Archives of Academic Emergency Medicine. 2024; 12(1): e32

OPEN ACCESS

REVIEW ARTICLE

Knowledge, Attitude and Perceptions of Healthcare Workers in Arab Countries Regarding Basic Life Support; a Systematic Review and Meta-Analysis

Mohammed Alsabri Hussein Alsabri[1]*, Sarah Makram Elsayed[2,3], Alaa Ahmed Elshanbary[4], Mohamed Sayed Zaazouee[5], Basel F. Alqeeq[6], Syeda Alishah Zehra[7], Khaled Mohammed Al-Sayaghi [8], Sameer A. Alkubati[9,10], Gamil Ghaleb Alrubaiee[11,12]

1. Emergency Department, Al-thawra Modern General Hospital, Yemen
2. Pediatrics Department, National Heart Institute, Giza, Egypt
3. Faculty of Medicine, October 6 University, Giza, Egypt
4. Faculty of Medicine, Alexandria University, Alexandria, Egypt
5. Faculty of Medicine, Al-Azhar university, Assiut, Egypt
6. Faculty of Medicine, Islamic University of Gaza, Gaza, Palestine
7. Dow Medical College, Karachi, Pakistan
8. Critical Care and Emergency Nursing Department, atTaibah University, Medina, Saudi Arabia
9. Department of Medical Surgical Nursing, College of Nursing, University of Hail, Hail, Saudi Arabia
10. Department of Nursing, Faculty of Medicine and Health Sciences, Hodeida University, Hodeida, Yemen
11. College of Nursing, University of Hail, Hail, Saudi Arabia
12. Department of Community Health and Nutrition, Al-Razi University, Hail, Saudi Arabia

Received: December 2023; Accepted: January 2024; Published online: 28 February 2024

Abstract: **Introduction:** Effective Basic Life Support (BLS) interventions, including cardiopulmonary resuscitation (CPR), are essential for enhancing survival rates. This review aimed to evaluate the knowledge, attitudes, and perceptions (KAP) of healthcare professionals regarding BLS in Arab countries. **Methods:** We conducted a systematic search on PubMed, Cochrane, Scopus, Web of Science, and EMBASE, to identify relevant studies. We included studies performed in Arab countries that included healthcare workers' KAP assessment towards BLS. The meta-analysis was carried out utilizing the OpenMeta Analyst Software, and a subgroup analysis was performed for Nursing staff category. The quality of the included cross-sectional studies was assessed through Newcastle-Ottawa quality assessment scale. **Results:** A total of 18 studies were included in our study, and eight of them entered the analysis. The study showed that 61.3% (95% confidence interval (CI): 48.9%, 73.7%, p<0.001) of health care workers were knowledgeable about the correct CPR ratio, and 62.1% (95% CI: 51.7%, 72.5%, p<0.001) answered the location of chest compression correctly. While, only 36.5% (95% CI: 23.5%, 49.6%, p<0.001) had correct answers regarding the compression rate, 48.1% (95% CI: 38.1%, 58.0%, p<0.001) were aware of the compression depth, and 34.8% (95% CI: 22.9%, 46.7%, p<0.001) answered the sequence correctly. **Conclusion:** The study revealed a gap regarding the BLS KAP of healthcare workers in different Arab countries, which crucially requires taking actions, in terms of frequent certified training sessions, assessments, and clear protocols.

Keywords: Cardiopulmonary Resuscitation; Health Knowledge, Attitudes, Practice; Life Support Care; Education; Middle East; Health Personnel; Arabs

Cite this article as: Alsabri MAH, Elsayed SM, Elshanbary AA, et al. Knowledge, Attitude and Perceptions of Healthcare Workers in Arab Countries Regarding Basic Life Support; a Systematic Review and Meta-Analysis. Arch Acad Emerg Med. 2024; 12(1): e32. https://doi.org/10.22037/aaem.v12i1.2223.

1. Introduction

Worldwide, cardiovascular diseases are the number one cause of death, with one death attributed to this cause every twelve minutes (1). Sequels of cardiovascular diseases, such as respiratory failure and circulatory shock, are reversible but

*Corresponding Author: Mohammed Alsabri; Emergency Department, Al-thawra Modern General Hospital, Sana'a, Yemen. P.O.Box: 11566, Email: alsabri5000@gmail.com, Tel: +9671246966, ORCID: https://orcid.org/0000-0002-7278-2289.

result in millions of deaths globally. There is a disproportionate number of such deaths in developing countries (2). The American Heart Association has noted that administering cardiopulmonary resuscitation (CPR) and defibrillation within the first three to five minutes of collapse can yield survival rates ranging from 49% to as high as 75% (3). Implementing effective resuscitation training is critical for improving survival rates and outcomes.

Effective education is considered by the American Heart Association (AHA) as a vital variable in improving outcomes of cardiac arrest (4).

Resuscitation training programs aim to provide evidence-based knowledge and skills to reduce the morbidity and mortality of reversible life-threatening conditions. Such training is necessary to allow for lay persons and healthcare providers alike to consistently apply this evidence-based approach 4. It has been reported that resuscitation teams with one or more members trained in advanced cardiovascular life support (ACLS) have better outcomes (3,4).

The level of knowledge and attitude of healthcare professionals towards resuscitation training varies widely across the globe. In developed and developing countries alike, community-based critical care interventions have been shown to reduce mortality (2,5); however, poor outcomes have been reported in the latter due to inadequate assessment, treatment, and monitoring stemming from providers being undertrained (1).

Several obstacles to resuscitation training in developing countries have been identified including language barriers, inadequate time, and differences in clinical practice 2. While the demand for resuscitation courses is continuing to rise in developed countries, such training in underdeveloped and developing countries is not practiced routinely 5. As an example, a recent study conducted in Upper Egypt reported inadequate and suboptimal CPR knowledge among all junior doctors and medical students surveyed; however, it was also noted that the participants possessed positive attitudes and an eagerness toward training 6. Similar results were reported in a cross-sectional study of health interns in Saudi Arabia 5. Therefore, this study aimed to review the literature, and evaluate and analyze the Knowledge, Attitudes, and Perceptions (KAP) of healthcare professionals in Arab countries concerning Basic Life Support (BLS).

2. Methods

2.1. Study design and setting

This study is a systematic review and meta-analysis, which followed the reporting items of preferred reporting items for systematic reviews and meta-analyses (PRISMA) guidelines7. All steps were done per the Cochrane Handbook of Systematic Reviews Interventions (8). Based on the PRISMA guidelines, we created the review protocol and a search strategy. The protocol was registered in PROSPERO (International Prospective Register of systematic reviews) 2023, registration number: CRD42023456976.

2.2. Inclusion and selection criteria

The criteria included observational studies (cross-sectional) that assessed the knowledge, attitude, and perceptions (KAP) towards Basic Life Support (BLS) among healthcare workers in Arab/Middle Eastern countries. Our search was guided by the Population, Exposure and Outcome (PEO) framework, in which the population was healthcare professionals, the exposure was CPR training and the outcomes we assessed were the knowledge, attitude and practices concerning CPR. In the case of studies including both healthcare and non-healthcare workers, we included the study only when there were separable data for the healthcare workers eligible with our criteria, otherwise, we excluded the studies. We removed the duplicates using Endnote 8 software. Then, we screened the titles and abstracts, followed by full-text screening to identify the relevant studies.

