Factors Influencing Nurses' Skills in Managing Resuscitation Patients: A Systematic Review and Meta-Analysis

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Abstract

Cardiac arrest remains a major global health concern, and nurses' ability to perform effective cardiopulmonary resuscitation (CPR) is critical to patient survival. However, significant variations in CPR skills among nurses have been widely reported, influenced by factors ranging from individual characteristics to institutional support. This study aimed to systematically identify and analyze the factors influencing nurses' competence in performing CPR. A systematic literature review and meta-analysis were conducted in accordance with PRISMA guidelines, utilizing databases such as PubMed, ScienceDirect, Springer, and Google Scholar to identify relevant articles published between 2021 and 2025. Ten studies met the inclusion criteria and were appraised using the JBI Critical Appraisal Checklist. The results indicated that knowledge, education, training, retraining, work experience, situational awareness, work environment, body mass index (BMI), and psychological factors contribute to variations in CPR proficiency. Nevertheless, the pooled meta-analysis revealed a very small and statistically insignificant effect size (0.0665; 95% CI: -0.0464 to 0.1794), with moderate heterogeneity (I² = 57.5%). Subgroup analysis showed that structured training had a more substantial positive effect compared to work experience. These findings suggest that experience alone is insufficient to ensure CPR competence. Therefore, standardized, recurrent training aligned with international guidelines and supported by adequate clinical infrastructure is essential to enhance nurses' resuscitation skills and improve emergency care outcomes.

Keywords: CPR, Factor, Meta Analysis, Nursing Competence, Nursing Skills.

INTRODUCTION

Cardiovascular diseases, particularly myocardial infarction, remain one of the leading causes of mortality worldwide. According to the World Health Organization, (2021), myocardial infarction ranks among the top three causes of death globally, occupying the first position with an annual death toll of approximately 17.8 million people. A myocardial infarction occurs when the heart ceases to pump blood, resulting in the interruption of blood supply throughout the body. If not managed promptly, accurately, and effectively, this condition can lead to death or permanent disability.

One of the critical interventions in managing patients with cardiac arrest is cardiopulmonary resuscitation (CPR). Effective CPR can significantly increase the likelihood of achieving return of spontaneous circulation (ROSC). However, global data indicate that despite CPR being administered, success rates remain low. Shao et al., (2020) reported that among 151 patients who experienced in-hospital cardiac arrest (IHCA) over a 40-day period in Wuhan, only 13.2% achieved ROSC, with only four patients surviving 30 days post-event. Most patients were over 60 years old and had comorbidities such as hypertension, with the majority of cases occurring in general wards (83.1%). Similar findings were reported by Sheth et al., (2020) in New York City, documenting poor prognosis and high mortality rates in IHCA patients related to COVID-19.

In Indonesia, the burden of heart disease is similarly significant. Myocardial infarction is a major cause of death and poses a considerable challenge to emergency services in hospitals. Within the Emergency Department (ED) context, patient mortality can be attributed to several factors, including disease severity, limited facilities, and insufficient readiness of healthcare professionals to manage emergencies optimally

(Mostafa & El-Atawi, 2024). A critical moment in cardiac arrest management is the "golden period," a crucial timeframe during which rapid and precise intervention can save lives. Unfortunately, during this phase, not all healthcare providers—especially nurses—possess the adequate skills and preparedness to perform CPR effectively.

International standards established by the American Heart Association emphasize the importance of technical proficiency in CPR, including chest compression rates of 100–120 compressions per minute, a minimum depth of 5 cm, minimizing interruptions, switching compressors every two minutes, and effective ventilation. Deviations from these protocols can significantly reduce CPR success rates (American Heart Assosciation, 2020).

Nurses play a strategic frontline role in providing first aid, particularly in the ED. They are required to have advanced skills in managing emergencies such as cardiac arrest. Ideally, such knowledge and skills are acquired through formal education and various training programs, including Basic Heart Disease (BHD), Triage, Basic Trauma and Cardiac Life Support (BTCLS), Basic Life Support (BLS), Advanced Cardiac Life Support (ACLS), and Emergency Nurse in Life Support (ENIL). However, field observations reveal that many nurses remain insufficiently responsive and skilled in emergency situations (Hardiansyah et al., 2020). This discrepancy highlights a gap between ideal competencies and actual practice.

Several studies have explored factors influencing nurses' CPR skills. Rahmawati et al., (2023) identified significant associations between nurses' knowledge, work experience, training, and body mass index with their CPR skills. Bashir et al., (2025) also reported positive correlations between knowledge, education level, work tenure, and training with nurses' resuscitation capabilities. Similarly, (Nasution & Nurhidayah, 2021) added that nurses' readiness to perform CPR is influenced by standard operating procedures (SOPs), availability of facilities, training, knowledge, and experience.

