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Factors associated with knowledge and attitude towards adult cardiopulmonary resuscitation among healthcare professionals at the University of Gondar Comprehensive Specialized Hospital, Northwest Ethiopia: an institutional-based cross-sectional study

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ABSTRACT

Objective This study was conducted to assess the factors associated with knowledge and attitude towards adult cardiopulmonary resuscitation (CPR) among health professionals at the University of Gondar Hospital, Northwest Ethiopia.

Study design An institutional-based cross-sectional study was conducted from 15 February to 15 March 2018. Both bivariable and multivariable logistic regression analyses were used to identify factors associated with knowledge and attitude level of health professionals towards CPR. Variables with a p value less than <0.2 in the bivariable analysis were fitted into the multivariable analysis. In the multivariable analysis, variables with a p value <0.05 were considered statistically significant.

Setting University of Gondar Comprehensive Specialized Hospital, Northwest Ethiopia.

Participants A total of 406 health professionals (physicians, nurses, anaesthetists, health officers and midwives) were included.

Results Among the study participants, 25.1% (95% CI 21.2 to 29.3) had good knowledge and 60.8% (95% CI 55.9 to 65.5) had good attitude towards adult CPR. Work experience (adjusted OR (AOR): 5.02, 95% CI 1.25 to 20.20), number of work settings (AOR: 6.52, 95% CI 2.76 to 15.41), taking CPR training (AOR: 2.76, 95% CI 1.40 to 5.42), exposure to cardiac arrest case (AOR: 2.16, 95% CI 1.14 to 4.07) and reading CPR guidelines (AOR: 5.57, 95% CI 2.76 to 11.20) were positively associated with good knowledge. Similarly, taking CPR training (AOR: 1.74, 95% CI 1.42 to 1.53) and reading CPR guidelines (AOR: 2.74, 95% CI 1.55 to 4.85) were positively associated with good attitude.

Conclusions The level of knowledge and attitude of health professionals towards adult CPR was suboptimal. Health professionals who were taking CPR training and reading CPR guidelines had good knowledge and attitude towards CPR. In addition, work experience, number of work settings and exposure to cardiac arrest case had a positive association with CPR knowledge. Thus, providing regular CPR training and work setting rotations is highly crucial.

Strengths and limitations of this study

► The study was conducted including different health professionals.
► This study used standardised and structured tools to assess knowledge and attitude level of health professionals.
► The study did not investigate the practice level of professionals.
► The study might be subjected to social desirability bias.

INTRODUCTION

Cardiopulmonary arrest is the most critical medical and surgical emergency.[1] It is a major health problem worldwide and is common especially in areas with low income, which may be associated with inadequate medical care and facilities.[2][3] Cardiac arrest may occur in and out of hospitals[4] due to different reasons, such as traumatic injuries of any cause, cardiac diseases and stroke.[5–7]

Cardiopulmonary resuscitation (CPR) is the standard treatment used for the management of cardiac arrest and combines chest compressions with ventilation.[8] Adequate knowledge and skills of healthcare givers with regard to the manoeuvres and techniques for CPR prevents irreversible organ damages and improves the chances of survival of cardiac arrest victims.[8][9] As a result, CPR

requires comprehensive efforts, with adequate knowledge and skills as well as interests and positive attitude to help victims.[10] Thus, health professionals should have basic knowledge on the fundamental aspects of basic life support (BLS) and advanced cardiac life support (ACLS) and perform high-quality CPR to improve survival from cardiac arrest.[11–14] However, knowledge and skills gap among health professionals with regard to CPR and management strategies for cardiac arrest is a global problem.[6 15]

Among Kuwait dental physicians, age, gender, years of experience and formal CPR training were correlated with CPR knowledge.[16] BLS and ACLS knowledge and skills tend to degrade after some time, and regular training and practice as a refresher course have been recommended in different studies.[17–19]

Some of the previous studies showed that health professionals have good knowledge in BLS/ACLS, such as in the use of automated external defibrillator, compression rate, compression to ventilation ratio and checking the pulse for signs of life.[18 20–22] Some literature also suggests that frequent training is important to retain good knowledge and attitude towards CPR.[17 23–25]

A study among Singapore primary care physicians showed that those who were less than 50 years old were more trained in BLS and ACLS and had good knowledge than those older than 50 years old.[20] Similarly, a cross-sectional study in a Jamaican university hospital indicated that physician seniority was inversely related to knowledge scores.[21] Another hospital-based study in Malaysia revealed that being a junior in clinical practice significantly increased the level of confidence in performing CPR.[17]

In a Nepal study on clinical faculty members (dental and basic sciences members, house officers, nurses and health assistants), knowledge score was significantly higher in those who had taken CPR training of 5 years' duration than those who had taken training of more than 5 years' duration and those who had not taken CPR training at all.[23] In addition, another study in Pakistan reported that the reason for inability and underconfidence in initiating BLS among radiology residents and radiologists was inadequate training.[26]

Finally, a study conducted among nurses in Ethiopia showed that those who had 5–10 years of clinical experiences, were working in different wards and were taking BLS training were more knowledgeable compared with their counterparts.[27]

This study aimed to assess the factors associated with knowledge and attitude level of health professionals towards CPR at the University of Gondar Comprehensive Specialized Hospital, Northwest Ethiopia.

MATERIALS AND METHODS
Study setting and population
An institutional-based cross-sectional study was conducted from 15 February to 15 March 2018. All anaesthetists,

health officers, nurses, midwives, psychiatry nurses and physicians who were working at the University of Gondar Comprehensive Specialized Hospital during the data collection period were included in this study. The University of Gondar Comprehensive Specialized Hospital is one of the medical schools in Ethiopia and is currently serving a population of around five million.