2.3. Study selection

Following the database searches, all citations were imported into the EndNote X8 Windows version. Duplicate references resulting from the overlap of database content were identified and removed. Two independent reviewers (MSZ and AA) screened the titles and abstracts of all unique citations against the predefined inclusion and exclusion criteria. Any disagreements between the two reviewers at this stage were resolved through discussion, or, if necessary, a third reviewer (MA) was consulted. Studies that appeared to meet the inclusion criteria, or for which there was insufficient information in the title and abstract to make a clear decision, were advanced to full-text review. Again, two independent reviewers (MSZ and AA) assessed each full-text article to determine its eligibility. Another author (SME) revised the full-text screening. The disagreements were resolved through consultation with MA. The reference lists of all included studies were scanned to identify additional studies that might have been missed during the initial database searches. Any potentially relevant studies identified through this process were subjected to full-text review and included if they met the criteria.

2.4. Searching the literature

We performed a systematic search on different electronic databases (PubMed, Cochrane, Scopus, Web of Science, and EMBASE) until April 3, 2023 for related records. The search strategy used was (Knowledge OR Awareness OR Information OR Skill* OR Ability OR Expertise) AND (“Cardiopulmonary resuscitation” OR CPR OR “basic life support” OR BLS OR resuscitation) AND (Arab* OR “Middle East” OR “Arabian Gulf” OR Algeria OR Bahrain OR “the Comoros Islands” OR Djibouti OR Egypt OR Iraq OR Jordan OR Kuwait OR Lebanon OR Libya OR Morocco OR Mauritania OR Oman OR Palestine OR Qatar OR “Saudi Arabia” OR Somalia OR Sudan OR Syria OR Tunisia OR “United Arab Emirates” OR Yemen). The

search strategy underwent minimal adjustments to suit different electronic databases.

2.5. Quality assessment

The quality of the included cross-sectional studies was assessed through Newcastle-Ottawa quality assessment scale (NOS). The scale encompasses three different domains for quality assessment (i.e., study selection, comparability, and outcome assessment) with seven items to evaluate and a maximum score of 9. Studies were considered to be of good quality if they scored at least 5 points.

2.6. Data extraction

We extracted data related to the following: 1) Summary of included studies and baseline Characteristics, including country, setting, study design, study participants, response rate, mean age ± SD, female %, tool used to measure knowledge, good knowledge regarding BLS, positive attitude towards BLS, previous certificate, valid certificate, and conclusion, 2) Study outcomes, which included correct CPR ratio, correct location for chest compression, correct compression rate, compression depth, and correct sequence of CPR. When there were data for pre-and-post-training, we extracted the pre-training data. Also, we extracted the data for adults, and in cases of data including both adults and children. In cases of studies including children, or neonates, without data for adults, we extracted those data. We extracted the data in the form of event and total. Data were extracted by BF, and then revised thoroughly by SME. Any conflicts or disagreements were resolved by discussions with MA and MSZ.

2.7. Data synthesis and statistical analysis

We performed the analysis using the OpenMeta Analyst. Data were presented as a proportion estimate and 95% confidence interval (CI).

Data were considered significant if p-value was <0.5. Moreover, heterogeneity was defined as a P-value for heterogeneity lower than 0.1. We performed a subgroup analysis according to the healthcare workers' categories, and analyzed the data for the nurses. In cases of studies not having applicable data for entering the analysis, we included the studies as qualitative synthesis.

3. Results

3.1. Literature search

The initial search identified a total of 4573 records from five different databases. Following the duplicates' removal, we had 3705 records.

Through the title and abstract screening, 3512 records were excluded. The reasons for exclusion included study designs that did not meet our criteria, such as review articles, non-English studies, and conference abstracts. Also, studies not matching our targeted population (healthcare workers in Arab countries) were excluded. After performing the full-text screening, which included 193 records, and conducting the manual search, we excluded studies that were not English, not conducted in Arab countries, included non-healthcare workers, or included healthcare workers with them but data of healthcare workers could not be separated and conference abstracts. Finally, we had a total of 18 included studies 5,6,9-24, and eight of them were included in the quantitative synthesis 5,6,9,12-14,22,24. Figure 1 shows the PRISMA flowchart of study inclusion.

3.2. Characteristics of the included studies and population

Of the included studies, 11 included nursing staff, exclusively. The included countries were Saudi Arabia, Egypt, Jordan, Lebanon, Oman, Kuwait, Iraq, Yemen, Bahrain, and Qatar. The mean age ranged from 24.67 to 46.95 years. The percentage of females exceeded half of the participants in more than half of the included studies. Additional data regarding response rates, knowledge, attitude, and previous certificates are presented in Table 1.

3.3. Quality assessment of included studies

Overall, the scores of the included studies ranged between five and eight, with seven of them scoring seven, and four studies scoring six. All studies, except for Al Nasri et al., Bulushi 24, and Alkhaqani et al.19, scored zero in the 'Non-Response Rate' in the selection domain. Table 2 presents the details of the quality assessment.

3.4. Quantitative synthesis

Correct CPR ratio

The pooled analysis of eight studies showed that 61.3% (95% CI: 48.9%, 73.7%; p<0.001) were knowledgeable about the correct CPR ratio. However, the results were heterogeneous (p<0.001, I2=97.73%; Figure 2). The subgroup analysis of Nursing staff, which included five studies, showed that a significant proportion, 66.5% (95% CI: 49.7%, 83.3%, p<0.001; Table 3), were knowledgeable about the correct CPR ratio.

Correct location of chest compression

The pooled analysis of six studies revealed that 62.1% (95% CI: 51.7%, 72.5%, p<0.001) were knowledgeable about the correct location. Meanwhile, the results were heterogeneous (p<0.001, I2=93.867%; Figure 3). The subgroup analysis of nursing staff showed that 66.8% (95% CI: 54.6%, 79.0%, p<0.001; Table 3) gave correct answers about the location.

Correct compression rate

A total of five studies showed that 36.5% (95% CI: 23.5%, 49.6%, p<0.001) had correct answers regarding the compression rate.

However, the results were heterogeneous (p<0.001, I2=95.556%; Figure 4). Also, the subgroup analysis of nursing staff showed that 42% (95% CI: 24.6%, 59.4%, p<0.001; Table 3) were aware of the correct compression rate.

Compression depth

The pooled analysis of six studies revealed that 48.1% (95%

CI: 38.1%, 58.0%, p<0.001) were aware of the compression depth. Meanwhile, the results were heterogeneous (p<0.001, I2=94.566%; Figure 5). In addition to this, the subgroup analysis of nursing staff showed that 56.3% (95% CI: 48.9%, 63.8%, p<0.001; Table 3) were aware of the correct depth.

Correct sequence of CPR

The pooled analysis of three studies showed that 34.8% (95% CI: 22.9%, 46.7%, p<0.001) were aware of the correct sequence. The results were heterogeneous (p<0.001, I2=93.804%; Figure 6).

Qualitative Synthesis

AL-Hadrawy et al. 21 showed a fair knowledge about the neonatal cardiopulmonary resuscitation among the nurses who participated. Moreover, there was a significant association between this knowledge and the years of experience, hospital name, and number of training courses.

