPR/AED project. 55.4% of those who were willing to use AED in a cardiac arrest have a confidence level above 5 (lowest 1–highest 10) [Figure 1].

## Chest Compression - only Resuscitation versus Cardiopulmonary Resuscitation

Only 63.8% would perform mouth-to-mouth ventilation during CPR, and 84.9% prefer conducting standard CPR (both ventilation and chest compression) over chest compression-only CPR [Table 4].

The association between the characteristics of the study participants and their knowledge and attitude are summarized in Tables 5 and 6.

By crossing with age [Table 7], we found that the frequency of ACLS-trained individuals, subjective knowledge to operate AED, and the confidence level of AED operation significantly differ with age. We found that 40.4% of physicians aged <35 years are ACLS trained, whereas 21% those aged ≥35 years get ACLS trained (contingency coefficient = 0.199,  $P = 0.007$ ). Furthermore, 88.1% of physicians aged ≥35 are reported that they do know how to operate an AED compared to 67.9% of physician aged <35 years (contingency coefficient = 0.228,  $P = 0.001$ ). Among the physicians who were willing to use an AED in situations of CPR in case, 68.8% of physicians aged ≥35 years have more than 5/10 score of the confidence level in using AED compared to 51.6% in physicians aged <35 years (contingency coefficient = 0.278,  $P = 0.025$ ).

Crossing with gender [Table 8], the level of confidence to use an AED significantly differs with gender. Among the physicians who were willing to use an AED in situations of CPR in case, 70.7% of male physicians have more than 5/10 score of the confidence level in using AED compared to 41.5% in female physicians (contingency coefficient = 0.346,  $P = 0.004$ ).

In crossing with nationality [Table 9], we found that those who are ACLS trained, who responded by “yes” for knowledge of how to operate AED, who have valid BLS certificate, and who are willing to perform mouth to mouth ventilation during CPR are significantly differ with nationality. 40% of Saudi physicians are ACLS trained opposed to only

**Table 2: Respondent's knowledge of defibrillation**

<b>Knowledge</b>	<b>Categorical</b>	<b>Frequency (%)</b>
Answer_A	False True	31/185 (16.8) 154/185 (83.2)
Answer_E	False True	53/185 (28.8) 131/185 (71.2)
Answer_D	False True	22/185 (11.9) 163/185 (88.1)
Was the defibrillator being used for any cardiac arrest cases that were attended by you?	Missing	142/185 (76.8)
AED requires the operator to be able to interpret ECG rhythms (Correct answer: False)	No Not applicable Yes False	26/185 (14.1) 2/185 (1.1) 15/185 (8.1) 96/185 (51.9)
Besides CPR, which intervention do you think is the most important in saving lives? (if he chooses "Defibrillation": It will be true)	True False	89/185 (48.1) 58/185 (31.4)
Total score (full score = Five questions answered correctly)	True	127/185 (68.6)
	0 1 2 3 4 5	5/185 (2.7) 8/185 (4.3) 17/185 (9.2) 36/185 (19.5) 74/185 (40) 45/185 (24.3)
Do you know how to operate an AED?	No Yes	44/185 (23.8) 141/185 (76.2)
Have you attended any AED training?	No Yes	42/185 (22.7) 143/185 (77.3)

AED: Automated external defibrillator, ECG: Electrocardiogram, CPR: Cardiopulmonary resuscitation

16.9% of non-Saudi physicians (contingency coefficient = 0.227, P = 0.002). 93% of non-Saudi physician have valid BLS certificate compared to 75% of Saudi physician (contingency coefficient = 0.201, P = 0.003). Further, 70.9% of Saudi physicians reported that they know how to operate AED opposed to 88.1% among non-Saudi physicians (contingency coefficient = 0.186, P = 0.015). 76.3% of non-Saudi physicians would perform mouth-to-mouth ventilation during CPR as opposed to only 58.9% of Saudi physicians (contingency coefficient = 0.168, P = 0.031).

