A Cross Sectional Study on Knowledge and Practice Towards Cardiopulmonary Resuscitation Among Health Professionals Working at Mekelle University, Mekelle Ethiopia.

Kore Menjie Benwu (✉ absuakuamu2030@gmail.com)
Mekelle University College of Health Sciences

Hagos Gebregziabher Gebremedhin
Mekelle University College of Health Sciences, Mekelle University

Naod Bulti Etanaa
Mekelle University College of Health Sciences, Mekelle University

Haftom Berhane Desta
Mekelle University College of Health Sciences, Mekelle University

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A cross sectional study on Knowledge and Practice towards cardiopulmonary resuscitation among Health Professionals working at Mekelle University, Mekelle, Ethiopia.

1. Kore Menjie Benwu (Corresponding author)
   Assistant professor of anesthesia
   Mekelle University College of Health Science Department of Anesthesia.
   Email ID: absuakuamu2030@gmail.com
   Po-box 1871, Ethiopia
   Mobile +251910133773

2. Hagos Gebregziabher Gebremedhin
   Assistant professor of anesthesia
   Mekelle University College of Health Science Department of Anesthesia
   Email ID: hagosg484@gmail.com

3. Naod Bulti Etanaa
   Assistant professor of anesthesia
   Mekelle University College of Health Science Department of Anesthesia
   Email ID: nhabesha@gmail.com

4. Haftom Berhane Desta
   Assistant professor of anesthesia
   Mekelle University College of Health Science Department of Anesthesia
   Email ID: b.haftom@gmail.com
ABSTRACT

**Background**: - Quality cardiopulmonary resuscitation is a procedure needs to be done to save life of cardiac arrest victim. It is significant for health professionals to successfully perform such lifesaving skills that they rarely perform. The aim of this study was to assess the knowledge and skill towards cardiopulmonary resuscitation among health professionals working at Ayder comprehensive specialized hospital.

**Method** -. Institution-based cross sectional-study design was applied among different level of health care provider at Ayder comprehensive specialized hospital. SPSS version 20 used for data analysis and Chi-Square test applied to determine the association between different variables.

**Result**: - Two hundred forty-five participants were originally engaged in this study over a month with a response rate of 100%. One hundred sixty-nine (68.98%) were nurses by profession and 169 (68.9%) of the participants had work experience of fewer than five years. When the service year of the participants increases, the practice adherence to the current guideline is very apart from the participant who had less years of experience which is statically significant (chi-square = 20.888, \( P = 0.0004 \)).

**Conclusions**: - Our result demonstrates that health professionals who works at Ayder comprehensive specialized hospital had inadequate knowledge and practice for cardiopulmonary resuscitation.

**Key words**: - Cardiopulmonary resuscitation; Knowledge, Skill, Healthcare provider
Background

Cardiopulmonary resuscitation is a vital component of Basic Life Support (BLS) and Advanced Life Support (ALS) (1, 2). Cardiopulmonary resuscitation (CPR) is the revival of cardiac output and pulmonary ventilation following cardiac arrest and apnoea by using artificial respiration and manual closed chest compressions or open cardiac massage(3). The American Heart Association (AHA) and the International Liaison Committee on Resuscitation included BLS in their guidelines in 2000(4). Since then, the guideline is updated every five years for different modifications to ensure quality CPR. Effective CPR is vital for survival of cardiac arrest victims. The chances of survival in cardiac arrest decreases by between 7% and 10% for each minute of CPR delay (1, 5).

Quality CPR is required to save life of cardiac arrest victim. It is significant for health professionals to successfully perform such lifesaving skills that they rarely perform. This makes it imperative for regular retraining in CPR. It cannot be overemphasized that CPR is a critical procedure in cardiac arrest that may be rarely performed but has to be competently done when it is necessary (1, 6). The quality of CPR performed by rescuers depends on learners integrating, retaining and applying the cognitive, behavioral and psychomotor skills required to successfully perform resuscitation(2).

Different literatures indicates that there is deficiency of cardiopulmonary resuscitation knowledge and skill across different groups of health care providers(5, 7-9). Even in developed countries like westerns, it is not uncommon to have different level of knowledge and skill in health care providers working in the same institutions (1). CPR knowledge and skill depend on how frequent training were given and according to some of the developed countries, it is important to have compulsory training every two years(1, 5, 10). Despite it is known that frequent planned training is important,
there are no established CPR training schedules for hospital-based healthcare providers in Ethiopia, and other developing countries like Kenya, Uganda and Nepal which indicates an existing CPR education and practice gap (1).