Abolfotouh et al. 10 found that repeated educational programs could enhance healthcare workers' attitudes in terms of CPR performance and automated external defibrillator (AED) use. Another study revealed that BLS knowledge and basic resuscitation skills were extremely low among nurses at Al-Najaf teaching hospital 19, Also AlShoshan et al. 11 investigated BLS course effectiveness using the Kirkpatrick model. They showed that healthcare workers had positive reactions toward the course and had progressed in their BLS-related behaviors. However, there was a drop in their knowledge after 6 months from the course, which highlighted the necessity of frequent training and knowledge evaluation.

Hendy et al. 20 found that a rise in the attitude scores and a fall in the stress scores, among pediatric nurses, were significantly associated with postgraduate educational level, pediatric BLS and AED use training attendance, exposure to over 10 cardiac arrest cases in the last year, and having an advanced life-support license. Marzooq and Lyneham15 found that only 7% of the included nurses passed the knowledge test, and stated that less education and experience were associated with a lack of recalling of essential CPR knowledge. Noureddine et al.16 revealed that there was a lack of policy, even at the healthcare institution level, for resuscitation guidance for out-of-hospital arrest victims. Moreover, another study by Noureddine et al.17 concluded that Lebanon requires a national policy on CPR, frequent training for all nurses, and a Good Samaritan law, as they found that training, fear of being sued, and geographical site predicted the nurses' readiness towards CPR performance. In addition to this, Toubasi et al. 18 demonstrated that BLS simulation training sessions were associated with significant improvement in skills and performance among Jordanian nurses, and recommended refreshment BLS training sessions. While, Veettil et al.

23concluded that CPR knowledge and skills practice among healthcare providers in the Primary Health Care Corporation' in Qatar was satisfactory.

4. Discussion

This study aimed to analyze the knowledge, attitudes, and perceptions of healthcare workers toward basic life support in Arab countries. The meta-analysis revealed that more than half of the included participants were knowledgeable about the correct CPR ratio, and correct location for chest compression (61.3%, and 62.1% respectively). On the contrary, less than half of them were aware of the correct compression rate, CPR depth, and correct sequence (36.5%, and 48.1%, and 34.8% respectively). In addition to this, 66.% of the nurses answered correctly about the CPR ratio, 66.8% about the location, and 56.3% about the depth, while 42% answered correctly regarding the compression rate. In a study conducted in Ethiopia, similar to our results, health-care workers' knowledge, attitudes, and perceptions were inadequate, unfavorable, and not safe when it came to cardiac arrest management 26. It was reported that even though healthcare interns had a good attitude and self-declared average knowledge, more than 2/3 of them were neither aware of the recent BLS guidelines nor of the correct sequence of resuscitation 5. This was similar to what Aroor et al. had found in their study conducted in South India, as the participants declared that they had good knowledge, however, most of them did not answer more than half of the questions correctly 26. This points to the critical importance of properly assessing the KAP among healthcare workers frequently, both for them to be self-aware and encouraged to exert more efforts towards enhancing their knowledge and skills when needed, and also for those in charge being able to take proper actions in terms of providing sufficient training sessions including hands-on approaches.

Several factors could be associated with healthcare workers' KAP regarding BLS. Previous studies, conducted in Arab and non-Arab countries including healthcare workers and non-healthcare workers, have reported that the educational level, previous CPR training, and previously receiving CPR information were associated with higher knowledge scores 6,9,27-29. In a multicenter cohort study analyzing 56,765 out-of-hospital cardiac arrests in the Asia-Pacific, the modifiable factors associated with better outcomes included bystander CPR, out-of-hospital defibrillation, and response time 8 minutes. On the other hand, out-of-hospital advanced airway was associated with reduced out-of-hospital cardiac arrest survival 30. Also, Adal and Emishaw found that being a physician, having advanced cardiac life support training, having over 6 years of work experience, as well as working in an emergency unit for over 10years were associated with better knowledge of advanced cardiac life support among healthcare providers 31.

In a recently published statement by the International Liaison Committee on Resuscitation (ILCOR) 32, it was concluded that the majority of resuscitation recommendations were established from a high-resource settings' perspective and were targeted to be applied in such settings; therefore, there were difficulties in their applicability in low-resource

settings. Meanwhile, organizations, including ILCOR, have taken a suboptimal approach to encourage the implementation of these recommendations in low-resource settings, and have not sufficiently considered local contexts and priorities 33. Researchers sought to improve the international guidelines to be more applicable in low-resource settings and to offer reasonable statements that shall reduce the worldwide burden of cardiac arrest. The primary action points involved ethics, experts in the field, research, registries, education, barriers and facilitators, politics and organizations, implementation, evaluation, and resources, which are all explained thoroughly in the statement 32.The authors emphasized the necessity of calibrating and discussing their first consensus statement on resuscitation in low-resource settings, in order to reach a consensus by experts from all settings, ultimately allowing this to serve as a stepping-stone 32. The strengths of this study include being the first meta-analysis to investigate the knowledge, attitudes, and perceptions of healthcare workers towards basic life support in Arab countries, based on our search, which could open doors for future research and increased progress. Our strict following of the PRISMA guidelines, and the inclusion of numerous Arab countries were also among the strengths of our study.

We recommend and encourage future research to include a larger sample size and to focus on physicians and other healthcare worker categories. In addition to this, we are encouraging future studies to assess the KAP before and after performing CPR course, including long-term follow-up, and to investigate possible associated factors that impact BLS KAP and CPR performance to be able to target the priorities in tackling this issue and focus on what could be done for better performance. In addition to this, separate data regarding healthcare workers' KAP regarding BLS in adults, children, and also in neonates would be very beneficial. More importantly, we call for action and address Arab countries to increase efforts toward equipping healthcare workers with proper basic life support training sessions and ensuring the quality of performance through proper and frequent assessments. In addition to this, we are shedding a spotlight on the importance of adopting national policies that should unite the healthcare workers' efforts and act as a guide to them for ensuring proper BLS conduction.

5. Limitations

The limitations include the participants being mostly dominated by a specific category of healthcare workers, which was the Nursing staff; so the generalization of the results among healthcare workers is limited. Moreover, there were limited pre-and-post data that prevented us from investigating the impact of the CPR course on the healthcare workers. In addition, even though we had a large number of included studies (N=18), only eight of them had applicable data to enter our meta-analysis. Also, there were no separate data for neonates, children, and adults.

6. Conclusions

This study reveals significant gaps in the Basic Life Support (BLS) knowledge among healthcare workers in various Arab countries. While over half of the participants had correct knowledge in some aspects, such as CPR ratio and correct location, deficiencies in critical elements like compression rate and sequence existed. Urgent interventions, including regular certified training, ongoing assessments, and standardized protocols, are imperative to improve BLS knowledge. Bridging these gaps will enhance emergency response effectiveness in Arab healthcare settings.

7. Abbreviations

Cardiopulmonary resuscitation (CPR); American Heart Association (AHA); Advanced cardiovascular life support (ACLS); Knowledge, attitude, and perceptions (KAP); Basic Life Support (BLS); Newcastle-Ottawa quality assessment scale (NOS); Confidence interval (CI); Automated external defibrillator (AED); International Liaison Committee on Resuscitation (ILCOR).

8. Declarations

8.1. Acknowledgments

None.

8.2. Conflict of interest

The authors declare that they have no conflict of interest.

8.3. Ethical approval and consent to participate

Not applicable.

8.4. Consent for publication

Not applicable.

8.5. Funding

No funding was received for this research.

