Advanced cardiac life support knowledge, practice, and associated factors among general practitioners and nurses at primary hospitals in Ethiopia

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Abstract

Advanced cardiac life support (ACLS) refers to a set of life-saving protocols and skills for urgently and emergently treating life-threatening conditions that result in cardiac arrest. An institutional-based cross-sectional study was conducted to assess knowledge, practices, and associated factors of ACLS among general practitioners (GPs) and nurses in Ethiopia. Data were collected using self-administered questionnaires. Data entry was carried out using EpiData version 4.6, and the analysis was performed using STATA 14. Bivariate and multivariable logistic regression analyses were employed. The study included 147 GPs and nurses, yielding a response rate of 94.2%, with 39.5% (95% CI: 32.3-47.7) and 35.37% (95% CI: 28.68-43.8) demonstrating good knowledge and practice, respectively. Sex, education, experience, and the availability of emergency equipment were significantly associated with the knowledge. Workplace, exposure to cases of cardiac arrest, training, and experience were found to be significantly associated with practice. There is a significant gap in both knowledge and practice. Based on our results, we recommend simulation-based in-service training and the inclusion of ACLS protocols in the formal education of health students.

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Introduction

Cardiac arrest is the sudden loss of the heart's ability to pump, causing the heart to stop beating unexpectedly. This cessation of heart activity leads to the interruption of blood flow to the brain, lungs, and other organs. Breathing becomes abnormal or ceases altogether, and the affected person loses consciousness.[1] Cardiac arrest is the most common type of emergency in adults, children, and newborns, and it can have fatal outcomes accounting for roughly half of all cardiovascular disease deaths worldwide.[2-4] In a hospital setting, cardiac arrest is an event that can potentially affect any hospitalized patient and is associated with a significant mortality risk if not recognized and managed promptly. Advanced cardiac life support (ACLS) is a set of life-saving protocols and skills for urgently and emergently treating life-threatening conditions that result in cardiac arrest. This involves the use of advanced medical procedures, medications, and techniques.[5] Recognizing signs of sudden cardiac arrest, performing cardiopulmonary resuscitation (CPR), and using an automated external defibrillator (AED) for defibrillation are all part of ACLS.[6] The ACLS guidelines were first published in 1974 by the American Heart Association and have been updated several times until 2020. ACLS has a profound impact on patients' outcomes,[7] as resuscitation skills can restore life or consciousness. Survival rates can be two to four times higher when initiated within the first minute of cardiac arrest.[8]

In most cases of hospital cardiac arrest, healthcare workers are typically the first responders. To reduce the mortality rate and increase the survival ratio, healthcare providers must have a solid understanding of basic ACLS knowledge and practices.[9] Their knowledge is essential for improving patient outcomes,[10] as ACLS is a key component of the survival chain that increases the rate of

survival.[11] Every medical professional prone to emergencies must be on call at all times to save lives and improve the quality of CPR.[12] While resuscitation guidelines recommend that all medical personnel working in the intensive care unit and emergency department (ED), as well as those responsible for patient resuscitation, should regularly receive ACLS training,[13] healthcare workers, particularly nurses, may lack knowledge of ACLS. This is often attributed to the fact that ACLS training is not required as part of their education and certification requirements.[12] Many health professionals suggest that resuscitation knowledge is underdeveloped due to a lack of formal training in medical and nursing careers.[12] International studies on the knowledge, attitude, and skills/practices of various professionals regarding ACLS and basic life support (BLS) have revealed a widespread deficiency in ACLS knowledge and practice.[9-12] In Ethiopia, ACLS and even BLS are not as widely developed as they are in other developed countries, primarily due to the lack of modern medical instruments and well-trained professionals. Many healthcare workers, especially nurses, have underestimated their knowledge of ACLS.[14-16] A study conducted among healthcare workers at Felege Hiwot Comprehensive Specialized Hospital in Bahir Dar, Ethiopia, revealed that 59.5% of healthcare workers, including nurses and physicians, had poor knowledge of ACLS.[16] According to a study conducted at Debre Markos Referral Hospital in Ethiopia, 64.2% of all healthcare providers had negative attitudes toward CPR, while 88.9% practiced unsafe CPR.[17] A similar study at Gondar Comprehensive Specialized Hospital in Northwest Ethiopia found that only 25% of healthcare professionals had a good level of knowledge about adult CPR.[18] In contrast to Western nations, Ethiopia does not impose stringent licensing regulations that require physicians, nurses, and other healthcare practitioners to be trained in up-to-date BLS and ACLS guidelines. The lack of a mandatory requirement may potentially result in a gap in knowledge and practical skills. Currently, no research has been conducted to assess the levels of knowledge, practical application, and factors associated with advanced cardiac life support among nurses and general practitioners (GPs) in three specific public primary hospitals in Oromia, Ethiopia. As a result, this study was designed to investigate the healthcare workforce's understanding, implementation, and influential factors related to ACLS at these aforementioned hospitals.