Sample size, sampling technique and procedure
Single population proportion formula was used to determine the sample size. It was calculated by considering 95% CI, a 5% margin of error and 50% as a proportion of good knowledge about CPR. Finally, a sample size of 424 was obtained after adding a 10% non-response rate. Stratified sampling followed by simple random sampling technique was employed to reach study participants. Initially, health professionals were stratified into different categories based on their field of study. A total of 843 healthcare professionals were obtained from the College of Medicine and Health Science and the University of Gondar Comprehensive Specialized Hospital human resources department. The total number of health professionals included in the study was proportional to the number of health professionals in each profession. Finally, a simple random sampling technique was employed to select study participants.

Operational definition
► *Knowledge on CPR*: study participants who answered 80% and above correct answers to the knowledge questions on CPR were considered to have good knowledge, while participants who scored below 80% were considered to have poor knowledge.[22 28–30]
► *Attitude towards CPR*: study participants who answered 80% and above correct answers to the attitude questions on CPR were considered to have positive attitude, whereas those who answered below 80% were considered to have poor attitude.[22 28] Each item of the attitude questionnaire was measured on a 5-point Likert scale, which has a total of 13 items, with a minimum total score of 13 and a maximum of 65, and expressed in percentage.
► *Number of work settings*: health professionals' number of work areas, whether working in one area or in more than one work area, at the University of Gondar Comprehensive Specialized Hospital.
► *Work experience*: health professionals' total years of experience after graduation and starting work.
► *Exposure to cardiac arrest case*: exposure of health professionals to cardiac arrest victims during their entire work experience.
► *Reading CPR guidelines*: health professionals' habit or experience of reading CPR guidelines at any time during their work experience.
► *Training on CPR*: health professionals taking CPR training for the last 2 years were considered to have regular training.

Data collection procedures

Three data collectors and one supervisor were recruited for the study. An English version of the self-administered questionnaire was used to collect data from the professionals. A total of 13 attitude and 28 knowledge questions were used to assess healthcare professionals' level of attitude and knowledge, respectively. The questionnaire was derived from a standard reference American Heart Association (AHA) guidelines for CPR and emergency cardiac care based on the course content of the 2015 AHA BLS and ACLS and were validated by the AHA.[22 29 31] The sum of correct responses for the 28 knowledge questions was computed and expressed in percentage to categorise whether study participants have good or poor knowledge. Similarly, attitude was measured on a 5-point Likert scale and expressed in percentage to categorise whether study participants have positive or negative attitude. Reliability of the tool was checked using reliability coefficient (Cronbach's alpha) and was 0.88 for knowledge and 0.86 for attitude (online supplemental files 1–4).

Data quality control

To ensure quality of data, pretest was done on 22 (5% of the sample size) health professionals at the Felege Hiwot Referral Hospital. Based on the findings amendments were made on the questionnaires. A 1-day training was given to the data collectors and the supervisor on the aim or objective of the study, how to approach study subjects, how to use the questionnaire, and how to supervise and collect data.

The principal investigator and the supervisor checked the collected data for completeness, accuracy and clarity. Daily supervision and feedback were done by the principal investigator and the supervisor during the entire period of data collection. Finally coding, data entry, data cleaning and crosschecking were done before data analysis.

Data analysis and interpretation

Epi Info V.7 and SPSS V.20 were used for data entry and analysis, respectively. Descriptive statistics were carried out and the results were presented using text, tables and graphs. Both bivariable and multivariable binary logistic regression analyses were used to identify factors associated with level of knowledge and attitude of health professionals. Variables with a p value less than <0.2 in the bivariable analysis were fitted into the multivariable logistic regression analysis using the 'enter' method. Both crude OR and adjusted OR (AOR) with the corresponding 95% CI were calculated to show the strength of association. In the multivariable analysis, variables with a p value of <0.05 were considered statistically significant. Hosmer-Lemeshow test was used to check for goodness of fit.

Patient and public involvement

The questionnaires used for this study were developed by the researchers by review of different literature and guidelines. Patients were not directly involved in the study. The results will be used by health researchers and policy makers of the country.

Table 1 Sociodemographic characteristics of health professionals working at the University of Gondar Comprehensive Specialized Hospital, Northwest Ethiopia, 2018 (N=406)

Variables	Frequency (n)	Percentage
Age (years)		
20–29	246	60.6
30–39	151	37.2
≥40	9	2.2
Sex		
Male	262	64.5
Female	144	35.5
Religion		
Orthodox	329	81.0
Muslim	40	9.9
Protestant	32	7.9
Catholic	5	1.2
Occupation		
Physician	111	27.3
Nurse	215	52.9
Health officer	6	1.5
Anaesthetist	17	4.1
Midwife	45	11.1
Psychiatry nurse	12	3.0
Educational status		
BSc degree	283	69.7
Master's degree	34	8.4
Resident	63	15.5
Specialist	26	6.4

RESULTS

Sociodemographic characteristics of the study participants

A total of 406 study participants were involved in the study, with a response rate of 95.7%. The median age of the study participants was 28 (IQR=6) years. Around two-thirds (65%) of the participants were male and most (81.0%) were orthodox in religion.

With regard to their profession, 111 (27.3%) were physicians, 215 (52.9%) nurses, 6 (1.5%) health officers, 17 (4.1%) anaesthetists, 45 (11.1%) midwives and 12 (3.0%) psychiatry nurses (table 1).