A similar phenomenon was observed by the researcher during clinical practice at Hospital X in Tegal Regency. It was found that CPR implementation during cardiac arrest tended to be entrusted mainly to nurses with specific certifications such as ACLS, senior nurses with longer work experience, or more often to male nurses. This indicates potential bias and unequal distribution of CPR skills among nursing staff. In emergency situations, all nurses should ideally possess adequate competence to initiate life-saving interventions without reliance on select individuals.

This gap raises a critical question: What factors consistently influence nurses' skills in managing cardiac arrest patients? To address real-world challenges and improve the quality of emergency care services, a comprehensive and systematic synthesis of scientific evidence on these factors is necessary. Therefore, conducting a systematic review and meta-analysis to objectively and scientifically integrate previous research findings is warranted.

This article aims to systematically explore and identify factors influencing nurses' skills in managing cardiopulmonary resuscitation (CPR) patients through a systematic review and meta-analysis. By integrating diverse empirical findings, this study is expected to provide a scientific foundation for designing training programs, capacity-building initiatives, and improving emergency care systems more effectively and equitably at both national and global levels.

RESEARCH METHODS

Study Design and Reporting

This review follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, which aim to ensure that the methods and results of the systematic review are described comprehensively and in detail, thereby enabling full transparency in the collection and presentation of evidence regarding various factors influencing emergency department nurses' ability to perform resuscitation (Haddaway et al., 2022; Page et al., 2021). The study included all articles that met the eligibility criteria, published between January 2021 and May 22, 2025, to address the research questions.

Search Strategy

In this study, article searches were conducted using four data sources: Springer, ScienceDirect, Google Scholar, and PubMed NCBI. The search strategy involved exploring articles using the keywords: "Factor" AND "Nursing Skills" AND "Resuscitation" AND "CPR" in international databases, and the keywords: "Faktor" AND "Keterampilan Perawat" AND "Resusitasi" AND "RJP" in national databases.

Eligibility Criteria

Data were obtained by reviewing research findings reported in journals, using the PICOT framework (Population, Intervention, Comparison, Outcomes, Time study) to screen articles in accordance with the objectives of this study. These criteria are detailed in Table 1

Table 1. Criteria Article

Criteria	Inclusion	Exclusion
Population	National and international articles relevant to the topic, specifically nurses' skills in managing resuscitation patients	National and international articles not related to nurses' skills in managing resuscitation patients
Intervention	No Intervention	No Intervention
Comparison	No Comparison	No Comparison
Outcomes	Factors influencing nurses' skills in managing resuscitation patients	Factors that do not or minimally influence nurses' skills in managing resuscitation patients
Time Study	Article published between January 2021 to May 2025	Article published before 2021
Study design	Quantitative and qualitative studies, as well as open-access articles	Systematic reviews such as narrative reviews, meta-analyses, literature reviews, and non-open access articles
Language	Articles published in Indonesian and English	Articles published in languages other than Indonesian and English

Data Collection Process

Data were independently collected by the authors through a blind review process using an Excel worksheet to compile one-page summaries. The worksheet recorded key information, including an overview of each article, research design, study location, population and sample size, research findings, and methodological quality assessment based on the JBI checklist scoring.

Appraisal of Bias Across Study

The risk of bias assessment in this study was conducted using the JBI Critical Appraisal Checklist for Analytical Cross-Sectional Studies. This checklist evaluates methodological aspects such as the clarity of population inclusion criteria, validity and reliability of measurement tools, control of confounding factors, and adequacy of data analysis. Each item is rated as "Yes," "No," "Unclear," or "Not Applicable" to provide an overview of the methodological quality of the cross-sectional studies assessed. By applying this appraisal tool, the study aims to systematically identify potential biases in observational studies, thereby enhancing the reliability and validity of the conclusions drawn in the systematic review and meta-analysis.

Synthesis of Results

The analysis was conducted using OpenMEE, an open-source, cross-platform software for ecological and evolutionary meta-analysis. A quantitative description of the combined results was preplanned. The final interpretation of the pooled outcomes was adjusted according to the level of heterogeneity observed. Heterogeneity was assessed using the Cochrane χ^2 test (Q-test) with a significance threshold set at alpha = 0.05. The degree of heterogeneity was also measured and interpreted using the I^2 statistic in accordance with recommendations from the Cochrane Handbook for Systematic Reviews of Interventions. The I^2 statistic indicates the percentage of total variation across studies attributable to heterogeneity rather than chance (Higgins & Green, 2020). Based on the degree of heterogeneity, the pooled results were reported, discussed, and generalized according to their significance level. Studies that were not included in the meta-analysis were still incorporated into the systematic review to avoid potential misinterpretations by readers. The final effect sizes were calculated and reported with appropriate confidence intervals (CI). This method is suitable for estimating effect sizes from studies with varying outcome measurement contexts.