Material and Methods

Study design and setting

An institution-based cross-sectional study design was employed from March 15 to April 15, 2023, at Holota, Ginchi, and Enchini primary hospitals in West Shoa, Oromia, Ethiopia. These three public hospitals are located 40 kilometers west of the capital, Addis Ababa. Holota Primary Hospital has over 90 beds and serves a population of over 500,000 people, with over 300 daily visitors. The hospital employs 132 health professionals and has ED, internal medicine, pediatrics, surgery, obstetrics and gynecology, and dental care. Enchini Primary Hospital has over 250 daily visitors and more than 75 beds, serving a population of over 600,000 people. It also has emergency, internal medicine, pediatrics, surgery, obstetrics and gynecology, and dental care departments, with a staff of 130 health professionals. Ginchi Primary Hospital caters to a population exceeding 500,000 and serves more than 200 individuals daily, with over 70 beds. It has 86 health professionals working in emergency, internal medicine, pediatrics, surgery, obstetrics and gynecology, and dental care departments.

Study participants

The hospitals were chosen using a simple random sampling technique, the lottery method, from among the seven West Shoa primary hospitals. We selected Holota, Enchini, and Ginchi primary hospitals for the study, with Guder Hospital serving as the pretest site.

The sample size was calculated using the single population proportion formula, with a confidence interval of 95% and a margin of error (d) of 5%. In the absence of research on the prevalence of ACLS practices and associated factors in primary hospitals in Ethiopia, we used 50% as the best estimate. Initially, this calculation yielded a sample size of 384. However, because the population in the study area is less than 10,000, we used a correction formula to determine the sample size. With this correction, the sample size for the study of practice and associated factors was reduced to 201 participants after accounting for non-respondent rates. For the study of knowledge and associated factors related to ACLS, a statistical formula based on previous research conducted at Bahidar[16] revealed a prevalence of 40.5%. Therefore, the final sample size for this aspect of the study was determined to be 198, taking no response rates into account. Finally, we decided to use the larger sample size of 201 for both knowledge and practice. The total number of nurses and GPs in the study area was 180, which was the predetermined number of study participants. All study participants in these hospitals worked in the ED on a rotational basis. The study included all GPs and nurses who were working during the study period. GPs or nurses who refused to participate were excluded. Based on the exclusion criteria, 24 participants were removed from the original study population of 180. The study included 156 participants, with 9 being excluded after data collection due to incomplete data. As a result, 147 participants were included in the final analysis as follows: 12 GPs and 51 nurses from Enchini Primary Hospital; 11 GPs and 36 nurses from Ginchi Primary Hospital; and 15 GPs and 31 nurses from Holota Primary Hospital.

Data collection tool and procedure

Data were collected through self-administered structured questionnaires. Three data collectors were involved in the data collection process after receiving training. The questionnaires were derived from the standard reference, American Heart Association (AHA) guidelines for ACLS, based on the course content of the 2020-2025 AHA BLS and ACLS.[5] The study tools were also checked for reliability, yielding a Cronbach's alpha result of 0.851 for knowledge and 0.818 for practice. They were validated by the AHA's teaching manual. The questionnaire had an English version and was divided into four parts. The first part consisted of 12 questions related to the socio-demographic characteristics of the respondents. The second part contained 17 questions to assess the knowledge of the respondents regarding ACLS, with the scores classified into two levels: good and poor knowledge. The third part included 9 questions related to practice in ACLS, with the scores classified into two levels: good practice and poor practice. The fourth part comprised 12 questions related to associated factors of ACLS knowledge and practice.

Data quality control

The three data collectors have a Bachelor of Science (BSc) degree. They underwent a 2-day training session in ACLS guidelines before the actual data collection. Throughout the data collection period, the principal investigator closely monitored the process, checking for data completeness and consistency.

Leveling of knowledge and practice

Good knowledge of advanced cardiac life support

Study participants who answered 80% or more of the knowledge questions about ACLS.

Poor knowledge of advanced cardiac life support

Participants scored below 80% on the knowledge questions about ACLS.