Work-related characteristics of study participants

More than half (239, 58.9%) of the study participants had 2–5 years of work experience. More than two-thirds (287, 70.7%) worked only in one ward/outpatient department, whereas 212 (52.2%) worked in different wards. More

than half (220, 54.2%) of the study participants had encountered cardiac arrest case in their work area and 145 (65.9%) of them resuscitated those cardiac arrest victims (table 2). On the other hand, 75 (34.1%) study participants did not resuscitate the victim due to different reasons (figure 1).

Knowledge level of health professionals about adult CPR

Only 102 (25.1%) (95% CI 21.2 to 29.3) participants had good knowledge about adult CPR. The median knowledge score of the study participants was 14.5 (IQR=13). The level of knowledge differs across different professions (figure 2).

The most correctly answered question by study participants was estimation of effectiveness of CPR (328, 80.8%), followed by the importance of chest compression during CPR (324, 79.8%). The least answered question was the first step for CPR for an adult unresponsive to shouting and shaking with hands among health professionals alone at the health facility (138, 34.0%), followed by correct sequence of adult BLS according to the 2015 AHA guidelines (141, 34.7%) (table 3).

Attitude level of health professionals about CPR

Of the study participants, 247 (60.8%) (95% CI 55.9 to 65.5) had good attitude. The median attitude score of health professionals towards adult CPR was 53 (IQR=10). Based on profession, 100 (90.1%) physicians and 16 (94.1%) anaesthetists had better attitude towards adult CPR compared with other professions (figure 3).

Most health professionals believe that BLS/ACLS training should be given before practising CPR. In addition, some of the professionals strongly agreed that they should be recertified on CPR course every 2 years (table 4).

Factors associated with knowledge of health professionals

In the bivariable logistic regression analysis, variables such as sex, age, work experience, number of work settings, educational status, exposure to cardiac arrest case, CPR training and reading international CPR guidelines were significant. However, only work experience, taking CPR training, number of work settings, exposure to cardiac arrest case and reading international CPR guidelines were significantly associated with good knowledge.

Accordingly, health professionals who had greater than 5 years of work experience were 5.02 times more likely to have good knowledge than health professionals who had less than 2 years of work experience (AOR: 5.02, 95% CI 1.25 to 20.20). Similarly, the odds of having good knowledge towards adult CPR were 6.52 times (AOR: 6.52, 95% CI 2.76 to 15.41) higher among health professionals working in more than one work area as compared with health professionals with exposure in only one work area. The study also revealed that the likelihood of having good knowledge towards adult CPR was 2.76 times (AOR: 2.76, 95% CI 1.40 to 5.42) higher among health professionals who had taken CPR training as compared with
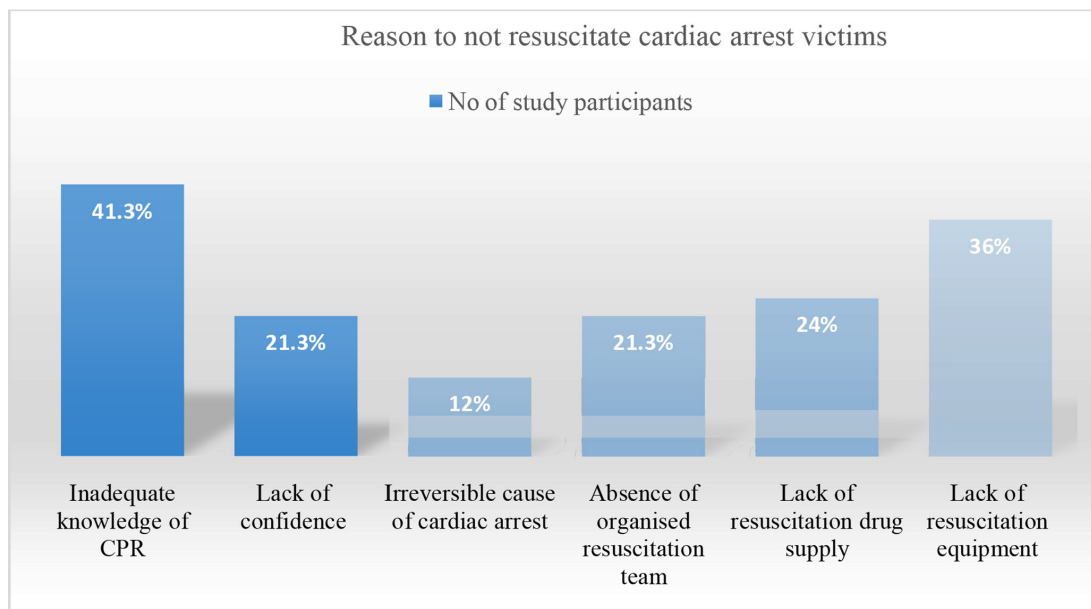
Table 2 Work-related characteristics of health professionals working at the University of Gondar Comprehensive Specialized Hospital, Northwest Ethiopia, 2018 (N=406)

Variables	Frequency (n)	Percentage
Work experience (years)		
<2	53	13.1
2–5	239	58.9
>5	114	28.0
Specific work area*		
Emergency	88	21.7
Wards†	212	52.2
Recovery room	33	8.1
Intensive care unit	62	15.3
Operation room	76	18.7
Outpatient department	172	42.4
Others‡	27	6.7
Number of work settings		
Works only in one work area	287	70.7
Works in more than one work area	119	29.3
Basis of knowledge about CPR*		
Reading	114	38.3
University/college course	234	78.7
Seminar presentation	85	28.6
Preservice training	26	8
Inservice training	85	28.6
Encountered cardiac arrest case		
Yes	220	54.2
No	186	45.8
Did you resuscitate the cardiac arrest victim? (n=220)		
Yes	145	65.9
No	75	34.1
CPR training		
Yes	158	38.9
No	248	61.1
When did you take CPR training? (n=158)		
≤2 years ago	43	27.2
>2 years ago	115	72.8
Reading CPR guidelines		
Yes	150	36.9
No	256	63.1

*Multiple response.
†Wards (medical, surgical, orthopaedic, paediatrics, obstetrics, gynaecology and psychiatry).
‡Others (dental, optometry, pathology and radiology).
CPR, cardiopulmonary resuscitation.