Crossing with the frequency of the years of experience [Table 10], we found that, being trained in ACLS, the difference in scores in knowledge items and the response to the question do you know how to operate an AED significantly differ with years of experience. 40% of physicians with <10 years of experience are ACLS trained versus 20% of those with ≥10 years of experience (contingency coefficient = 0.203, P = 0.006). However, 70.4% whose years of experience <10 years respond that they know how to operate AED versus 85.7% in those whose years of experience more or equal 10 years (contingency coefficient = 0.171, P = 0.021). Furthermore, the physicians with years of experience ≥10 get greater mean (3.8/5) of knowledge scores compared to mean (3.5/5) of knowledge scores in those years of experience are <10 years (contingency coefficient = 0.163, P < 0.047).

By crossing qualification variables (family physicians vs. other specialties) with their knowledge and attitude of CPR and AED [Table 11]. We found that the preferred method of resuscitation significantly differs among family physician respondents against other specialty respondents. 94% of family physician respondent preferred standard CPR, both ventilation and chest compression resuscitation versus 81.1% of the other specialty respondents (contingency coefficient = 0.153, P = 0.038).

By crossing qualification variables (GP vs. other specialties) with their knowledge and attitude [Table 5], GP respondents do not differ significantly from other specialty respondents regarding items of knowledge, knowing how to operate AED, the level of confidence to use an AED, and other items of attitude.

Furthermore, we found that physicians who are not willing to use AED in cardiac arrest patient have less mean of knowledge scores compared to whom who are willing to use AED when necessary (P = 0.010) [Table 12]. Furthermore, 40.9% of physicians who are not willing to use AED in cardiac arrest are reported that they know how to operate AED compared to 80.9% of physicians who are willing to use AED in cardiac arrest and that founded statistically significant (P = 0.010) [Table 13].

**Table 3: Respondent's attitudes of defibrillation**

Attitudes	Categorical	Frequency (%)
If an AED is available, would you use it to attend to your cardiac arrest patient?	No	22/185 (11.9)
	Yes	163/185 (88.1)
What is your confidence level in using AED?	1	11/164 (6.7)
	2	11/164 (6.7)
	3	17/164 (10.4)
	4	28/164 (17.1)
	5	17/164 (10.4)
	6	25/164 (15.2)
	7	22/164 (13.4)
	8	11/164 (6.7)
	9	22/164 (13.4)
	10	11/164 (6.7)
You would not use the AED because	Missing	163/185 (88.1)
	Do not know how to use an AED	8/185 (4.3)
	Do not know what is an AED	2/185 (1.1)
	Fear of legal liability	2/185 (1.1)
	Not confident	10/185 (5.4)
Are you willing to buy an AED?	No	138/185 (74.6)
	Yes	47/185 (25.4)
How much are you willing to pay for an AED?	Missing	138/185 (74.6)
	<\$1,000	31/185 (16.8)
	\$1,000 -\$2,999	14/185 (7.6)
	Above \$5,000	2/185 (1.1)
	Missing	47/185 (25.4)
Why are you not willing to buy an AED?	Difficult to maintain	19/185 (10.3)
	Not useful	9/185 (4.9)
	Other	26/185 (14.1)
	Too expensive	51/185 (27.6)
	Unsure of how to use	33/185 (17.8)
	Easy to maintain	21/185 (11.4)
	Easy to use	92/185 (49.7)
	Other	13/185 (7)
What would encourage you to purchase an AED?	Reasonable price	59/185 (31.9)
	No	45/185 (24.3)
Are you willing to attend an AED training course, at your own expense?	Yes	140/185 (75.7)
	No	24/185 (13)
Do you agree that all clinics should be equipped with an AED?	Yes	161/185 (87)
	No	29/185 (15.7)
Would you support legislation to make defibrillators compulsory equipment for all clinics?	Yes	156/185 (84.3)
	No	26/185 (14.1)
Would you support/participate in community CPR/AED project?	Yes	159/185 (85.9)

AED: Automated external defibrillator; CPR: Cardiopulmonary resuscitation

Regarding BLS training [Table 14], we found that 81% of physicians with valid BLS training certificate responded to "do you know to operate AED" by yes compared to 57.1% physicians with expired BLS training certificate (contingency coefficient = 0.223,  $P = 0.006$ ).