Good practice of advanced cardiac life support

Participants who meet above the mean score of ACLS (>50%) practice questions.

Poor practice of advanced cardiac life support

Participants who scored below the mean score of ACLS (≤50%) practice questions.

Data analysis

The data were entered using EpiData version 4.6, and subsequently, the data were exported and analyzed with STATA version 14. Categorical variables are presented as numbers and percentages, and continuous variables as mean with standard deviation or median with interquartile range, depending on the distribution. After verifying all the assumptions for logistic regression, binary logistic regression analysis was employed to assess the associations between dependent and independent variables. Variables with p<0.25 in bivariate logistic regression were entered into the multivariable analysis. Crude and adjusted odds ratios were computed, each with appropriate 95 percent confidence intervals. In multivariable logistic regression, independent variables with P<0.05 were considered statistically significant.

Results

Socio-demographic characteristics of the study participants

One hundred eighty individuals were approached, and 156 agreed to participate. Due to incompleteness and inconsistency in their responses, 9 subjects were excluded from the analysis, yielding a response rate of 94.23%. Among the included participants, 75 (51.03%) were female. The average age of the participants was 30 years. 133 (90.47%) held a bachelor's degree (BSc). 109 (74.15%) were nurses. The participants had a mean experience of 6.46 years (SD ±4.466). The emergency area was assigned to the majority of participants, 70 (47.6%) (Table 1).

More than half of the study participants (61.95%) had never received ACLS training. The majority of the study participants, 135 (91.84%), had been exposed to cases of cardiac arrest cases and had been involved in resuscitation efforts. Less than half of 29 respondents (19.72%) reported the availability of emergency medication and equipment in the study area (Table 1).

Knowledge of participants towards advanced cardiac life support

The percentage of knowledge scores among the respondents ranged from 29.4% to 94%. The participants' mean score on knowledge questions was 65.53±18.98. Notably, 39.5% of the study participants demonstrated good knowledge of ACLS. The quantity and percentage of right answers for each knowledge question among the participants are shown in Table 2. The percentage of correct answers ranged from 37.2% to 65.5%. Remarkably, 96 participants (65.5%) correctly identified the acronym for AED. Additionally, the questions related to "the critical characteristics of

Table 1. Socio-demographic and characteristics of study participants at selected primary public hospitals in Ethiopia (2023).

Variable	Whole cohort n (%)	Sex	
		Female n (%)	Male n (%)
Educational level			
Bachelor degree	133 (90.4)	72 (54.1)	61 (45.8)
Diploma	14 (9.5)	3 (21.4)	11 (78.5)
Profession			
General practitioner	38 (25.8)	16 (42.1)	22 (57.8)
Nurse	109 (74.1)	59 (54.1)	50 (45.8)
Assigned workplace			
Emergency	70 (47.6)	32 (45.7)	38 (54.2)
Medical ward	29 (19.7)	15 (51.7)	14 (48.2)
Outpatient department	22 (14.9)	8 (36.3)	14 (63.6)
Operating room	5 (3.4)	3 (60)	2 (40)
Pediatric ward	11 (7.4)	11 (91.6)	1 (8.3)
Surgical ward	10 (6.8)	6 (60)	4 (40)
Age (Median, IQR)	30, (22-44)	28, (22-38)	32, (26-44)
Experience (Mean, SD)	6.46, (±4.4)	4.32 (±2.6)	8.2 (±4.2)
On job Training on ACLS			
Yes	56 (38)	25 (44.6)	31(55.3)
No	91 (61.9)	50 (54.9)	41(45)
Exposure to cardiac arrest case			
Never	12 (8.1)	5 (41.6)	7 (58.3)
Yes	135 (91.8)	70 (51.8)	65 (48.1)

ACLS, advanced cardiac life support; IQR, interquartile range; SD, standard deviation.

high-quality CPR," "the location of CPR for adults," and "the first drug of choice during cardiac arrest" had the highest correct response rates, scoring 62%, 54%, and 54%, respectively. Conversely, 60.8% of participants answered the question regarding the proper order of the typical sinus rhythm of electrical cardiac activity incorrectly, and 60.1% of respondents correctly answered the definition of ACLS. Regarding other questions, such as "when to stop CPR," "initial management of symptomatic bradycardia," and "immediate management of ventricular fibrillation," over half of the respondents provided correct responses at rates of 53%, 52.7%, and 51%, respectively. A significant discrepancy was seen when respondents' total knowledge levels were broken down by profession: 12.9% of GPs and 47.6% of nurses had inadequate knowledge (Figure 1).