Figure 1 Reasons not to resuscitate cardiac arrest victims according to health professionals at the University of Gondar Comprehensive Specialized Hospital, Northwest Ethiopia, 2018 (n=75). CPR, cardiopulmonary resuscitation.

their counterparts. Health professionals who had exposure to cardiac arrest case were 2.16 times (AOR: 2.16, 95% CI 1.14 to 4.07) more likely to be knowledgeable than those who had no cardiac arrest exposure. Finally, health professionals who read international CPR guidelines were 5.57 times more likely to have good knowledge than those who did not read international CPR guidelines (AOR: 5.57, 95% CI 2.76 to 11.20) (table 5).

Factors associated with attitude of health professionals

Both bivariable and multivariable logistic regression analyses were done to see the effect of selected characteristics on the attitude of health professionals. Variables such as age, sex, number of work settings, educational

status, CPR training and reading CPR guidelines had significant association with attitude of health professionals in the bivariable analysis. However, only CPR training and reading CPR guidelines were significantly associated with good attitude in the multivariable analysis.

The likelihood of having good attitude towards adult CPR was 1.74 times (AOR: 1.74, 95% CI 1.42 to 3.53) higher among health professionals who had taken CPR training as compared with health professionals who had not taken CPR training. Similarly, the likelihood of having good attitude towards adult CPR was 2.74 times (AOR: 2.74, 95% CI 1.55 to 4.85) higher among health

Figure 2 Knowledge level of health professionals in each department at the University of Gondar Comprehensive Specialized Hospital, Northwest Ethiopia, 2018 (N=406).

Table 3 Correct responses to knowledge questions by health professionals at the University of Gondar Comprehensive Specialized Hospital, Northwest Ethiopia, 2018 (N=406)

Questions	Frequency	Percentage
The cause of reversible cardiac arrest	229	56.4
Importance of chest compression during CPR	324	79.8
Not the component of high-quality CPR	172	42.4
The steps of adult chain of survival	187	46.1
An indication to stop CPR	225	55.4
The effectiveness of CPR can be estimation	328	80.8
The correct sequence of the BLS steps, according to the 2015 AHA guidelines	141	34.7
Immediate action for an adult victim not responding to shaking and shouting (note: if multiple rescuers are present)	254	62.6
First step for an unresponsive adult person (note: if you are alone at that place)	138	34.0
The location of hands during chest compression for adult victim	269	66.3
Site of pulse check in an adult cardiac arrest	309	76.1
For an adult victim not responding to you even after shaking and shouting, the time to check for pulse	191	47
The compression to ventilation ratio according to adult BLS AHA 2015 guidelines	186	45.8
The recommended rate of effective chest compression	158	38.9
The recommended chest compression depth for adults according to AHA 2015	236	58.1
Signs of airway obstruction	323	79.6
The manoeuvre used to open airway	291	71.7
The rescuers switch roles when performing two-rescuer CPR	154	37.9
The breathing rate in an adult with an advanced airway in place during two-rescuer CPR	174	42.9
Non-shockable cardiac arrest	223	54.9
Defibrillation is indicated for documented occurrence	212	52.2
The defibrillator pads placement on an adult victim	264	65.0
Recommendations during the use of defibrillator	180	44.3
Drug and dose during shockable cardiac arrest	185	45.6
Drug used during CPR in non-shockable cardiac arrest	178	43.8
The recommended intravenous fluid during CPR	286	70.4
A type of equipment used to monitor the ventilation rate, quality of CPR and return of spontaneous circulation	214	52.7
After return of spontaneous circulation from CPR, the postresuscitation care	218	53.7

AHA, American Heart Association; BLS, basic life support; CPR, cardiopulmonary resuscitation.

professionals who read CPR guidelines as compared with health professionals who did not read CPR guidelines (table 6).

DISCUSSION

Health professionals are believed to be knowledgeable, have good attitude and are competent in caring for patients. In hospitals deterioration of patients can be gradual and preventable if health professionals manage their patients closely using their knowledge and skills in resuscitation.[8 9]

Cardiopulmonary arrest is a major health problem worldwide and is common especially in areas with low income, which may be associated with inadequate medical care and facilities.[2 3] Hence good CPR knowledge and favourable attitude are extremely important in preventing cardiac arrest and reviving the life of a patient who suddenly collapsed. However, health professionals often fail to provide high-quality CPR. Also, poor-quality CPR has been shown to have similar outcomes to patients receiving no CPR.[32]