8.6. Authors' contributions

Mohammed Alsabri Hussein (MAH), along with MSZ (Mohammed Sayed Zaazoue), and Sarah Makram Elsayed (SME) have contributed equally and are considered as first authors. The corresponding author proposed the project, wrote the protocol, participated in the screening and the selection of the studies, contributed to the conception, formulation, and drafting of the article, reviewed and revised the manuscript.
MSZ also wrote the protocol, conducted the search strategy, and helped with the data analysis as well.
MSZ and AA participated in the screening of the studies.
BF participated in the data extraction, quality assessment of the included studies and critical revision.
SME conducted the data analysis, participated in writing, and revised the screening process, data extraction, and participated in the critical revision of the manuscript.

(SZ, KA, SAK, GG) participated in writing and revision of the final manuscript.
All authors approved the final manuscript as submitted and agreed to be accountable for all aspects of the work.

8.7. Using artificial intelligence chatbots

None

References

1. Papi M, Hakim A, Bahrami H. Relationship between knowledge and skill for basic life support in personnel of emergency medical services, Islamic Republic of Iran. East Mediterr Health J. 2020;26(10):1193-9.
2. Meaney PA, Topjian AA, Chandler HK, Botha M, Soar J, Berg RA, et al. Resuscitation training in developing countries: a systematic review. Resuscitation. 2010;81(11):1462-72.
3. American Heart Association. 2005 American Heart Association (AHA) guidelines for cardiopulmonary resuscitation (CPR) and emergency cardiovascular care (ECC) of pediatric and neonatal patients: pediatric basic life support. Pediatrics. 2006;117(5):e989-1004.
4. Ko JS, Kim SR, Cho BJ. The Effect of Cardiopulmonary Resuscitation (CPR) Education on the CPR Knowledge, Attitudes, Self-Efficacy, and Confidence in Performing CPR among Elementary School Students in Korea. Healthcare (Basel). 2023 Jul 17;11(14):2047.
5. Saquib SA, Al-Harthi HM, Khoshhal AA, Shaher AA, Al-Shammari AB, Khan A, et al. Knowledge and Attitude about Basic Life Support and Emergency Medical Services amongst Healthcare Interns in University Hospitals: A Cross-Sectional Study. Emerg Med Int. 2019;2019:9342892.
6. Mohammed Z, Arafa A, Saleh Y, Dardir M, Taha A, Shaban H, et al. Knowledge of and attitudes towards cardiopulmonary resuscitation among junior doctors and medical students in Upper Egypt: cross-sectional study. Int J Emerg Med. 2020;13(1):19.
7. Moher D, Liberati A, Tetzlaff J, Altman DG, Group TP. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med. 2009;6(7):e1000097.
8. Higgins JP, Green S, eds. Cochrane Handbook for Systematic Reviews of Interventions: Cochrane Book Series. John Wiley and Sons Ltd; 2008.
9. Alkubati SA, McClean C, Yu R, Albagawi B, Alsaqri SH, Alsabri M. Basic life support knowledge in a war-torn country: a survey of nurses in Yemen. BMC Nurs. 2022;21(1):141.
10. Abolfotouh MA, Alnasser MA, Berhanu AN, Al-Turaif DA, Alfayez AI. Impact of basic life-support training on the attitudes of health-care workers toward cardiopulmonary resuscitation and defibrillation. BMC Health Serv Res. 2017;17(1):674.
11. AlShoshan F, Zawawi A, AlHarbi A. Evaluation of the Effectiveness of Basic Life Support Courses among Health Care Professionals at the Ministry of National Guard Health Affairs. Int J Med Res Health Sci. 2019;8(7):30-7.
12. Alkandari SA, Alyahya L, Abdulwahab M. Cardiopulmonary resuscitation knowledge and attitude among general dentists in Kuwait. World J Emerg Med. 2017;8(1):19-24.
13. Al-smadi AM, Bani Hani S, Shajrawi A, Ashour A, Halabi M, Mousa A, et al. Knowledge and practice toward basic life support among nurses working with SARS-CoV-2 patients in Jordanian hospitals. Work Older People. Working with Older People: Community Care Policy and Practice, 27(4), 323–334.
14. Elazazay HM, Abdelazez AL, Elsaie OA. Effect of Cardiopulmonary Resuscitation Training Program on Nurses Knowledge and Practice. Life Sci J. 2012;9(4):3494-503.
15. Marzooq H, Lyneham J. Cardiopulmonary resuscitation knowledge among nurses working in Bahrain. Int J Nurs Pract. 2009;15(4):294-302.
16. Noureddine S, Avedissian T, Isma'eel H, El Sayed MJ. Assessment of cardiopulmonary resuscitation practices in emergency departments for out-of-hospital cardiac arrest victims in Lebanon. J Emerg Trauma Shock. 2016;9(3):115-21.
17. Noureddine S, Avedissian T, Khatib N, Irani J. Towards better out-of-hospital cardiopulmonary resuscitation: A survey of nurses. J Clin Nurs. 2021;30(19-20):3036-44.
18. Toubasi S, Alosta MR, Darawad MW, Demeh W. Impact of simulation training on Jordanian nurses' performance of basic life support skills: A pilot study. Nurse Educ Today. 2015;35(9):999-1003.
19. Alkhaqani AL. Exploring Nurses' Knowledge and Attitudes Concerning Basic Life Support: A Questionnaire Survey Study. Al-Rafidain J Med Sci. 2023;5:40-7.
20. Hendy A, Hassani R, Ali Abouelela M, Nuwayfi Alruwaili A, Abdel Fattah HA, Abd Elfattah Atia G, et al. Self-Assessed Capabilities, Attitudes, and Stress among Pediatric Nurses in Relation to Cardiopulmonary Resuscitation. J Multidiscip Healthc. 2023;16:603-11.
21. Al-Hadrawy ZAA, Khadim RA, Shaker E. Assessment of Nurses' Knowledge toward Neonatal Resuscitation. Indian J Forensic Med Toxicol. 2021;15(3):2196-202.
22. Hafez A, Shehab M. Assessment of Basic Life Support Knowledge Among Nursing Professionals. Egypt J Occup Med. 2020;44(1):455-70.
23. Veettil ST, Anodiyil MS, Khudadad H, Kalathingal MA, Hamza AH, Ummer FP, et al. Knowledge, attitude, and proficiency of healthcare providers in cardiopulmonary resuscitation in a public primary healthcare setting in Qatar. Front Cardiovasc Med. 2023;10:1207918.
24. AL Nasri A, AL Bulushi A. Examining Nurses' Theoretical Knowledge, Attitude, and Practice of Cardio-pulmonary Resuscitation in Hospitals and Primary Health Care Set-