The practice of participants towards advanced cardiac life support

Out of the total study participants, 52 (35.37%) demonstrated good practice, while 95 (64.63%) had poor practice in ACLS. The practice questionnaire included nine questions, with a mean score of 50.50±20.67. Scores ranged from 11.1% to 100%. Participants who scored higher than the mean were categorized as having good ACLS practice, whereas those who scored lower than the mean were categorized as having poor ACLS practice.

Table 3 shows the respondents' practice question scores in terms of both number and percentage, with correct answer percentages ranging from 34.8% to 69.4%. Notably, about 102 (69.4%) participants answered the question of how to administer CPR to adult victims correctly. Additionally, the questions related to "the proper steps for operating an AED" and "how to manage an immediately obstructed airway" were the most correctly answered practice questions, with percentages of 61.5% and 57.1%, respectively. Conversely, 65.2% of participants answered questions about "how to perform CPR for a child" incorrectly. The correct steps in "management of a shock" and "emergency care after witnessing a cardiac arrest" received correct responses from 63.9% and 60.8% of participants, respectively. Less than half of the respondents correctly answered the practice questions marked "witnessing an adult unresponsive victim who has been submerged in fresh water and just removed from it" and "treating an individual who presented in ventricular fibrillation after CPR and one-time attempt at defibrillation, then his new rhythm is third-degree AV block", with correct response rates of 41.4% and 45.6%, respectively. When assessing the overall practice levels of respondents based on their professions, a notable difference was found: 55.1% of nurses and 9.5% of GPs had poor practice (Figure 2).

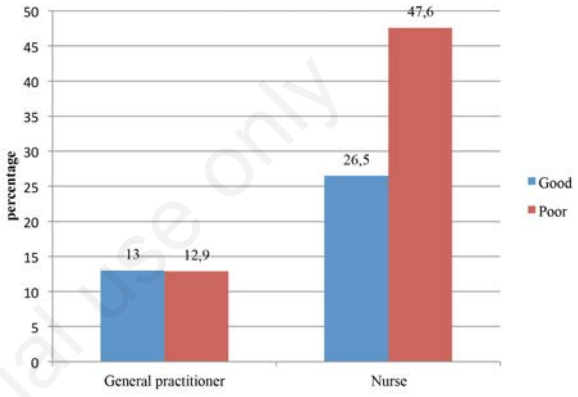

Figure 1. Overall knowledge level of respondents based on their profession at selected primary public hospitals, Ethiopia, 2023.

Table 2. Responses of participants to advanced cardiac life support knowledge questions at selected primary public hospitals in Ethiopia (2023).

Knowledge	Correct response N (147)	%	Incorrect response N (147)	%
Definition of ACLS	59	39.9	88	60.1
The site of electrical impulse for normal cardiac activity	63	42.6	84	57.4
The correct sequence of normal sinus rhythm and electrical heart activity	58	39.2	89	60.8
The first drug of choice during cardiac arrest	80	54	67	46
Abbreviation AED stands for	96	65.5	51	34.5
The proper pairing regarding CPR for an adult:	64	43.3	83	56.7
The critical characteristics of high-quality CPR include	91	62	56	38
Criteria to stop CPR	78	53	69	47
Position of pregnant women during CPR	62	41.9	85	58.1
The location for CRP in adult	80	54	67	46
You have just administered a drug to an individual in supraventricular tachycardia. She complains of flushing and chest heaviness. The drug most likely caused this complains is,	65	43.9	82	56.1
An individual presents with symptomatic bradycardia. Her heart rate is 32. The initial drug used for this case.	78	52.7	69	47.3
The location for chest compression in infants	65	44.3	82	55.7
The role of 2nd rescuer during CPR	62	42.2	85	57.8
The patient comes in the ER with ECG interpretations of ventricular fibrillation, what is your Immediate response to fix problems?	75	51	72	49

ACLS, advanced cardiac life support; AED, automated external defibrillator; CPR, cardiopulmonary resuscitation; ECG, electrocardiogram; ER, emergency room.