Knowing the current knowledge and skill of the health care providers of a hospital is very vital for planning to decrease the hospital mortality. Therefore, this study aimed to determine the knowledge and skills of health care providers to wards to CPR at Ayder Comprehensive Specialized Hospital.

**Method and Materials**

Using stratified random sampling technique different level of Ayder comprehensive specialized hospitals’ health care provider who had been participating in critical patient management identified. Then, using simple random sampling technique 245 participants invited in this study. The study was conducted from January 1 to 30/2021. Institution-based cross sectional-study design was applied among different level of health care provider at Ayder comprehensive specialized hospital.

Pre-tested structured questionnaire, on knowledge related questions such as pattern and quality indicator of CPR and skill related questions like as airway management, was prepared by reviewing previously published articles on the topic of knowledge and skill of health care providers to wards cardiopulmonary resuscitation (5, 11, 12). Using previously published articles around 20 questions were prepared as closed-ended and open-ended questions accordingly. The data were collected using structured interviewer administered questionnaire prepared to address demographic character, knowledge and skill of the participants. After debriefing on the data collection methods, three data collectors were used for data collection who had experience on
clinical data collection methods. Epi Info version 7 was used to record the data and SPSS version 20 was used for the analysis. Descriptive statistics were used to explore the socio-demographic characteristics of participants; factors possibly related to the knowledge and skill of the participants towards cardiopulmonary resuscitation were summarized as frequencies and percentages. Furthermore, chi-square test, with its full rule, was used to dig out the factors touching knowledge and skill of the health care providers towards cardiopulmonary resuscitation. P-values less than 0.05 were considered to be statistically significant in all cases.

**Operational definitions**

Specialist- Specialist refers those who are fellow of resident and who have certificate of specialty in different field of medicine

General practitioners- General practitioners refers to someone who is starts to practice medicine (interns) and already licensed to practice medicine (GP)

Good knowledge- Participants who answered ≥60% of knowledge related questions considered as having good knowledge

Poor knowledge- Participants who answered <60% of knowledge related questions considered as having poor knowledge

Good skill- Participants who answered ≥60% of academic related skill questions considered as having good skill

Poor skill- Participants who answered <60% of academic related skill questions considered as having poor skill

Current guideline- The 2020 America heart association cardiopulmonary resuscitation guideline

**Result**

Two hundred forty-five participants were originally engaged in the over a month were originally
enrolled in the study with response rate of 100%. As shown in table 1 the baseline characteristics of the 245 participants in this study, 160 (65.3%) of them were males, 145 (59.18%) were with age of 25-29, 170 (69.39%) were nurses by profession and 169 (68.98%) of the participants had work experience of fewer than five years (table 1).

Table 1: - Socio demographic characteristic of the participants working at Ayder comprehensive specialized hospital, 2021.

| Characteristics | Category            | Number | Percentage |
|-----------------|---------------------|--------|------------|
| Sex             | Male                | 160    | 65.3%      |
|                 | Female              | 85     | 34.7%      |
| Age             | 20-24               | 50     | 20.41%     |
|                 | 25-29               | 145    | 59.18%     |
|                 | 30-34               | 41     | 16.73%     |
|                 | 35-40               | 7      | 2.86%      |
|                 | >40                 | 2      | 0.82%      |
| Qualification   | Specialist          | 27     | 11.02%     |
|                 | General practitioner| 17     | 6.94%      |
|                 | Anesthetist         | 9      | 3.67%      |
Knowledge of participants about cardiopulmonary resuscitation.

Participants were asked whether they had training exposure and knowledge on pattern of cardiopulmonary resuscitation. While 239 (97.55%) participants had either in-service or pre-service training exposure, 6 (2.455%) didn’t exposed for any training on cardiopulmonary resuscitation. Similarly, while 104 (42.55%) of the participants respond that they are not sure of the pattern of cardiopulmonary resuscitation sequence; the rest 141 (57.55%) of the participants respond that they think that they are sure of the sequence of CPR. (fig 1).