## DISCUSSION

In Saudi Arabia, there is a variety of physicians who differ in their demographic characteristic, years of experience, qualification, knowledge, and attitude in PHCs, for example, we can see board-certified physicians beside postgraduate

non-board-certified physicians who work in the same PHC, physicians younger than 35 years are quite more frequent representing 109 individuals (almost 59% of the sample) compared to 76 physicians older than 35 (41%), and this can be related to the increasing number of new Saudi medical graduate joining public health as GPs. Furthermore, family physicians are 50 individuals (constitutes 27% of the sample), their portion in public health manpower is higher than before, and it was increasing since the approval of the Postgraduate Center of Family Medicine in Al-Ahsa in 2011. All those physicians should have a minimum level of skills in BLS that need a periodic update and follow-up to

ensure a continuous good quality of care for emergency cases that may visit PHCs at any time.

We have proposed that the PCPs are lacking the skills pertaining to process the CPR, especially handling the AED during a cardiac arrest situation. This may be due to insufficient exposure of physicians at primary care setting to emergency cases. For this reason, we made this survey to create an epidemiological data, describe the situation, and measure the potential preparedness for successful early use of AED and initiation of CPR when needed among PCPs in urban PHC centers in Al-Ahsa.

Many factors may have a significant effect on the skills of PCPs in dealing with emergency situations. In our study, we have selected the technical experience in utilizing the AED and defibrillation as a main dependent variable which may reflect the general background of PCPs about dealing with cardiac arrest.

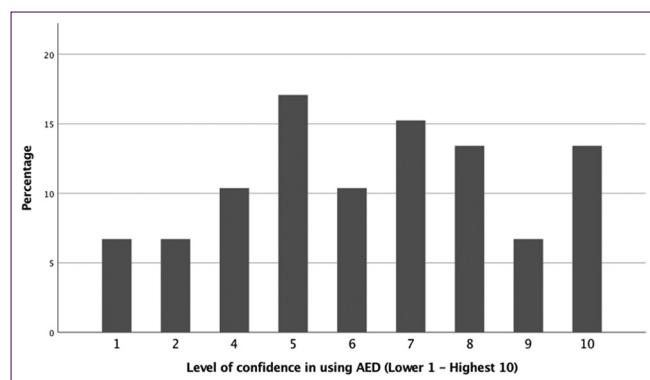
Unfortunately, only 19.5% have a defibrillator in their clinic, so clinics are deficient in the availability of AED in PHC

clinic. However, in Saudi Arabia, still more PHC centers are undergoing qualification and accreditation by the Quality Assurance Department in the Ministry of Health, and availability of AED devices and resuscitation supplies is mandatory for such accreditation.

68.6% of the respondents are aware that defibrillation is the most important intervention in lifesaving in CPR situations which is a good awareness prevalence percentage. However, only 24.3% could answer all the five questions pertaining to awareness and knowledge about AED and its use correctly. This may be related to the very infrequent hands-on practice using AED and the spaced BLS course. 76% subjectively reported that they know how to operate AED and this may give a clue to the effectiveness of BLS training programs in Saudi Arabia as 99.5% of responders reported. That they are BLS trained, and 80% of them having valid BLS certificate. Furthermore, 81% of physicians with valid BLS training certificate are responded to "do you know to operate AED" by yes compared to 57.1% physicians with expired BLS training certificate (contingency coefficient = 0.223,  $P < 0.006$ ).

However, this can be because a valid BLS certificate is an obligatory requirement for renewal of the professional registration ID by the SCHS which is, in turn, a requirement for employment and practice as a health-care provider.