Factors associated with the knowledge of advanced cardiac life support

The unadjusted binary logistic regression analysis revealed nine variables that contributed to the understanding of ACLS. Six of these variables, with p-values less than 0.25, showed a significant correlation with knowledge of ACLS. Comparing male and female respondents, the former showed 7.83 times greater knowledge [COR 7.83, 95% CI (1.72-35.53)]. Compared to those with a diploma, participants with a bachelor's degree had higher odds of having good knowledge [COR = 10.84, 95% CI: 3.4-34.25]. Compared to individuals without ACLS training, those who received it had a tenfold higher likelihood of having good knowledge [COR=10, 95% CI (2.86-34.8)]. Compared to respondents assigned to the outpatient department, those assigned to the ED had higher odds of having good knowledge [COR=5.41, 95% CI: 1.35-21.61]. Work experience showed an inverse association with participants' ACLS knowledge [COR=0.71, 95% CI: 0.60-0.85], suggesting that knowledge levels tended to decline with increasing work experience. Moreover, participants who worked in areas with easy access to emergency medications and equipment showed higher levels of knowledge than those who worked in less-equipped areas [COR=4.81, 95% CI: 1.20-19.12] (Table 4). In the multivariable logistic regression analysis, sex, level of education, availability of equipment, and years of experience were found to be significantly associated with ACLS knowledge at a p-value of less than 0.05. Compared to female respondents, males were 3.8 times more likely to have good knowledge [AOR=3.84, 95% CI: (1.005-14.717)]. Compared to diploma nurses, GPs and degree-holding nurses exhibited significantly higher knowledge [AOR=13.4, 95% CI: (1.83-97.74)]. The odds of having good knowledge decreased by 32% for each extra year of experience [AOR=0.67, 95% CI: (0.54-0.85)]. Study participants who worked in areas with emergency medication and well-equipped workplaces had 5.3 times higher odds of having good knowledge than those who worked in places with fewer resources [AOR=5.32, 95% CI: (1.44-19.67)] (Table 4).

Factors associated with the practice of advanced cardiac life support

In the unadjusted binary logistic regression analysis, sex, work experience, training, assigned workplace, and exposure to cases of cardiac arrest showed associations with ACLS practice, with p-values less than 0.25. Male respondents had 9.9 times higher odds of practicing ACLS compared to female respondents [COR=9.92, 95% CI: 1.23-17.90]. Compared to participants who did not receive ACLS training, those who did receive ACLS training had a 5.5-fold higher likelihood of practicing ACLS [COR=5.57, 95% CI: (1.43-21.54)]. With each additional year of work experience, the likelihood of good practice in ACLS increased by 1.2 times [COR 1.23, 95% CI: 1.03-1.48]. Nurses and GPs working in the emergency area were 5.4 times more likely to practice ACLS compared to others working in other wards [COR=5.4, 95% CI: (1.35-21.61)]. Participants with more exposure to cases of cardiac arrest were 9.7 times more likely to perform ACLS practice compared to those with no exposure [COR=9.71, 95% CI: (2.56-37.21)] (Table 5). In the multivariable logistic regression analysis, assigned workplace, training, exposure to cases of cardiac arrest, and work experience were found to be significantly (P-value less than 0.05) associated with the practice of ACLS. Participants working in the ED were 4.9 times more likely to practice ACLS than those working in another workplace [AOR=4.87, 95% CI: 1.11-21.30]. For each additional year of work experience, the odds of demonstrating good practice in ACLS increased by 1.44 times [AOR=1.44, 95%

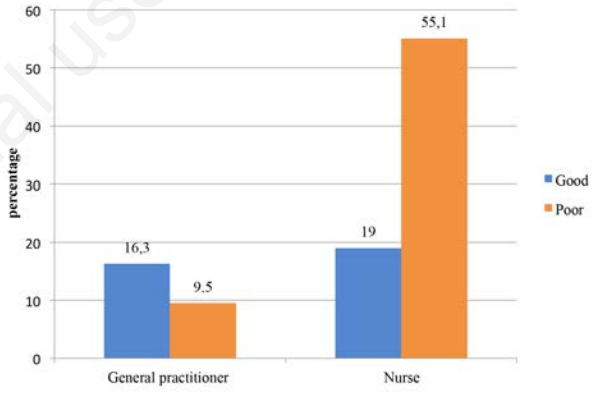

Figure 2. Overall practice levels of respondents based on their professions at selected primary public hospitals in Ethiopia (2023).

Table 3. Responses of study participants to advanced cardiac life support practice questions at selected primary public hospitals in Ethiopia (2023).