In the current study, the knowledge level of health professionals towards adult CPR was 25.1% (95% CI 21.2 to 29.3). The finding is lower compared with other studies done in Kuwait (36%),[16] Jamaica (46%),[17] Pakistan (44.85%)[26] and Nigeria (36.9%).[24] The possible explanation for this variation might be that the current study was conducted including different health professionals, while
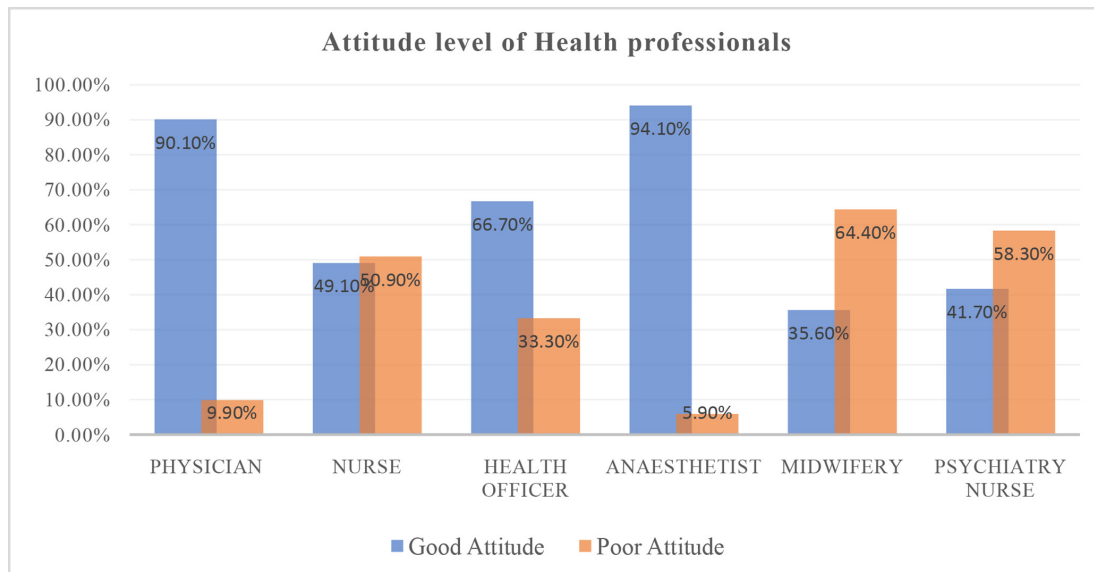
Figure 3 Attitude level of health professionals in each department at the University of Gondar Comprehensive Specialized Hospital, Northwest Ethiopia, 2018 (N=406).

the abovementioned studies were conducted only among junior medical practitioners. In addition, the study participants in Kuwait and Pakistan had taken regular CPR training every 2 years, while participants in the current study were not taking regular CPR training every 2 years.

However, in this study, knowledge level was higher than in studies done in Addis Ababa, Ethiopia (6.7%)[33] and

South Africa (11%).[30] The possible explanation might be because half of the study participants in Addis Ababa had less than 5 years of work experience and also that most of the participants (84%) were BSc holders. The study also used the highest cut-off point as a pass mark to determine level of knowledge. Also, in a South African study the number of trained professionals was lower than

Table 4 Responses to attitude questions by health professionals at the University of Gondar Comprehensive Specialized Hospital, Northwest Ethiopia, 2018 (N=406)

Attitude questions	Health professionals' response to attitude questions on CPR, n (%)				
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Interest in profession.	26 (6.4)	23 (5.7)	23 (5.7)	187 (46.1)	147 (36.2)
Aware about the importance of CPR in clinical practice.	16 (3.9)	26 (6.4)	31 (7.6)	177 (43.6)	156 (38.4)
Confident in recognising a victim who needs CPR.	10 (2.5)	23 (5.7)	31 (7.6)	182 (44.6)	160 (39.4)
Willing to provide chest compressions to a victim.	13 (3.2)	38 (9.4)	30 (7.4)	197 (48.5)	128 (31.5)
Willing to provide mouth-to-mouth ventilation.	36 (8.9)	111(27)	73(18)	131 (32.3)	55 (13.5)
Knowledge and attitude of health professionals towards CPR can affect patient outcome.	11 (2.7)	18 (4.4)	31 (7.6)	163 (40.1)	183 (45.1)
All professionals should get BLS training before practising CPR.	11 (2.7)	21 (5.2)	23 (5.7)	137 (33.7)	214 (52.7)
All professionals should get ACLS training before practising CPR.	14 (3.4)	29 (7.1)	27 (6.7)	150 (36.9)	186 (45.8)
Establishing CPR team may have good outcome for cardiac arrest victims.	12 (3.0)	27 (6.7)	35 (8.6)	165 (40.6)	167 (41.1)
CPR can be done by all health professionals.	11 (2.7)	52 (12.8)	26 (6.4)	154 (37.9)	163 (40.1)
Immediate access to defibrillator and resuscitation drugs in all hospital areas.	20 (4.9)	45 (11.1)	31 (7.6)	154 (37.9)	156 (38.4)
Health professionals should be recertified on CPR course every 2 years.	8 (2.0)	38 (9.4)	55 (13)	132 (32.5)	173 (42.6)
BLS and ACLS should be given in undergraduate course.	12 (3.0)	19 (4.7)	31 (7.6)	169 (41.6)	175 (43.1)

ACLS, advanced cardiac life support; BLS, basic life support; CPR, cardiopulmonary resuscitation; HPs, health professionals.

Table 5 Multivariable logistic regression showing factors associated with knowledge of health professionals at the University of Gondar Comprehensive Specialized Hospital, Northwest Ethiopia, 2018