Participants were interviewed for knowledge on indicators of quality CPR, which are depth of the chest compression, hand position and rate of compression; 50 (20.41%), 220 (89.79%), 15 (6.12%) of the respondent answered correctly, whereas 15 (6.12%), 23 (9.39%) and 7 (2.86%) of the participants respond that they are not sure respectively. (Fig 2). Regarding to period of the training

| Profession          | Count | Percentage |
|---------------------|-------|------------|
| Nurse               | 170   | 69.39%     |
| Midwifery           | 13    | 5.31%      |
| Physiotherapy       | 9     | 3.67%      |

| Service year        | Count | Percentage |
|---------------------|-------|------------|
| <5 year             | 169   | 68.98%     |
| 5-10 year           | 63    | 25.71%     |
| 11-15 year          | 7     | 2.86%      |
| 16-20 year          | 4     | 1.63%      |
| >20 year            | 2     | 0.82%      |
exposure for cardiopulmonary resuscitation were checked and from 239 participants who were exposed for cardiopulmonary training 191(80%) of them were exposed during pre-service education. Whereas 48(20%) of the respondents exposed for cardiopulmonary training during in-service time (fig 3).

**Skill of participants about cardiopulmonary resuscitation.**

Apart from the knowledge of the cardiopulmonary resuscitation, participants were asked for any experience of cardiopulmonary resuscitation; only 220(89.80%) participants had experience on doing cardiopulmonary resuscitation (fig 4). Participants were checked about their skills how they were maintaining the ratio of compression to ventilation before intubation; while majority of the respondents 206(93.64%) replied that the ration should 30:2, The same question was forwarded to them if any change after the patient get intubated 176(80.00%) of the respondents didn’t change their mind on the ratio of compression to ventilation which is 30:2. But 30(13.64%) of the respondents replied that once the victim is intubated there is no need of coordination of the compression and ventilation (fig 5). Similarly, participants were asked to replay how they manage the airway for ventilation or intubation during cardiopulmonary resuscitation for trauma patients, while 119(54.09%) replied they used head tilt, 14(6.36%) preferred chin lift, 56(25.46%) used both head tilt and chin left and 31(14.09%) preferred to use jaw thrust (fig 6).

**Chi-square test analysis**

Chi-square test analysis was done to some variables which can determine the skill and the knowledge of the participants about cardiopulmonary resuscitation. According to the chi-square test analysis for different factors, participants who had more years of experience had poor knowledge on cardiopulmonary resuscitation which is statically significant (chi-square = 20.288,
likewise, when the age of the participants increases the knowledge related questions are poorly addressed by the participants which is statically significant (chi-square = 20.274, \( P = 0.0004 \)).

Regarding to the sex, in both male and female groups, participants who had good knowledge was 3 times more on cardiopulmonary resuscitation; which is not statically significant (chi-square = 20.217, \( P = 0.641 \)). Participants who had in-service training in cardiopulmonary resuscitation was 15 times high to have good knowledge on current guideline of the current cardiopulmonary resuscitation. But it is only 2 times more to have good current cardiopulmonary resuscitation knowledge for those who had training during pre-service time. The difference on the training exposure time is statically significant (chi-square = 11.925, \( P = 0.001 \)) (table 2).

Chi-square regarding to sex, the male participants practice cardiopulmonary resuscitation three times better than the female participants but it is not statically significant (chi-square = 4.962, \( P = 0.026 \)). Similarly, when the service year of the participants increases, the practice adhere to the current guideline is very poor which is statically significant (chi-square = 49.159, \( P = 0.001 \)). Lastly, practitioners who have been exposed for cardiopulmonary resuscitation guideline during in-service time practice cardiopulmonary resuscitation in good manner two times more than those who exposed during pre-service time which is statically significant (chi-square = 17.575, \( P = 0.002 \)) (table 2).
Table 2: - Association of different parameters to knowledge and skill of participants working at Ayder comprehensive specialized hospital, 2021.