Regarding ACLS training, we found that those aged  $<35$  years, who have  $<10$  years of practice, and Saudi physicians are more likely to be ACLS trained ( $P = 0.007$ , 0.006, and 0.002, respectively), and this can be explained that newly graduated physicians try to improve their knowledge and curriculum vitae for increasing their chance of joining a specialty program in the presence of high competition. Those aged  $\geq 35$  years and who have  $\geq 10$  years of practice are more tend to subjectively know how to operate AED



**Figure 1: The level of confidence in operating an automated external defibrillator (AED) PR among those who would use AED during CPR**

**Table 4: Comparison between chest-compression-only resuscitation and standard cardiopulmonary resuscitation**

Chest compression-only resuscitation vs. cardio-pulmonary resuscitation	Categorical	Frequency (%)
Would you perform mouth-to-mouth ventilation during CPR?	No	67/185 (36.2)
Which method of resuscitation would you prefer?	Yes	118/185 (63.8)
	Both ventilation and chest compression	157/185 (84.9)
Chest compression-only		28/185 (15.1)
Chest compression-only. Reason:	Missing	157/185 (84.9)
	As effective as CPR	13/185 (7)
	Easier to learn	9/185 (4.9)
	Unwilling to do mouth-to-mouth	6/185 (3.2)
Both ventilation and chest compression. Reason:	Missing	27/185 (14.6)
	Confident of CPR techniques	20/185 (10.8)
	More effective	61/185 (33)
	Recommended by National Resuscitation Council	77/185 (41.6)

CPR: Cardiopulmonary resuscitation, CCR: Chest compression-only

**Table 5: Association between respondent's characteristics with knowledge and attitude**

Question	Age	Gender	Year of experience?	Nationality	Specialist Training (FM vs Other)	Specialist Training (GP vs Other)
Trained in BCLS	0.061, 1	0.061, 1	0.057, 1	0.051, 1	0.12, 0.27	0.095, 0.373
Valid BCLS certificate	0.095, 0.445	0.123, 0.180	0.068, 0.621	0.212, 0.003	0.069, 0.551	0.040, 0.928
Trained in ACLS	0.199, 0.007	0.039, 0.635	0.203, 0.006	0.227, 0.002	0.058, 0.483	0.104, 0.194
Valid ACLS certificate	0.148, 0.142	0.023, 0.839	0.164, 0.091	0.184, 0.066	0.039, 0.810	0.002, 1
Ever attended cardiac arrest cases	0.094, 0.226	0.062, 0.449	0.129, 0.091	0.019, 0.872	0.136, 0.067	0.165, 0.03
Know to operate AED	0.228	0.024, 0.001 0.861	0.171, 0.021	0.186, 0.015	0.111, 0.173	0.115, 0.153
Level of confidence in using AED	0.278, 0.025	0.346, 0.004	0.282, 0.076	0.186, 0.676	0.254, 0.151	0.192, 0.63
Willing to buy AED	0.214, 0.004	0.157, 0.039	0.182, 0.015	0.112, 0.146	0.157, 0.036	0.116, 0.121
Agreed that all clinics should have AED	0.037, 0.660	0.093, 0.267	0.030, 0.660	0.091, 0.238	0.126, 0.09	0.101, 0.181
Would support legislation to make AED compulsory in all clinics	0.028, 0.838	0.058, 0.539	0.030, 0.835	0.053, 0.518	0.105, 0.173	0.067, 0.406
Would support/participate in community CPR/AED project	0.010, 1	0.135, 0.085	0.037, 0.665	0.087, 0.261	0.001, 1	0.106, 0.189
Obtained total score	0.165, 0.067	0.165, 0.408	0.163, 0.047	0.140, 0.620	0.148, 0.84	0.131, 0.805
Would perform mouth-to-mouth ventilation during CPR	0.125, 0.090	0.012, 1	0.1, 0.207	0.168, 0.031	0.028, 0.734	0, 1
Preferred method of resuscitation (CCR vs CPR)	0.015, 1	0.015, 0.838	0.050, 0.535	0.089, 0.271	0.153, 0.038	0.107, 0.203
Besides CPR, which intervention do you think is the most important in saving lives?	0.20, 0.872	0.122, 0.109	0.001, 1	0.083, 0.308	0.018, 0.86	0.039, 0.626