Variables	Knowledge status		Crude OR (95% CI)	Adjusted OR (95% CI)
	Good, n (%)	Poor, n (%)		
Sex				
Male	76 (29.0)	186 (71.0)	1.00	1.00
Female	26 (18.1)	118 (81.9)	0.53 (0.32 to 0.89)	1.07 (0.55 to 2.06)
Age				
20–29	42 (17.1)	204 (82.9)	1.00	1.00
30–39	57 (37.7)	94 (62.3)	2.94 (1.84 to 4.70)	1.02 (0.48 to 2.18)
≥40	3 (33.3)	6 (66.7)	2.42 (0.58 to 10.09)	1.66 (0.21 to 12.69)
Level of education				
BSc degree	38 (13.4)	245 (86.6)	1.00	1.00
MSc degree	19 (55.9)	15 (44.1)	8.16 (3.82 to 17.43)	2.73 (0.91 to 7.32)
Resident	21 (33.3)	42 (66.7)	3.22 (1.72 to 6.02)	0.75 (0.27 to 2.05)
Specialist	16 (61.5)	10 (38.5)	10.31 (4.36 to 24.39)	0.589 (0.16 to 2.01)
Work experience (years)				
<2	5 (9.4)	48 (90.6)	1.00	1.00
2–5	48 (20.1)	191 (79.9)	2.41 (0.91 to 6.38)	2.03 (0.62 to 6.66)
>5	49 (43.0)	65 (57.0)	7.23 (2.68 to 19.53)	5.02 (1.25 to 20.20)*
Number of work settings				
Works only in one area	40 (14.4)	237 (85.6)	1.00	1.00
Works in more than one area	62 (48.1)	67 (51.9)	5.48 (3.38 to 8.87)	6.52 (2.76 to 15.41)*
Exposure to cardiac arrest case				
No	33 (17.7)	153 (82.3)	1.00	1.00
Yes	69 (31.4)	151 (68.6)	2.11 (1.32 to 3.39)	2.16 (1.14 to 4.07)*
CPR training				
No	25 (10.1)	223 (89.9)	1.00	1.00
Yes	77 (48.7)	81 (51.3)	8.48 (5.05 to 14.23)	2.76 (1.40 to 5.42)*
Reading CPR guidelines				
No	20 (7.8)	236 (92.2)	1.00	1.00
Yes	82 (54.7)	68 (45.3)	14.22 (8.42 to 24.86)	5.57 (2.76 to 11.20)*

Cox and Snell R-squared: 0.318.
*Significantly associated with knowledge of health professionals (p<0.05); 1.00: reference.
CPR, cardiopulmonary resuscitation.

the current study, which was a significant factor in determining health professionals' level of knowledge.

In this study, work experience has a strong association with participants' knowledge towards CPR. This finding is consistent with a study done in Ethiopia aimed to assess the knowledge and practices of nurses in two hospitals.[27] It is known that knowledge can be acquired through experience, so that individuals who had long clinical experience had high probability of getting CPR cases, leading them to read, search and understand CPR. However, contradicting findings were reported from Kuwait, where participants at lower career hierarchy and with less than 10 years of clinical experience had significantly higher knowledge scores in comparison with the

more experienced ones. This might be because, without sufficient training and practice, a significant amount of theoretical information will be forgotten after 12 months, and there will not be any remaining adequate theoretical practical skills.[16]

In the current study, participants working in different wards were more knowledgeable compared with participants working in only one ward. This result is in agreement with a Turkey study done to evaluate nurses' and doctors' knowledge of basic and advanced life support.[34] This might be because health professionals working in more than one work area and in high-risk areas had more repeated exposures to cardiac arrest cases, and as a result they acquire good theoretical knowledge and positive

Table 6 Multivariable logistic regression showing factors associated with attitude of health professionals at the University of Gondar Comprehensive Specialized Hospital, Northwest Ethiopia, 2018

Variables	Attitude status		Crude OR (95% CI)	Adjusted OR (95% CI)
	Good, n (%)	Poor, n (%)		
Sex				
Male	172 (65.6)	90 (34.4)	1.00	1.00
Female	75 (52.1)	69 (47.9)	0.56 (0.37 to 0.86)	0.72 (0.45 to 1.14)
Age				
20–29	141 (57.1)	106 (42.9)	1.00	1.00
30–39	102 (68.0)	48 (32.0)	1.59 (1.04 to 2.44)	1.42 (0.88 to 2.28)
≥40	4 (44.4)	5 (55.6)	0.60 (0.15 to 2.29)	0.76 (0.19 to 3.09)
Number of work settings				
Works only in one area	143 (49.8)	144 (50.2)	1.00	1.00
Works in more than one area	104 (87.4)	15 (12.6)	6.98 (3.87 to 12.57)	5.55 (0.98 to 10.3)
Level of education				
BSc degree	184 (65.0)	99 (35.0)	1.00	1.00
MSc degree	19 (55.9)	15 (44.1)	0.68 (0.33 to 1.40)	1.12 (0.51 to 2.43)
Resident	27 (42.9)	36 (57.1)	0.40 (0.23 to 0.73)	0.71 (0.39 to 1.31)
Specialist	17 (65.4)	9 (34.6)	1.01 (1.43 to 2.36)	1.36 (0.55 to 3.39)
CPR training				
No	138 (55.6)	110 (44.4)	1.00	1.00
Yes	109 (69.0)	49 (31.0)	1.77 (1.16 to 2.69)	1.74 (1.42 to 3.53)*
Reading CPR guidelines				
No	131 (51.2)	125 (48.8)	1.00	1.00
Yes	116 (77.3)	34 (22.7)	3.25 (2.06 to 5.12)	2.74 (1.55 to 4.85)*

Cox and Snell R-squared: 0.175.
*Significantly associated with attitude of health professionals ($p<0.05$); 1.00: reference.
CPR, cardiopulmonary resuscitation.

attitude. This is also supported by UK resuscitation guidelines, which state that staff who had more exposures to different patient care areas may have more advanced resuscitation knowledge and skills.[35]

CPR training was significantly associated with health professionals' knowledge towards CPR. Study participants who had taken CPR training were more knowledgeable than their counterparts. This finding is in line with a study in Ethiopia.[27] Other studies also reported that taking CPR training results in health professionals having good knowledge about CPR.[18 23 33 36] This might be because health professionals who had taken regular CPR training acquired up-to-date information about CPR and there was no fad in knowledge, and as a result they had good knowledge of CPR.