| Variables         | Knowledge to current CPR guidelines is to the standard | Chi - square | P-Value |
|-------------------|------------------------------------------------------|-------------|---------|
|                   | Yes | Frequency | %  | No | Frequency | %  |         |         |
| Age (yrs.)        |     |           |    |     |           |    |         |         |
| 20-24             | Yes | 46        | 92.00% | No | 4         | 8.00% | 20.274* | 0.0004  |
|                   |     | 106       | 73.10% |    | 39        | 26.90% |          |         |
| 30-34             | Yes | 30        | 73.17% | No | 11        | 26.83% |          |         |
| 35-40             | Yes | 1         | 14.29% | No | 6         | 85.71% |          |         |
| >40               | Yes | 0         | 0      | No | 2         | 100%   |          |         |
| Sex               |     |           |    |     |           |    |         |         |
| Male              | Yes | 118       | 73.75% | No | 42        | 26.25% | 0.217   | 0.641   |
| Female            | Yes | 65        | 76.47% | No | 20        | 23.53% |          |         |
| Year of experience (yrs.) | Yes | 140     | 82.84% | No | 29        | 17.16% | 20.288* | 0.0004  |
|                   |     | 40        | 63.49% |    | 23        | 36.51% |          |         |
|                   |     | 2         | 28.57% |    | 5         | 71.43% |          |         |
|                   |     | 1         | 25.00% |    | 3         | 75.00% |          |         |
| Training exposure | Preservice | | Inservice | | | | | CPR- practice |
|-------------------|-----------|------------------|-------|-----|-----|-----|-----|-----|
| Good practice     | Poor practice | | | | | | | P-Value |
| Frequency | % | Frequency | % | Chi-square | | | | |
| Age (yrs.) | 20-24 | 30 | 75.00% | 10 | 25.00% | | | 3.991* | 0.407 |
| | 25-29 | 80 | 61.54% | 50 | 38.46% | | | | |
| | 30-34 | 24 | 58.54% | 17 | 41.46% | | | | |
| | 35-40 | 3 | 42.86% | 4 | 57.14% | | | | |
| | 40+ | 0 | 0 | 2 | 100% | | | | |
| Sex | Male | 84 | 57.14% | 63 | 42.86% | | | 4.962 | 0.026 |
| | Female | 53 | 72.60% | 20 | 27.40% | | | | |
| | <5 | 121 | 78.06% | 34 | 21.94% | | | 49.159* | 0.001 |
| | 5-10 | 14 | 26.92% | 38 | 73.08% | | | | |

* Indicates statistical significance.
Ontime and effective cardiopulmonary resuscitation is the primary intervention for reversing the cardiac and respiratory activity of patients who have got cardiopulmonary arrest secondary to different reasons. Across the world studies shows that most of the health care providers are not well updated to the current cardiopulmonary resuscitation changes (2, 11). According to the American heart association, which is one of the responsible organization to change the cardiopulmonary resuscitation guideline, the pattern of cardiopulmonary resuscitation is changed from ABC to CAB (13). In our study only 57.55% of respondents correctly answered the changed pattern of cardiopulmonary resuscitation which is CAB. In addition to the sequence of the resuscitation, the 2015 AHA guideline put emphasis maintaining the quality of CPR (14). In this study participants were asked to reply for questions on the indicators of quality of cardiopulmonary resuscitation, 20.41% and 6.12% of participant answered the depth and rate of the cardiopulmonary resuscitation correctly. The finding of our study regarding to the sequence and indicators of quality cardiopulmonary resuscitation is very low compared with other study done in another site(11). The low result of our study might be explained by two reasons. The first one is

| year of experience (yrs.) | 11-15 | 14.29% | 6 | 85.71% |
|---------------------------|-------|--------|--|--------|
| 16-20                     | 1     | 25.00% | 3 | 75.00% |
| >20                       | 0     | 0      | 2 | 100%   |
| Training exposure         |       |        |   |        |
| Pre-service               | 99    | 55.62% | 79 | 44.38% |
| In-service                | 38    | 90.48% | 4 | 9.52%  |

*Yates Corrected Chi-squares*

**Discussion**

Ontime and effective cardiopulmonary resuscitation is the primary intervention for reversing the cardiac and respiratory activity of patients who have got cardiopulmonary arrest secondary to different reasons. Across the world studies shows that most of the health care providers are not well updated to the current cardiopulmonary resuscitation changes (2, 11). According to the American heart association, which is one of the responsible organization to change the cardiopulmonary resuscitation guideline, the pattern of cardiopulmonary resuscitation is changed from ABC to CAB (13). In our study only 57.55% of respondents correctly answered the changed pattern of cardiopulmonary resuscitation which is CAB. In addition to the sequence of the resuscitation, the 2015 AHA guideline put emphasis maintaining the quality of CPR (14). In this study participants were asked to reply for questions on the indicators of quality of cardiopulmonary resuscitation, 20.41% and 6.12% of participant answered the depth and rate of the cardiopulmonary resuscitation correctly. The finding of our study regarding to the sequence and indicators of quality cardiopulmonary resuscitation is very low compared with other study done in another site(11). The low result of our study might be explained by two reasons. The first one is...
in our study most of the participants (80%) got the CPR training during pre-service education and the second reason is the setting of the study, which is in reference study most of the participants had higher degree of education.