tings in South Sharqiyah, Sultanate of Oman. Am J Nurs Res. 2020;8(5):577-87.
25. Abebe TA, Zeleke LB, Assega MA, Sefefe WM, Gebremedhn EG. Health-Care Providers' Knowledge, Attitudes, and Practices Regarding Adult Cardiopulmonary Resuscitation at Debre Markos Referral Hospital, Gojjam, Northwest Ethiopia. Adv Med Educ Pract. 2021;12:647-54.
26. Aroor AR, Saya RP, Attar NR, Saya GK, Ravinanthanan M. Awareness about basic life support and emergency medical services and its associated factors among students in a tertiary care hospital in South India. J Emerg Trauma Shock. 2014;7(3):166-9.
27. Albadi S, Al-Hadi H, Nadar SK. Knowledge and Attitudes toward Basic Life Support among Medical Students in Oman. Indian J Crit Care Med. 2020;24(7):599-600.
28. Ojifinni K, Motara F, Laher AE. Knowledge, Attitudes and Perceptions Regarding Basic Life Support Among Teachers in Training. Cureus. 2019;11(12):e6302.
29. Oktay V, Cirali IC, Baydar O, Sansoy V. Knowledge and experience of cardiopulmonary resuscitation among cardiologists in clinical practice: A multicenter cross-sectional study. Anatol J Cardiol. 2019;21(6):296-304.
30. Tanaka H, Ong MEH, Siddiqui FJ, Ma MHM, Kaneko H, Lee KW, et al. Modifiable Factors Associated With Survival After Out-of-Hospital Cardiac Arrest in the Pan-Asian Resuscitation Outcomes Study. Ann Emerg Med. 2018;71(5):608-17.e15.
31. Adal O, Emishaw S. Knowledge and attitude of healthcare workers toward advanced cardiac life support in Felege Hiwot Referral Hospital, Bahir Dar, Ethiopia, 2022. SAGE Open Med. 2023;11:20503121221150101.
32. Schnaubelt S, Garg R, Atiq H, Baig N, Bernardino M, Bigham B, et al. Cardiopulmonary resuscitation in low-resource settings: a statement by the International Liaison Committee on Resuscitation, supported by the AFEM, EUSEM, IFEM, and IFRC. Lancet Glob Health. 2023;11(9):e1444-e53.

Table 1: Distribution of population and number of deaths by sex and year, crude and age-sex-standardized road traffic injury (RTI) mortality rate and proportional mortality (per100) in the study population

Study ID, Year	Country	Setting	Study design	Study participants	Response Rate	Mean Age ± SD	Female	Tool used to measure knowledge	Good knowledge regarding BLS	Positive attitude towards BLS	Previous certificate	Valid certificate	Conclusion
Al-Hadrawy et al., 2021	Iraq	Teaching hospitals	Cross-sectional questionnaire survey	Nursing staff (n = 60)	NR	NR	49 (81.7%)	A developed questionnaire with the help of arranged interview.	NR	NR	NR	NR	There was fair knowledge among the nurses regarding neonatal cardiopulmonary resuscitation.
Abolfotouh et al., 2017	Saudi Arabia	Training centers	Quasi-experimental study	Healthcare professionals, pre-BLS group (n = 421) post-BLS group (n = 321)	NR	NR	Pre-BLS: 297 (70.5%) Post-BLS: 201 (62.6%)	A questionnaire on BLS knowledge (previously validated)	NR	Pre-BLS: 53.4% Post-BLS: 64.8%	64 (15.2%)	NR	Positive attitude was significantly predicted by the recent completion of BLS training, the number of previous BLS training courses, and previous exposure to cardiac-arrest cases, as well as by low concern scores.
Al Nasri et Al Bulushi, 2020	Oman	Hospitals and PHC centers	Cross-sectional questionnaire survey	Nursing staff (n = 267)	94.60%	NR	240 (89.9%)	A questionnaire on BLS knowledge (previously validated)	4.50%	59%	251 (94%)	128 (48%)	Knowledge of the nurses in BLS and ACLS was found to be low.
Alkandari et al., 2017	Kuwait	Electronic survey	Cross-sectional questionnaire survey	Dentists (n = 208)	83.20%	32.8 (23-64)	85 (40.9%)	A questionnaire on BLS knowledge (Based on AHA guidelines, 2010)	30%	NR	NR	90 (36%)	The majority of general dental practitioners in Kuwait had inadequate knowledge on CPR.
Alkhaqani, 2023	Iraq	Teaching hospital	Cross-sectional questionnaire survey	Nursing staff (n = 200)	95.20%	NR	124 (62%)	A questionnaire on BLS knowledge (self-structured)	'NR	NR	NR	NR	Most nurses had not attended any BLS training previously, and their knowledge about BLS was poor.
Alkubati et al., 2022	Yemen	Public and private hospitals	Cross-sectional questionnaire survey	Nursing staff (n = 200)	90.90%	29.89 ± 8.58	87 (43.5%)	A questionnaire on BLS knowledge (Based on AHA guidelines, 2015)	53.65%	NR	82 (41%)	NR	BLS knowledge among studied nurses in Yemen was below an acceptable level to ensure maximum survival in the event of cardiac arrest.

Table 1: Distribution of population and number of deaths by sex and year, crude and age-sex-standardized road traffic injury (RTI) mortality rate and proportional mortality (per100) in the study population (continue)

Study ID, Year	Country	Setting	Study design	Study participants	Response Rate	Mean Age ± SD	Female	Tool used to measure knowledge	Good knowledge regarding BLS	Positive attitude towards BLS	Previous certificate	Valid certificate	Conclusion
AlShoshan et al., 2019	Saudi Arabia	Training centers (conducted at the time of BLS training and 6 months later)	Quasi-experimental study	Healthcare professionals (At the time of training, n = 455) (6 months later, n = 192)	87.5	NR	NR	A questionnaire on BLS knowledge (Based on AHA guidelines)	Immediately after training: 95% After 6 months: mean difference in knowledge score (-9.27 ± 12.9)	NR	NR	NR	Healthcare professionals had generally positive attitudes and behavior concerning basic life support. There was a clear deterioration in basic life support knowledge 6 months after the course.
Alsmadi et al., 2022	Jordan	Hospitals	Cross-sectional questionnaire survey	Nursing staff working with COVID-19 patients (n = 386)	NR	30.8 ± 6.2	258 (66.85%)	A questionnaire on BLS knowledge (Based on AHA guidelines)	NR	NR	NR	NR	In general, nurses revealed a moderate level of knowledge and practice of BLS skills.
Elazazay et al., 2012	Egypt	Cancer institute (conducted at the time of BLS training and 1 month later)	Quasi-experimental study	Nursing staff (n = 111)	NR	NR	97 (87.4%)	A questionnaire on BLS knowledge (Based on AHA guidelines)	Before training: 11.7% Immediately after training: 89.2% After 1 month: 72.1%	NR	30 (27%)	NR	Training program was effective in improving nurses' knowledge and performance regarding CPR.
Hendy et al., 2023	Egypt	Public hospitals	Cross-sectional questionnaire survey	Nursing staff (n = 748)	80%	34.99 ± 5.12	508 (64.8%)	A questionnaire on BLS knowledge (previously validated)	NR	289 (36.9%)	388 (49.5%)	NR	Positive attitudes and improving self-assessed abilities decreased the nurses' stress levels regarding CPR.
Marzooq et al., 2009	Bahrain	Public hospital	Cross-sectional questionnaire survey	Nursing staff (n = 82)	82%	range (20-50)	77 (93.9%)	A questionnaire on BLS knowledge (self-structured)	NR	NR	49 (59.7%)	14 (17%)	There was a significant problem with the knowledge surrounding CPR. More concerning was the lack of professional responsibility in dealing with this inadequacy.