Previous exposure to cardiac arrest cases significantly influenced the CPR knowledge of health professionals. Those who have been exposed to cardiac arrest cases were more knowledgeable than those who have not been exposed, which is in agreement with the results of a Nepal study on BLS knowledge and attitude of medical professionals.[23] This might be because knowledge can be acquired from repeated exposures to cardiac arrest case management and experience.

In this study there was also a significant association between health professionals' knowledge and reading CPR guidelines. The finding in this study showed that health professionals who had the chance to read CPR guidelines were more knowledgeable than those who did not not read CPR guidelines. As supported by studies, reading can independently affect knowledge of professionals.[37 38] This is because health professionals who read CPR guidelines had better understanding of the theoretical and practical aspects of CPR and they can easily remember CPR principles and have up-to-date knowledge about CPR working guidelines.

In this study, the attitude level of health professionals towards CPR was 60.8% (95% CI 55.9 to 65.5). The finding is lower than a study done among Pakistan healthcare providers aimed to assess the retention of knowledge and skills in BLS (84.8%).[18] The possible explanation for this variation might be that the participants of the Pakistan study had regular training every 2 years, which is an advantage since health professionals

are able to update their knowledge, which might influence their attitude.

Study participants who had taken CPR training had good attitude compared with their counterparts. This finding is in agreement with a study in Pakistan healthcare providers aimed to assess the retention of knowledge and skills in BLS.[18] This might be because healthcare professionals who had taken regular CPR training acquired up-to-date information about CPR and that professionals may share personal experiences with each other.

In this study, health professionals who read CPR guidelines are 2.80 times more likely to have good attitude than those who did not read CPR guidelines. As reported from different studies,[39 40] health professionals' attitude might change with training incentives and reading. Due to this possible reason, reading CPR working guidelines gave confidence and positive attitude towards CPR among health professionals.

This study has its own limitations. First, the study is cross-sectional and cannot establish cause and effect relationship. Second, there might be social desirability bias among respondents in answering the knowledge and attitude questions. Finally, the study did not include the practice of CPR, and the findings may not be generalised to all health professionals in the Amhara Region.

In conclusion, this study confirmed that the level of knowledge and attitude of health professionals towards adult CPR was suboptimal, according to the AHA reference for CPR certification. Taking CPR training and reading CPR guidelines were significantly associated with both good knowledge and attitude of health professionals towards CPR, while health professionals' work experience, exposure to cardiac arrest case and work exposure were significantly associated with good knowledge. Therefore, regular CPR training and reading CPR guidelines are recommended to increase the level of knowledge and attitude of health professionals towards adult CPR. Also, updating CPR guidelines and providing access for every health professional are crucial. Finally, conducting similar studies that include the level of skills of professionals by simulation-based or real cardiac arrest cases is recommended.

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REFERENCES

1 Nolan JP, Soar J, Zideman DA, et al. European resuscitation Council guidelines for resuscitation 2010 section 1. executive summary. *Resuscitation* 2010;51:1219–76.
2 Chugh SS, Reinier K, Teodorescu C, et al. Epidemiology of sudden cardiac death: clinical and research implications. *Prog Cardiovasc Dis* 2008;51:213–28.
3 Feero S, Hedges JR, Stevens P. Demographics of cardiac arrest: association with residence in a low-income area. *Acad Emerg Med* 1995;2:11–16.
4 Soo L, Huff N, Gray D, et al. Geographical distribution of cardiac arrest in Nottinghamshire. *Resuscitation* 2001;48:137–47.
5 Lockey D, Crewdson K, Davies G. Traumatic cardiac arrest: who are the survivors? *Ann Emerg Med* 2006;48:240–4.
6 Mehra R. Global public health problem of sudden cardiac death. *J Electrocardiol* 2007;40:S118–22.
7 Go AS, Mozaffarian D, Roger VL, et al. Heart disease and stroke statistics--2013 update: a report from the American Heart Association. *Circulation* 2013;127:e6–245.
8 Sreevastava DK, Roy PK, Dass SK, et al. Cardio-pulmonary Resuscitation : an overview of Recent Advances in Concepts and Practices. *Med J Armed Forces India* 2004;60:52–8.
9 Association AH. Highlights of the 2015 American heart association guidelines update for CPR and ECC. Dallas, USA, 2015.
10 Hodges UM, Adams AP. Guidelines for resuscitation. *Survey of Anesthesiology* 1994;38:301.
11 Nambiar M, Nedungalaparambil NM, Aslesh OP. Is current training in basic and advanced cardiac life support (BLS & ACLS) effective? A study of BLS & ACLS knowledge amongst healthcare professionals of North-Kerala. *World J Emerg Med* 2016;7:263.
12 Ralapanawa DMPUK, Jayawickreme KP, Ekanayake EMM, et al. A study on the knowledge and attitudes on advanced life support among medical students and medical officers in a tertiary care hospital in Sri Lanka. *BMC Res Notes* 2016;9:462.
13 Kleinman ME, Brennan EE, Goldberger ZD, et al. Part 5: adult basic life support and cardiopulmonary resuscitation quality. *Circulation* 2015;132:S414–35.
14 Cooper S, Johnston E, Priscott D, et al. Immediate life support (ILS) training impact in a primary care setting? *Resuscitation* 2007;72:92–9.
15 Ritter G, Wolfe RA, Goldstein S, et al. The effect of bystander CPR on survival of out-of-hospital cardiac arrest victims. *Am Heart J* 1985;110:932–7.
16 Alkandari SA, Alyahya L, Abdulwahab M. Cardiopulmonary resuscitation knowledge and attitude among General dentists in Kuwait. *World J Emerg Med* 2017;8:19.
17 Chew F Z A W M N KS, Mohd Hashairi F, Ida Zarina Z, et al. A survey on the knowledge, attitude and confidence level of adult cardiopulmonary resuscitation among junior doctors in hospital

Universiti Sains Malaysia and hospital Raja Perempuan Zainab II, Kota Bharu, Kelantan, Malaysia. *Med J Malaysia* 2011;66:56–9.