For basic life support the current cardiopulmonary resuscitation guideline recommended that for adult victim the chest has to be compressed 30 times for 2 ventilation(14). Participants were asked to respond the correct ratio of compression to ventilation ratio; 93.64% of the respondents answered correctly but only 80% of the respondents agree that they will keep doing the ratio 30:2 until the patient is intubated. The knowledge of our participants on the ratio of compression to ventilation was better than the reference study (11) reason might be explained by the sample size in the reference study was smaller.

The chi-square test analysis in our study shows that the more experienced participants had less efficient knowledge for the current CPR guideline (chi-square = 20.288, $P = 0.0004$) and CPR practice (chi-square = 49.159, $P = 0.001$) which is statically significant. Participants who had got on job training (in-service) on cardiopulmonary resuscitation had better knowledge (chi-square = 11.925, $P = 0.001$) and practice (chi-square = 17.575, $P = 0.002$) than participants who had got training during pre-service education and the difference in both cases is statically significant. The result of our study regarding to the knowledge and practice is agreed to other studies done abroad (12, 15, 16). To make sure the participants practice is in line with the current CPR guideline, it would have been better if we assess the participants when they perform cardiopulmonary resuscitation on anatomical model which shows the real practice. In addition, using only one type of data collection method might have limited the quality of the results.

**Conclusion**
Bringing together, our result demonstrates that health professionals who works at Ayder comprehensive specialized hospital had inadequate knowledge and practice for cardiopulmonary resuscitation. So, health care providers also need to be continuously updated themselves for cardiopulmonary resuscitation and the hospital also needs to prepare on job simulation training which would be problem solving.

**List of Abbreviation**

ABC- Airway, Breathing, Circulation  
ADF-Additional files  
AED- Automated external defibrillator  
BLS- Basic life support  
CAB- Circulation, Airway, Breathing  
CPR- Cardiopulmonary resuscitation  
SPSS- Statistical package for social sciences

**Declarations**

**Ethics approval and consent to participate**

The draft of this article was submitted to Mekelle university collage of health review board for approval and with minimal modification on the proposal we allowed to conduct the study. Once the institutional review board approve the study and after the aim of the study was elaborated, an oral consent was obtained from the health professionals before data collection. Participants were aware that partaking in the study was voluntary. The right to withdraw from the study at any time was also assured. Coding was used to eliminate names and other personal identification of respondents throughout the study process to ensure participants confidentiality.
Consent for publication

Not applicable

Availability of data and materials

All data generated or analyzed during this study are included in this published article are available with the corresponding author.

Competing interests

The authors declare that they have no competing interests

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The study was not funded by anybody

Authors' contributions

1. KMB: - Had presented ideas, statement of the problem, set the objectives of the study, development of questionnaire. Has also participated in data analysis and writing results, discussion, conclusion
2. HGG: - Participated on the development of study materials, methodology,
3. NBE: - Had also participate in editing the proposal and the result/research
4. HBD: - Had participated in writing the literature, supervised the quality of data collection, analysis and developed tables and figures for results

All authors read and approved the final manuscript

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Reference

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Figure title and Legend

Figure 1: - Distributions of participant’s recent knowledge about cardiopulmonary resuscitation in at Ayder comprehensive specialized hospital, 2021.

While 239(97.55%) participants had either in-service or pre-service training exposure, 6 (2.455%) didn’t exposed for any training on cardiopulmonary resuscitation. Similarly, while 104(42.55%) of the participants respond that they are not sure of the pattern of cardiopulmonary resuscitation sequence; the rest 141(57.55%) of the participants respond that they think that they are sure of the sequence of CPR.