Table 1: Distribution of population and number of deaths by sex and year, crude and age-sex-standardized road traffic injury (RTI) mortality rate and proportional mortality (per100) in the study population (continue)

Study ID, Year	Country	Setting	Study design	Study participants	Response Rate	Mean Age ± SD	Female	Tool used to measure knowledge	Good knowledge regarding BLS	Positive attitude towards BLS	Previous certificate	Valid certificate	Conclusion
Mohammed et al., 2020	Egypt	University's College of Medicine and the University Hospital	Cross-sectional questionnaire survey	N=205 (60 junior doctors and 145 medical students)	44%	-	20 (33%)	A semi-structured questionnaire (Based on the American Heart Association 2015 guidelines)	31.70%	95%	-	-	There was insufficient CPR knowledge among junior doctors and medical students. On the other hand, there were high positive attitudes and eagerness towards CPR training implementation.
Nouredddine et al., 2016	Lebanon	Hospitals (emergency departments)	Cross-sectional questionnaire survey	Physicians (n = 75)	10.64%	46.95 ± 10.4	12 (20.3%)	A questionnaire on BLS knowledge (previously validated)	NR	NR	NR	NR	Physicians often rely on well established criteria for initiating/continuing resuscitation; however, their decisions are also influenced by cultural factors such as victim's family's wishes.
Nouredddine et al., 2020	Lebanon	Electronic survey	Cross-sectional questionnaire survey	Nursing staff (n = 692)	NR	32.33 ± 7.97	535 (77.3%)	A questionnaire on BLS knowledge (previously validated)	NR	NR	663 (96%)	598 (86.4%)	Most nurses received cardiopulmonary resuscitation training, but 19.8% did not renew their certification in the past two years, because of limited training centers and lack of time.
Saquib et al., 2019	Saudi Arabia	University hospitals	Cross-sectional questionnaire survey	Healthcare interns (n = 698)	80.69%	24.67 ± 2.56	263 (41%)	A questionnaire on BLS knowledge (Based on AHA guidelines, 2015)	18.70%	NR	616 (88.2%)	NR	Overall awareness score was average, whereas the knowledge score was below average. Further, the participants showed a positive attitude toward BLS training

Table 1: Distribution of population and number of deaths by sex and year, crude and age-sex-standardized road traffic injury (RTI) mortality rate and proportional mortality (per100) in the study population (continue)

Study ID, Year	Country	Setting	Study design	Study participants	Response Rate	Mean Age ± SD	Female	Tool used to measure knowledge	Good knowledge regarding BLS	Positive attitude towards BLS	Previous certificate	Valid certificate	Conclusion
Toubasi et al., 2015	Jordan	Hospital	Quasi-experimental study	Nursing staff (n = 30)	NR	28.4 ± 4.1	18 (60%)	A questionnaire on BLS knowledge (Based on AHA guidelines, 2010)	NR	NR	NR	26 (86.7%)	BLS simulation training sessions were associated with significant improvement in skills and performance among Jordanian nurses.
Veettil et al., 2023	Qatar	PHC centers	Cross-sectional questionnaire survey	Healthcare professionals (n = 569)	NR	NR	413 (72.6%)	A questionnaire on BLS knowledge (previously validated)	NR	NR	551 (96.8%)	NR	The level of CPR knowledge, skills, and practice among healthcare providers in PHC centers was deemed satisfactory as most providers reported having performed CPR in the past.
Zayed et Saied, 2020	Egypt	Hospitals	Cross-sectional questionnaire survey	Nursing professionals (N=510)	80.44%	31.59± 7.77	451 (88.4%)	A questionnaire on BLS knowledge (previously validated)	33.90%	NR	177 (34.71%)	NR	There was inadequate BLS knowledge among the majority of nursing professionals working at Tanta University Hospitals. Therefore, it was recommended to have regular in-service training, re-certification of BLS competency, and rotating work schedule between different departments.

BLS: Basic Life Support; SD: Standard Deviation; NR: Not Reported; PHC: Primary Health Care; ACLS: Advanced Cardiac Life Support; CPR: Cardiopulmonary Resuscitation; AHA: American Heart Association.

Table 2: The table shows the quality assessment of the included cross-sectional studies using Newcastle-Ottawa quality assessment scale (NOS)

Study ID	Selection				Comparability	Outcome		Overall
	1	2	3	4	5	6	7	
AL-Hadrawy et al., 2021	⋆	⋆	0	⋆	⋆	⋆	⋆	6
Al Nasri et Al Bulushi, 2020	⋆	⋆	⋆	⋆⋆	⋆	⋆	⋆	8
Alkandari et al., 2017	⋆	⋆	0	⋆⋆	⋆	⋆	⋆	7
Alkhaqani et al., 2023	⋆	⋆	⋆	⋆	0	⋆	⋆	6
Alkubati et al., 2022	⋆	⋆	0	⋆⋆	⋆	⋆	⋆	7
Al-smadi et al., 2022	⋆	⋆	0	⋆⋆	⋆	⋆	⋆	7
Hendy et al., 2023	⋆	⋆	0	⋆⋆	⋆	⋆	⋆	7
Marzooq et al., 2009	⋆	0	0	⋆	⋆	⋆	⋆	5
Mohammed et al., 2020	⋆	⋆	0	⋆⋆	⋆	⋆	⋆	7
Noureddine et al., 2016	⋆	0	0	⋆⋆	⋆	⋆	⋆	6
Noureddine et al., 2020	⋆	⋆	0	⋆⋆	⋆	⋆	⋆	7
Saquib et al., 2019	⋆	⋆	0	⋆⋆	⋆	⋆	⋆	7
Veettil et al., 2023	⋆	⋆	0	⋆⋆	⋆	⋆	⋆	7
Zayed et Saied, 2020	⋆	⋆	0	⋆	⋆	⋆	⋆	6

⋆: one point, ⋆⋆: two points, 0: zero points
1: Representativeness of the case; 2: Sample size; 3: Non-response rate; 4: Ascertainment of the screening tool;
5: Confounders were investigated; 6: Assessment of the outcome; 7: Statistical test.
*Newcastle-Ottawa scale adapted for cross-sectional studies; item adequacy of monitoring does not score.
Zero star means that the item is not registered in the article; very good studies will receive: 8 to 9 points; good studies: 6-7 points; satisfactory studies: 5 points; and unsatisfactory studies: 0 to 4 points.
Studies can receive a maximum of one star for each item in the tool except for the ascertainment of the screening tool and the assessment of the outcome, both of which can score a maximum of two stars.

Table 3: Subgroup analysis of nursing staff knowledge regarding cardiopulmonary resuscitation (CPR)

Correct answers	N	PR (95% CI)	P value	Heterogeneity	
				I^2%)	P value
CPR ratio	5	0.665 (0.497,0.833)	<0.001	98.149	<0.001
Location of compression	4	0.668 (0.546, 0.790)	<0.001	94.665	<0.001
Compression rate	3	0.420 (0.246,0.59.4)	<0.001	96.783	<0.001
Compression depth	3	0.563 (0.489, 0.638)	<0.001	81.099	0.005

N: Number of included studies; PR: Proportion Rate; CI: confidence interval.