18 Ilyas R, KS-e Z, Pradhan N, *et al*. Retention of knowledge and skills of basic life support among health care providers trained in tertiary care hospital. *Pakistan Heart Journal* 2014;47.

19 Cheskes L, Dainty K, Beaton D. *Assessing public perceptions of cardiopulmonary resuscitation and bystander willingness to act in out-of-hospital cardiac arrest: a qualitative study: am heart Assoc*, 2013.

20 Ong ME, Yap S, Chan KP, *et al*. Knowledge and attitudes towards cardiopulmonary resuscitation and defibrillation amongst Asian primary health care physicians. *Open Access Emerg Med* 2009;1:11–20.

21 Howell P, Tennant I, Augier R, *et al*. Physicians' knowledge of cardiopulmonary resuscitation guidelines and current certification status at the university hospital of the West Indies, Jamaica. *West Indian Med J* 2014;63:739.

22 García ABS, Alemán JLF, Pérez NA, *et al*. Assessment of the knowledge level and its relevance in terms of CPR in medical personnel of the hospital emergency medical system of the autonomous community of the region of Murcia/Valoración del nivel de conocimientos Y SU adecuación en materia de RCP en El personal sanitario de Los servicios de urgencias hospitalarios de la Comunidad Autónoma de la Región de Murcia. *Enfermeria Global* 2015;14.

23 Roshana S, Kh B, Rm P, Batajoo K, Piryani R, *et al*. Basic life support: knowledge and attitude of medical/paramedical professionals. *World J Emerg Med* 2012;3:141.

24 Olajumoke TO, Afolayan JM, Raji SA, *et al*. Cardiopulmonary resuscitation - knowledge, attitude & practices in osun state, Nigeria. *J West Afr Coll Surg* 2012;2:23.

25 Govender K, Rangiah C, Ross A, *et al*. Retention of knowledge of and skills in cardiopulmonary resuscitation among healthcare providers after training. *South African Family Practice* 2010;52:459–62.

26 Alam T, Jamil Khattak Y, Anwar M, *et al*. Basic life support: a questionnaire survey to assess proficiency of radiologists and radiology residents in managing adult life support in cardiopulmonary arrest and acute anaphylactic reaction. *Emerg Med Int* 2014;2014:1–4.

27 Mekonnen M, Birhanu Z, Kassa H, *et al*. A cross sectional study on knowledge, practice and associated factors towards basic life support among nurses working in Amhara region referral hospitals. *Hospice & Palliative Medicine International Journal* 2018;2:123–30.

28 ECC Committee, Subcommittees and Task Forces of the American Heart Association. 2005 American heart association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* 2005;112.

29 Botha L, Geyser MM, Engelbrecht A. Knowledge of cardiopulmonary resuscitation of clinicians at a South African tertiary hospital. *S Afr Fam Pract* 2012;54:447–54.

30 Keenan M, Lamacraft G, Joubert G. A survey of nurses' basic life support knowledge and training at a tertiary hospital. *African Journal of Health Professions Education* 2009;1:3–7.

31 Onyeaso AO, Imogie A. Attitude towards cardiopulmonary resuscitation among some secondary school students in rivers state, Nigeria. *Br J Educ* 2014;2:37–43.

32 Burkhardt JN, Glick JE, Terndrup TE. Effect of prior cardiopulmonary resuscitation knowledge on compression performance by hospital providers. *West J Emerg Med* 2014;15:404–8.

33 Weji BG, Goshu EM, Melese KG. Assessment of knowledge, attitude and associated factors of cardiopulmonary resuscitation among anesthetists working in governmental and private hospitals in Addis Ababa, Ethiopia: institutional based cross-sectional study. *International Journal of Medicine and Medical Sciences* 2017;9:17–21.

34 Passali C, Pantazopoulos I, Dontas I, *et al*. Evaluation of nurses' and doctors' knowledge of basic & advanced life support resuscitation guidelines. *Nurse Educ Pract* 2011;11:365–9.

35 Truhlář A, Deakin CD, Soar J, *et al*. European resuscitation Council guidelines for resuscitation 2015: section 4. cardiac arrest in special circumstances. *Resuscitation* 2015;95:148–201.

36 Rajeswaran L, Ehlers VJ. Cardiopulmonary resuscitation knowledge and skills of registered nurses in Botswana. *Curationis* 2014;37:1–7.

37 Muijselaar MML, de Jong PF. The effects of updating ability and knowledge of reading strategies on reading comprehension. *Learn Individ Differ* 2015;43:111–7.

38 Mar R, Djikic M, Oatley K. *Effects of reading on knowledge, social abilities, and selfliood. Directions in empirical literary studies: in honor of Willie van peer*, 2008: 127.

39 Touza Garma C, Garma CT. Influence of health personnel's attitudes and knowledge in the detection and reporting of elder abuse: an exploratory systematic review. *Psychosocial Intervention* 2017;26:73–91.

40 Rise MB, Steinsbekk A. Long term effect on professionals' knowledge, practice and attitudes towards user involvement four years after implementing an organisational development plan: a controlled study. *PLoS One* 2016;11:e0150742.