Practice	Correct response N (147)	%	Incorrect response N (147)	%
The correct step for Emergency care	61	39.2	86	60.8
You are transporting an individual who goes into cardiac arrest. IV access is unsuccessful, the next step is	77	52.4	70	47.6
In the primary survey if you suspect the patient's way is obstructed, what is the initial management	84	57.1	63	42.9
Steps to perform CPR for adult victims	102	69.4	45	30.6
Step in the management of a shock	53	36.1	94	63.9
Baby "X "who is 4 years old, comes to the ER with loss of consciousness, and agonal breathing. There is no pulse, technique to perform CPR for this child	51	34.8	96	65.2
You are treating an individual who presented with ventricular fibrillation. After CPR and one attempt at defibrillation, his new rhythm is a third-degree AV block. The next step is	67	45.6	80	54.4
You are witnessing an adult unresponsive victim who has been submerged in fresh water and just removed from it, he has spontaneous breathing but he is unresponsive. The next step is	58	41.4	89	58.5
The proper steps for operating an AED are	90	61.5	57	38.5

AED, automated external defibrillator; AV, atrioventricular; CPR, cardiopulmonary resuscitation; ECG, electrocardiogram; ER, emergency room; IV, intravenous.

CI: 1.08-1.91]. Participants who received ACLS training were 13.6 times more likely to practice ACLS compared to those who did not undergo the training [AOR=13.63, 95% CI: 2.66 - 65.74]. Those who had previously witnessed a case of cardiac arrest were 14 times more likely to practice ACLS than people who had not [AOR=14.11, 95% CI: 2.9- 48.05)] (Table 5).

Discussion

Among the 147 respondents of this study, 51.03% were female, aligning with studies conducted in Ethiopia, which reported proportions of 54.9% and 52.9%.[19] However, a study conducted at Wollo University showed a different trend, with 57.2% of the participants being male,[20] which can be attributed to the study location difference. In line with a study done in Addis Ababa, where 90.2% of study participants had a BSc degree, the majority of study participants (90.4%) had one.[19] In terms of profession, 25.85% were GPs, which is similar to the 26.61% of general practitioners reported in an Ethiopian study.[20] Of the respondents, only 38.05% underwent ACLS training; this was done through on-the-job training. Similar findings were reported in a study conducted in Karela, India, where 38.6% of the participants had received ACLS training.[21] However, the percentage in this study was higher than in a study done in hospitals in the Amhara Region (31.4%),[15] and lower than in studies done at Jazan University in Saudi Arabia (47.7%), where training was obtained.[22] The differences in the findings across these studies can be attributed to variations in the accessibility of training programs and training preparedness.

In our study, 39.5% (95% CI: 32.3-47.7) of the participants showed good knowledge. These results align with a study conducted in Ethiopia and a South Indian study, which reported scores of 40.5% and 41.6%, respectively.[16,23] These findings, however, are not as high as those obtained from research carried out in Saudi Arabia, North Kerala, Turkey, and 65%, 76%, and 87% of the population, respectively.[21,24,25] The differences in ACLS knowledge levels observed in various studies point to potential differences in the usefulness and accessibility of ACLS training courses and readiness initiatives. These disparities may also be related to differences in training program quality, differences in professional knowledge, differences in resource availability, and differences in healthcare infrastructure.

The results of the multivariable logistic regression analysis showed that the availability of emergency supplies and medication, experience, sex, and educational attainment were all highly correlated with ACLS knowledge. This result is consistent with a study conducted in Pakistan, where educational level and experience were also identified as significant factors.[26] Male respondents were 3.84 times more likely than female responders to have good knowledge compared to female respondents. This is in line with a study from Sains Malaysia that found that males were 5.43 times more likely than females to have good knowledge.[27] The disparity in ACLS knowledge concerning sex can be explained by a higher proportion of males (54%) being assigned to the ED, which increases the likelihood of encountering cases of cardiac arrest. Training may also be a contributing factor, as a majority of males

Table 4. Bivariate and multivariable analysis of factors associated with study participants' knowledge of advanced cardiac life support at selected primary public hospitals in Ethiopia, 2023 (N=147).