Figure 2: - Distributions of participant’s knowledge about determinants of quality cardiopulmonary resuscitation at Ayder comprehensive specialized hospital, 2021.

Participants were interviewed for knowledge on indicators of quality CPR, which are depth of the chest compression, hand position and rate of compression; 50(20.41%), 220(89.79%), 15(6.12%) of the respondent answered correctly, whereas 15(6.12%), 23(9.39%) and 7(2.86%) of the participants respond that they are not sure respectively.

Figure 3: - Participant’s exposure time for cardiopulmonary resuscitation training at Ayder comprehensive specialized hospital, 2021.

Regarding to period of the training exposure for cardiopulmonary resuscitation were checked and from 239 participants who were exposed for cardiopulmonary training 191(80%) of them were exposed during pre-service education. Whereas 48(20%) of the respondents exposed for cardiopulmonary training during in-service time
Figure 4: - Experience of participants on cardiopulmonary resuscitation at Ayder comprehensive specialized hospital, 2021.

Apart from the knowledge of the cardiopulmonary resuscitation, participants were asked for any experience of cardiopulmonary resuscitation; only 220(89.80%) participants had experience on doing cardiopulmonary resuscitation.

Figure 5: - Participants skill on compression-ventilation ration and coordination on adult cardiopulmonary resuscitation at Ayder comprehensive specialized hospital, 2021. Participants were checked about their skills how they were maintaining the ratio of compression to ventilation before intubation; while majority of the respondents 206(93.64%) replied that the ration should 30:2, The same question was forwarded to them if any change after the patient get intubated 176(80.00%) of the respondents didn’t change their mind on the ratio of compression to ventilation which is 30:2. But 30(13.64%) of the respondents replied that once the victim is intubated there is no need of coordination of the compression and ventilation.

Figure 6: - Participants skill on how to opened the airway during cardiopulmonary resuscitation at Ayder comprehensive specialized hospital, 2021.

Participants were asked to replay how they manage the airway for ventilation or intubation during cardiopulmonary resuscitation for trauma patients, while 119(54.09%) replied they used head tilt, 14(6.36%) preferred chin lift, 56(25.46%) used both head tilt and chin left and 31(14.09%) preferred to use jaw thrust.

**Table title and legend**

Table: - Socio demographic characteristic of the participants working at Ayder comprehensive specialized hospital, 2021.
The baseline characteristics of the 245 participants in this study, 160 (65.3%) of them were males, 145 (59.18%) were with age of 25-29, 170 (69.39%) were nurses by profession and 169 (68.98%) of the participants had work experience of fewer than five years.

Table 2: Association of different parameters to knowledge and skill of participants working at Ayder comprehensive specialized hospital, 2021.

According to the chi-square test analysis for different factors, participants who had more years of experience had poor knowledge on cardiopulmonary resuscitation which is statically significant (chi-square = 20.288, \( P = 0.0004 \)). Likewise, when the age of the participants increases the knowledge related questions are poorly addressed by the participants which is statically significant (chi-square = 20.274, \( P = 0.0004 \)). Chi-square regarding to sex, the male participants practice cardiopulmonary resuscitation three times better than the female participants but it is not statistically significant (chi-square = 4.962, \( P = 0.026 \)). Similarly, when the service year of the participants increases, the practice adhere to the current guideline is very poor which is statically significant (chi-square = 49.159, \( P = 0.001 \)).
Figure 1

Distributions of participant’s recent knowledge about cardiopulmonary resuscitation in at Ayder comprehensive specialized hospital, 2021. While 239 (97.55%) participants had either in-service or pre-service training exposure, 6 (2.45%) didn’t exposed for any training on cardiopulmonary resuscitation. Similarly, while 104 (42.55%) of the participants respond that they are not sure of the pattern of cardiopulmonary resuscitation sequence; the rest 141 (57.55%) of the participants respond that they think that they are sure of the sequence of CPR.
Distributions of participant's knowledge about determinants of quality cardiopulmonary resuscitation at Ayder comprehensive specialized hospital, 2021. Participants were interviewed for knowledge on indicators of quality CPR, which are depth of the chest compression, hand position and rate of compression; 50(20.41%), 220(89.79%), 15(6.12%) of the respondent answered correctly, whereas 15(6.12%), 23(9.39%) and 7(2.86%) of the participants respond that they are not sure respectively.
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