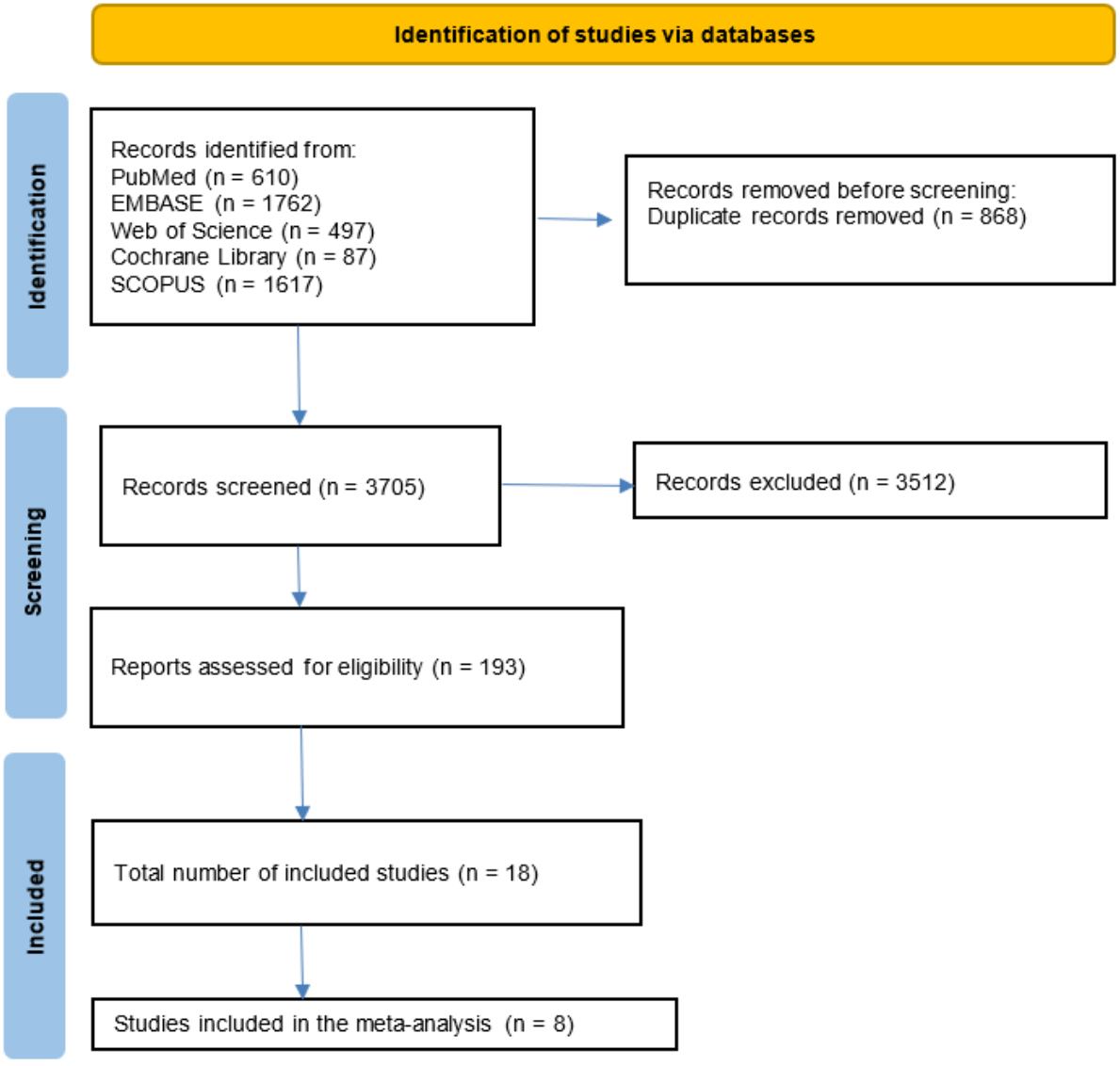

Figure 1: The preferred reporting items for systematic reviews and meta-analyses (PRISMA) flow diagram of study inclusion.

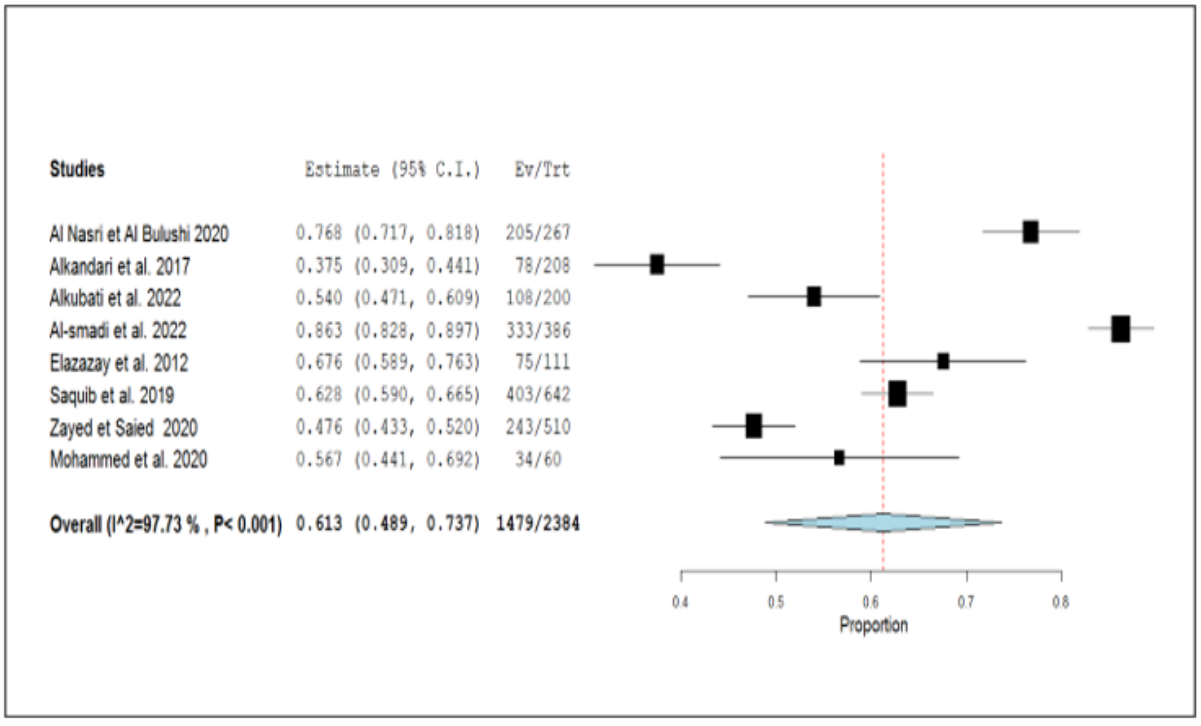

Figure 2: Forest plot of health workers' knowledge regarding correct cardiopulmonary resuscitation ratio in Arab Countries. C.I.: confidence interval; Ev/Trt: Events per treatment.