Variables	Knowledge		COR	p	AOR	p
	Good (%)	Poor (%)				
Sex						
Male	45(30.6)	27(18.37)	7.83(1.72-35.53)	0.008***	3.84(1.05-14.71)	0.049**
Female	13(8.85)	61(42.18)	1		1	
Age	58(39.5)	89(60.5)	3.33(.15-70.91)	0.44		
Educational level						
Diploma	1(0.7)	13(8.8)	1		1	
Degree	57(39.5)	75(51)	10.84(3.43-34.25)	0.000***	13.4(1.84-97.74)	0.010**
Profession						
Nurses	39(26.53)	70(47.6)	1			
GP	19(12.97)	19(12.9)	1.79(.27-11.98)	0.851		
Assigned workplaces						
Emergency	30(20.44)	40(27.21)	5.4(1.35-21.61)	0.017**	1.45(.65-3.26)	0.357
MW	6(4.08)	23(15.65)	2.5(.50-12.46)	0.264		
OPD	10(6.8)	12(8.16)	1.875(.41-8.43)	0.413		
PW	5(3.4)	6(4.08)	1			
SW	4(2.7)	6(4.08)	1			
OR	3(2.04)	2(1.36)	1			
Training on ACLS						
Yes	40(27.2)	16(10.9)	10 (2.86-34.8)	0.000***	2.54(.706-9.142)	0.153
No	18(12.3)	73(49.6)	1		1	
Exposure to cardiac arrest case						
Yes	55(37.4)	80(54.4)	.49 (.06-4.01)	0.511		
No	3(2.1)	9(6.1)	1			
Availability of Equipment						
Yes	16(10.88)	13(8.84)	4.8 (1.20-19.12)	0.026**	5.32(1.44-19.67)	0.012**
No	42(28.57)	76(51.7)	1		1	
Experiences	58(39.5)	89(60.5)	.718(.60-.85)	0.000***	.678 (.54-.85)	0.001***

AOR, adjusted odds ratio; COR, crude odds ratio; MW, medical ward; OPD, outpatient department; OR, operating room; PW, pediatric ward; SW, surgical ward; *significant at p<0.25, **significant at p<0.05, ***significant at p<0.01.

(55.3%) underwent ACLS training. Moreover, the access that people have to education and training can be influenced by gender roles and societal expectations. It is also possible that men are more likely to be inspired, encouraged, or to undergo ACLS training. This variation may also be caused by differences in the willingness to pursue training or take ACLS courses. The participants' knowledge of ACLS was found to be negatively correlated with their work experience. This may be explained by the progressive loss of theoretical knowledge that occurs with increasing work experience.

Degree holders among the study participants were found to be 13.4 times more knowledgeable compared to diploma nurses. This odds ratio is higher than what research done in Amhara has shown.[15] This result is not surprising because individuals usually gain more knowledge as they progress in their academic programs, and advanced degrees frequently offer a deeper and more thorough understanding of medical practices and procedures.

Individuals who worked in areas well-equipped with emergency medication and equipment had a 5.3-fold higher likelihood of knowing ACLS than people who worked in locations without such resources. This result is consistent with a study conducted at Felege Hiwot Hospital. The result underscores the critical role of access to emergency resources in healthcare settings. Adequate access to emergency medication and equipment can make a substantial difference in the preparedness and knowledge of healthcare professionals. When resources are readily available, healthcare professionals have the tools and materials necessary to recognize protocols.

In our study, only 35.37% (95% CI: 28.68-43.8) of participants demonstrated good practice in ACLS, while the majority of participants demonstrated poor practice. This finding is in line with a study from Tabuk universities, where over half of the participants had poor practice in ACLS.[28] However, it is higher than the findings of a study carried out in Bhutan, which reported that only 25% of participants had good practice skills.[29] These differences could be influenced by factors such as the quality of training programs, the availability of resources, and the level of experience among healthcare professionals.

In the multivariable logistic regression results, assigned workplace, training, exposure to cases of cardiac arrest, and experience were significantly associated with ACLS practice (P<0.05). Furthermore, our study revealed that there was no discernible variation in the profession's level of practice. This finding is in contrast to research from Nigeria,[30] where GPs demonstrated better practice compared to nurses. Additionally, our findings contradict a study conducted in Jamaican universities, that found a negative correlation between practicing ACLS and being a doctor.[18] The discrepancy between these findings was attributed to various factors, including differences in the study setting, healthcare systems, and the timing of the research. It is possible that the training and roles of healthcare professionals vary across regions and may be influenced by local healthcare practices and policies.