Results from cross-table (contingency coefficient, P value of Fisher's exact test). \*General Physician, post graduated physician who has Bachelor of Medicine and Bachelor of Surgery without speciality. \*Comparison between age group < 35 years and age group ≥ 35 years. \*Comparison between the group of < 10 years of experience and group of ≥ 10 years of experience. \*Comparison between Saudi nationality group and non-Saudi nationality group. ACLS: Advanced cardiac life support, AED: Automated external defibrillator, BLS: Basic cardiac life support, CCR: Chest compression-only resuscitation, CPR: Cardiopulmonary resuscitation, FM: Family medicine speciality, GPs: General physicians

**Table 6: Association between respondent's (BLS, ACLS training) with knowledge and attitude**

	Trained in BCLS	Valid BCLS certificate	Trained in ACLS	Valid ACLS certificate
Level of confidence in using AED	0.224, 0.409	0.340, 0.067	0.227, 0.382	0.308, 0.275
Willing to buy AED	0.043, 1	0.106, 0.243	0.033, 0.398	0.120, 0.245
Agreed that all clinics should have AED	0.028, 1	0.128, 0.215	0.095, 0.142	0.110, 0.255
Would support legislation	0.032, 1	0.074, 0.721	0.05, 0.042	0.015, 1
Would perform mouth-to-mouth ventilation during CPR	0.097, 0.362	0.170, 0.050	0.042, 0.626	0.018, 1
Preferred method of resuscitation	0.031, 1	0.110, 0.263	0.094, 0.273	0.233, 0.016
If an AED is available, would you use it to attend to your cardiac arrest patient?	0.027, 1	0.129, 0.195	0.102, 0.224	0.017, 1
Would you support/participate in community CPR/AED project?	0.03, 1	0.089, 0.572	0.048, 0.653	0.055, 0.541
Do you know how to operate an AED?	0.041, 1	0.223, 0.006	0.088, 0.271	0.077, 0.487
Besides CPR, which intervention do you think is the most important in saving lives?	0.050, 1	0.075, 0.855	0.054, 0.500	0.045, 0.681

ACLS: Advanced cardiac life support, AED: Automated external defibrillator, BLS: Basic cardiac life support, CPR: Cardiopulmonary resuscitation. Results from cross-table (Contingency coefficient, P Value of Fisher's exact test)

(P = 0.001 and 0.021, respectively). This can be due to frequent exposure to BLS training. In contrary, non-Saudi

physicians are more tend to subjectively know how to operate AED (P = 0.015,), which it cannot be explained.

**Table 7: Associations between age with knowledge and attitudes**

	Age		Total	P-value
	<35	35 or more		
Are you ACLS trained?				
No	65	60	125	0.007
Yes	44	16	60	
Total	109	76	185	
Do you know how to operate an AED?				
No	35	9	44	0.001
Yes	74	67	141	
Total	109	76	185	
What is your confidence level in using AED?				
1	7	4	11	0.025
2	5	6	11	
4	14	3	17	
5	18	10	28	
6	9	8	17	
7	14	11	25	
8	12	10	22	
9	6	5	11	
10	6	16	22	
Total	91	73	164	

ACLS: Advanced cardiac life support, AED: Automated external defibrillator

**Table 8: Associations between gender with knowledge and attitudes**

	Gender		Total	P-value
	Female	Male		
What is your confidence level in using AED?				
1	7	4	11	0.004
2	9	2	11	
4	7	10	17	
5	15	13	28	
6	6	11	17	
7	10	15	25	
8	5	17	22	
9	2	9	11	
10	4	18	22	
Total	65	99	164	

AED: Automated external defibrillator

Among the subgroup who would use the AED when attend cardiac arrest cases (attitude item), there are higher distribution of individuals who know how to operate AED (knowledge item) with statistical difference ( $P < 0.001$ ) and higher frequency of respondents who correctly answered the five questions on knowledge of defibrillation and AED (knowledge items) with significant statistical difference ( $P < 0.010$ ); it seems that those who would use AED in CPR tend to know how to operate AED and tend to score more on the knowledge questions.