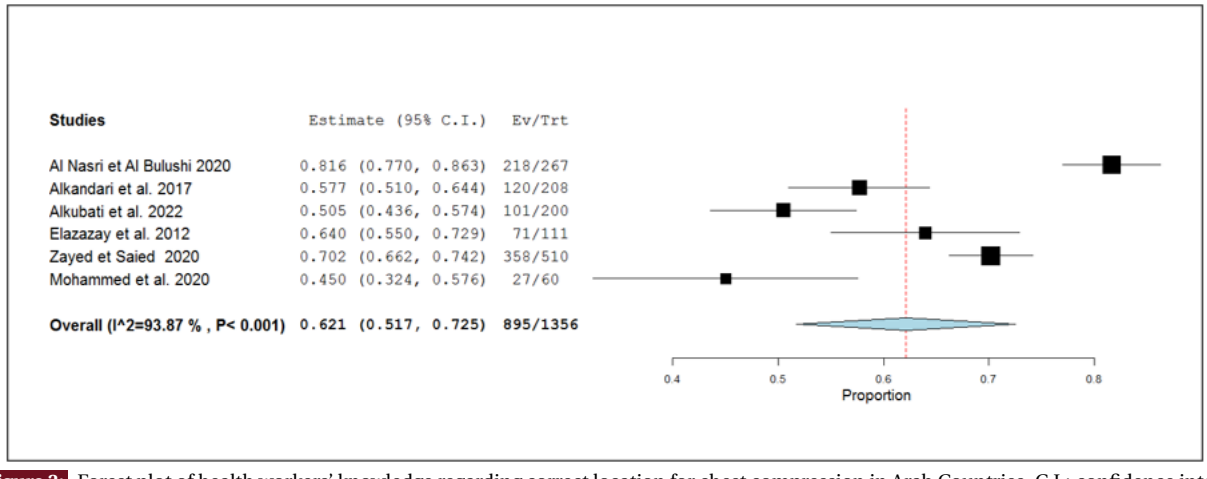

Figure 3: Forest plot of health workers' knowledge regarding correct location for chest compression in Arab Countries. C.I.: confidence interval; Ev/Trt: Events per treatment.

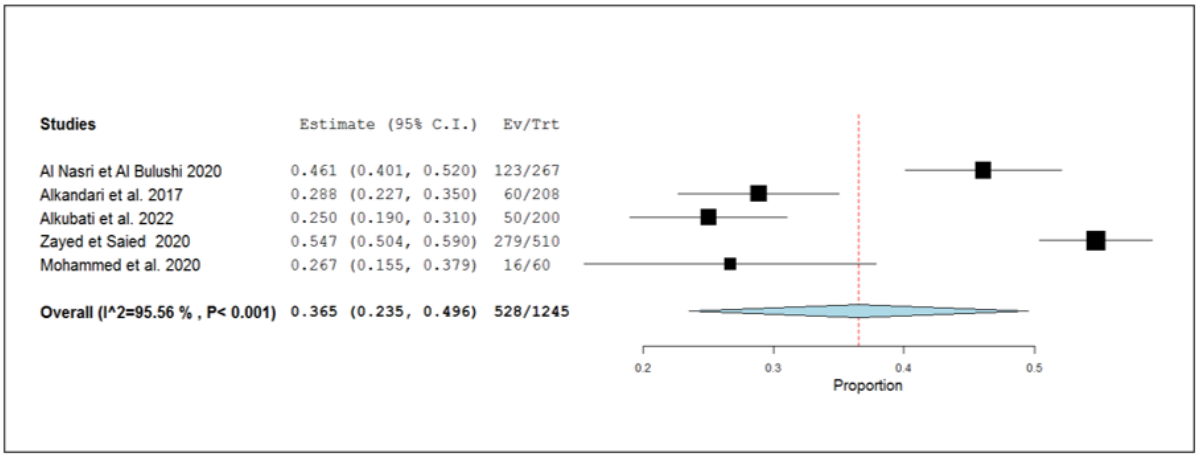

Figure 4: Forest plot of health workers' knowledge regarding correct chest compression rate in Arab countries. C.I.: confidence interval; Ev/Trt: Events per treatment.

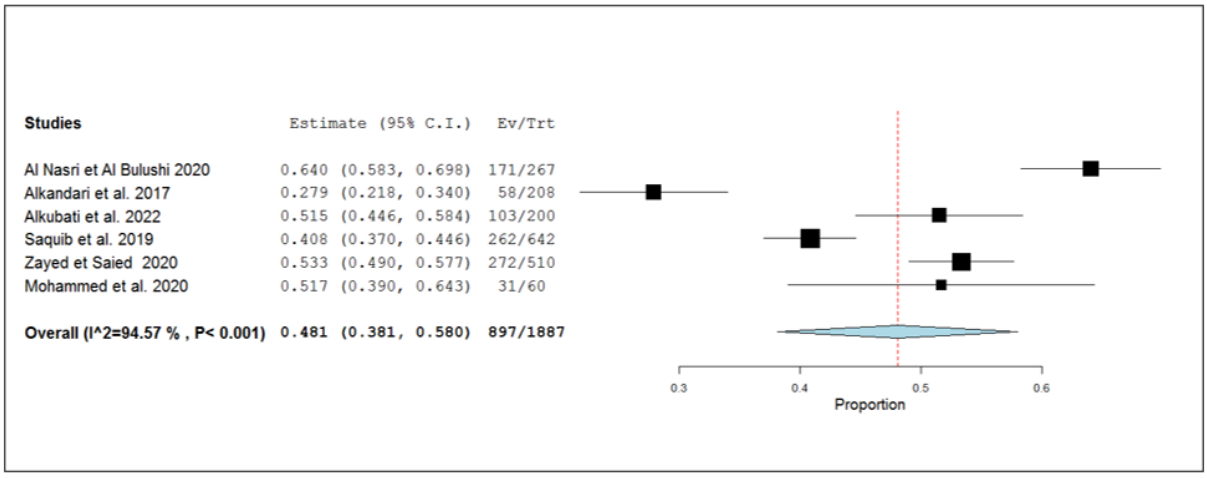

Figure 5: Forest plot of health workers' knowledge regarding chest compression depth in Arab countries. C.I.: confidence interval; Ev/Trt: Events per treatment.

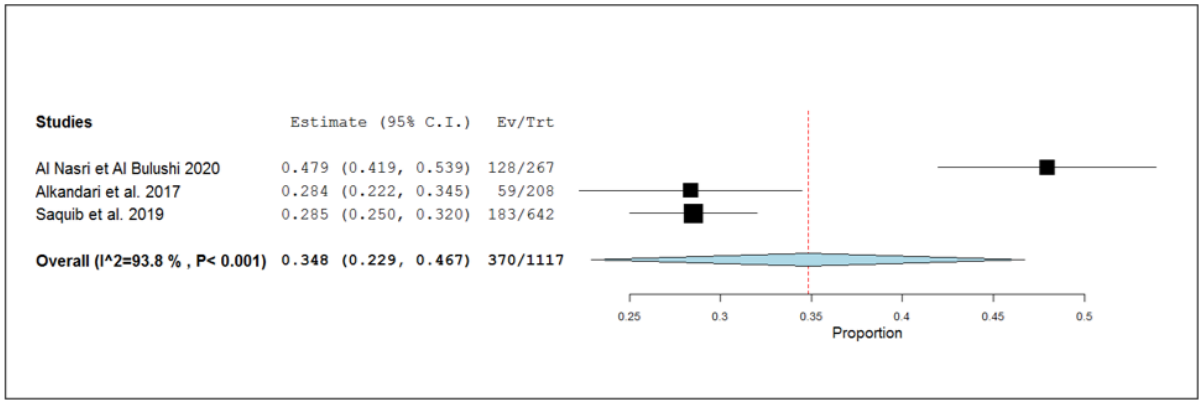

Figure 6: Forest plot of health workers' knowledge regarding correct sequence of cardiopulmonary resuscitation in Arab countries. C.I.: confidence interval; Ev/Trt: Events per treatment.