In our study, participants who had received ACLS training had 13.6 times higher odds of having good practice compared to those who had not. This suggests that training is an effective way to improve psychomotor skills and that practicing with someone who

Table 5. Bivariate and multivariable analysis of factors associated with study participants' practice of advanced cardiac life support at selected primary public hospitals in Ethiopia, 2023 (N=147)

Variables	Practice		COR	p	AOR	p
	Good (%)	Poor (%)				
Male	50(34)	22(14.9)	9.9 (1.23-17.904)	0.031**	1.914(.55-6.7)	0.309
Female	14(9.5)	61(41.6)	1		1	
Age	52(35.37)	95(64.63)	1.018(.936-1.108)	0.667		
Educational level						
Diploma	2(1.36)	12(8.15)	1		1	
Degree	50(34)	83(56.4)	3.6(.83-15.18)	0.088 *	2.722(.27-27.92)	0.399
Profession						
Nurses	28(19.04)	81(55.1)	1		1	
GP	24(16.3)	14(9.5)	2.027(.99-3.22)	0.001***	7.024(1.27-38.78)	0.025**
Assigned workplaces						
Emergency	33(22.45)	37(25.17)	5.41(1.35-21.61)	0.017**	4.879(1.12-21.31)	0.035**
MW	5(3.4)	24(16.32)				
OPD	7(4.76)	15(10.2)	8.75(.91-8.394)	0.060*	1	
PW	4(2.72)	7(4.76)	1			
SW	3(2.04)	7(4.76)	1			
OR	2(1.36)	3(2.04)	1			
Training on ACLS/BLS						
Yes	35(23.8)	21(14.28)	5.57(1.43-21.54)	0.013**	13.6(2.66-65.74)	0.010**
No	17(11.56)	74(50.34)	1		1	
Exposure to cardiac arrest case						
Yes	49(33.3)	86(58.5)	9.7(2.56-37.21)	0.001***	14.11(2.9- 48.05)	0.002***
No	3(2.04)	9(6.12)	1		1	
Availability of Equipment						
Yes	17(11.56)	12(8.16)	.45(.10-1.93)	0.288		
No	35(23.8)	83(56.46)	1			
Experiences	52(35.37)	95(64.63)	1.23(1.03- 1.48)	0.022 **	1.44(1.08-1.91)	0.006***

AOR, adjusted odds ratio; ACLS, advanced cardiac life support; BLS, basic life support; COR, crude odds ratio; GP, general practitioner; MW, medical ward; OPD, outpatient department; OR, operating room; PW, pediatric ward; SW, surgical ward; *significant at p<0.25, **significant at p<0.05, ***significant at p<0.01.

has received training can greatly boost their competency and capability. The result is higher than the study conducted in Gonder (AOR: 1.74, 95% CI 1.42 to 3.53).[18]

Work experience shows a strong association with participants' practice toward ACLS (AOR: 1.44, 95% CI 1.08-1.91). One possible explanation is that practice performance gets better with experience. Previous exposure to cases of cardiac arrest significantly influenced the ACLS practice. Healthcare professionals who had been exposed to cardiac arrest cases exhibited superior BLS/ACLS practice compared to those who had not, as reported in Amhara region referral hospitals.[18] This finding may be reasonable by the fact healthcare professionals who have encountered cases of cardiac arrest during their work have had the chance to use ACLS procedures and interventions in actual clinical settings. Compared to study participants in other departments, those assigned to the ED had a 4.9-fold higher likelihood of practicing ACLS. This could be explained by the fact that patients who come to the ED frequently have severe conditions that require ACLS interventions for them to survive, giving medical personnel practice opportunities. This finding is well-supported by the American Heart Association guidelines, which state that staff in critical care and emergency medicine may possess more advanced resuscitation knowledge and skills than those in their typical clinical roles.[2]

Methodological consideration

The study has several strengths. After conducting a survey, we were able to derive important conclusions and offer suggestions for enhancements. The findings also served as inspiration for subsequent studies and further exploration. Additionally, the transparency and clarity exhibited in the reporting of methods, research processes, and results contribute to the credibility of the study. This study's limitation stems from the fact that it was a survey assessment, meaning there might not have been much correlation between survey respondents' real-world behavior and their responses.

Conclusions

Our study highlights a significant gap in both knowledge and practice of ACLS among nurses and GPs. If regular and effective ACLS training is not provided, this gap may hurt patient survival rates during cardiac arrests. The multivariable logistic regression analysis identified several variables, including sex, educational status, experience, and the availability of emergency equipment and medication, that are related to one's knowledge of ACLS. Similarly, the assigned workplace, training, exposure to cases of cardiac arrest, and working experience were significantly associated with ACLS practice. These findings emphasize the importance of addressing these factors to improve knowledge and practice in ACLS. Since primary and district hospitals serve as the first line and core areas for immediate patient resuscitation, this study highlights the need for targeted, regular, in-service ACLS training to bridge the knowledge and practice gap among healthcare workers. Simulation-based education and training, incorporating tangible procedures, should be employed to acquire effective ACLS techniques. Based on these results, we advise including ACLS protocols in health students' formal education.

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