84.9% prefer conducting standard CPR (both ventilation and chest compression) over chest-compression-only CPR; this can show that most of PCPs are aware of updated

**Table 9: Associations between nationality with knowledge and attitudes**

	Nationality		Total	P-value
	Non-Saudi	Saudi		
You BLS trained?				
If yes, certification still valid?				
No	4	31	35	0.003
Yes	55	93	148	
Total	59	124	183	
Are you ACLS trained?				
No	49	74	123	0.003
Yes	10	50	60	
Total	59	124	183	
Do you know how to operate an AED?				
No	7	36	43	0.015
Yes	52	88	140	
Total	59	124	183	
Would you perform mouth-to-mouth ventilation during CPR?				
No	14	51	65	0.031
Yes	45	73	118	
Total	59	124	183	

ACLS: Advanced cardiac life support, AED: Automated external defibrillator,

CPR: Cardiopulmonary resuscitation

**Table 10: Associations between years of experience with knowledge and attitudes**

	Years of experience		Total	P value
	<10 years	10 years or More		
Are you ACLS trained?				
No	69	56	125	0.006
Yes	46	14	60	
Total	115	70	185	
Do you know how to operate an AED?				
No	34	10	44	0.021
Yes	81	60	141	
Total	115	70	185	
Score				
0	5	0	5	0.047
1	6	2	8	
2	12	5	17	
3	22	14	36	
4	45	29	74	
5	25	20	45	
Total	115	70	185	

ACLS: Advanced cardiac life support, AED: Automated external defibrillator

AHA guidelines (2015) that recommend the health-care providers to provide standard CPR (both ventilation and chest compression) compared to lay rescuer.

PCPs have an important role in OHCA, even with low chance for OHCA to present in PHCs, they still have the opportunity to be effective in improving OHCA survival. PCPs like any medical staff should be well trained and

**Table 11: Associations between family physicians vs. other specialities with knowledge and attitude**

	Specialist training		Total	P value
	Family medicine	Other		
Which method of resuscitation would you prefer?				
Both ventilation and chest compression	47	110	157	0.038
Chest compression-only	3	25	28	
Total	50	135	185	

AED: Automated external defibrillator

**Table 12: Association between knowledge and (would you use AED groups) (independent t-test)**

Would you use AED to attend to your cardiac arrest patient?			
No (n=22)	Yes (n=163)	Independent sample t-test	
Mean (SD)	Mean (SD)	t	P value
Knowledge	3 (1.480)	3.71 (1.163)	-2.602 0.010

AED: Automated external defibrillator, SD: Standard deviation

prepared to deal with cardiac arrest in the clinic or even in public areas when needed. In Saudi Arabia, there were no studies conducted regarding OHCA in PHCs or impact of PCPs in OHCA survival rates. We need such study to raise this issue and to evaluate the current situation and needs. PHCs in Saudi Arabia are widely distributed in urban and rural areas across the kingdom; this can give them great opportunity to deal with OHCA, especially in rural PHCs.

The strength of the study and the population of interest are well defined with high response rate which makes it more representative.

**Limitation of the study, time restriction:** There was no ample time to include more physicians working in rural PHCs due to lacking of easy communication or transportation to these areas.

### Recommendations

PHCs need to be reevaluated for the availability of resuscitation equipment such as AED.

Rural PHCs in remote areas where there is no hospital nearby need to be included in more expanded study.

The psychomotor skills for the use of AED need additional in-field research tool for frank assessment.

### CONCLUSIONS

Most of PCPs in Al-Ahsa, Saudi Arabia, aware of the importance of defibrillation in CPR and willing to use AED

**Table 13: Differentiation between (would you use AED Groups) and “Do you know how to operate an AED”**

	Q17 - Would you use AED to attend to your cardiac arrest patient?		Total	P value
	No	Yes		
Do you know how to operate an AED?				
No	13	31	44	0.001
Yes	9	132	141	

AED: Automated external defibrillator

**Table 14: Association between valid BLS training certificate and ‘know to operate AED**

	Valid BLS certificate		Total	P-Value
	No	Yes		
Do you know how to operate an AED?				
No	15	28	43	0.006
Yes	20	120	140	
Total	35	148	183	

AED: Automated external defibrillator, BLS: Basic life support

in their clinics. Moreover, most of them tend to prefer standard CPR (both ventilation and chest compression resuscitation).

The physician with >10 years of practice has more knowledge about the AED.

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