FINDING AND DISCUSSION

Study Selection Process

Figure 1 illustrates that from the four databases used, a total of 1,147 articles were initially identified. After screening for duplicates and publication year, 785 articles were excluded. Subsequently, title and abstract screening led to the exclusion of 288 articles for the following reasons: 48 articles were published

in languages other than English or Indonesian, 226 articles were not available in full text, and 14 articles employed a "Review" study design. A total of 74 full-text articles were then assessed for eligibility, resulting in the exclusion of 64 articles that did not align with the research topic. Ultimately, 10 articles were included and synthesized in this study.
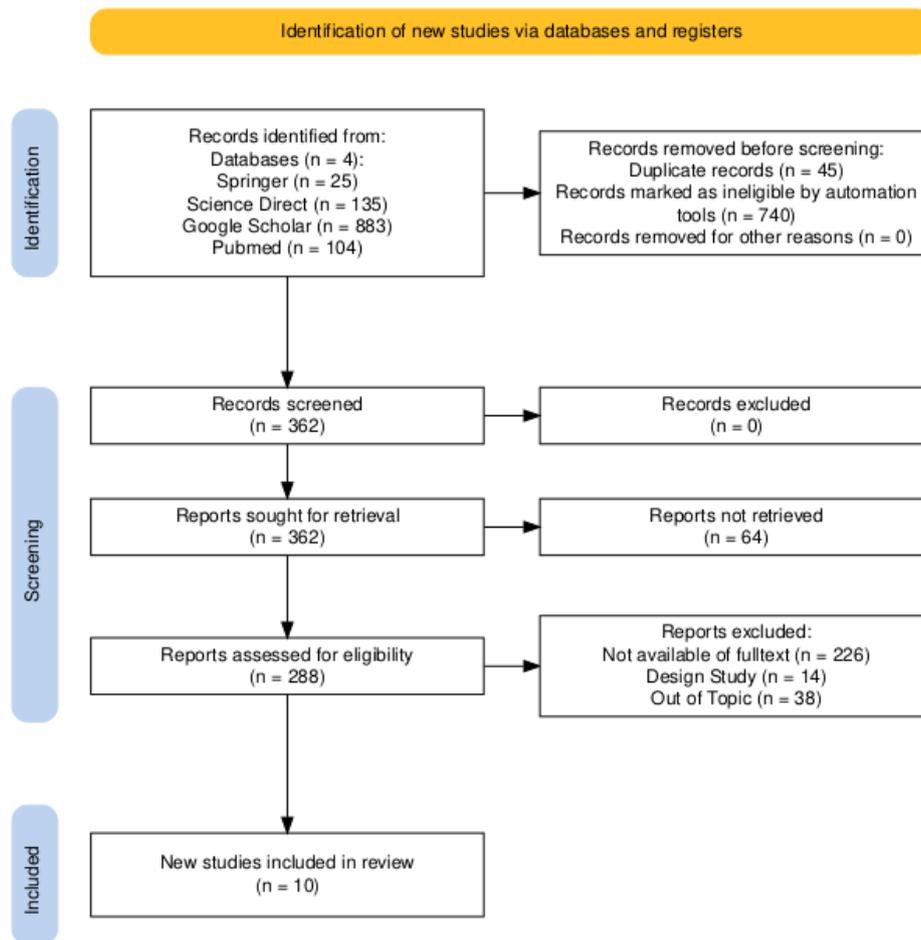

Figure 1. PRISMA Chart of Selection Process

Quality of Individual Study

Table 2 shows that all synthesized articles were assessed using the JBI critical appraisal tool, with 8 articles (80%) rated as good quality and 2 articles (20%) rated as moderate quality.

Table 2. JBI Article Appraisal

Author(s) and Year	JBI Appraisal
Heryadi et al. (2024)	**Moderate:** (phenomenological design, small sample size limitation, high subjectivity)
Seran et al. (2024)	**Good** (cross-sectional design, but limited generalizability)
Dewi & Kanita (2022)	**Good** (quantitative study with clear instrument validation)
Rahmawati et al. (2023)	**Good**, but limited by cross-sectional design
Araujo et al. (2022)	**Good**: prospective cohort intervention design with good control; limited generalizability (single setting)
Alaryani et al. (2021)	**Good**: large-sample cross-sectional; valid instruments; limited causal inference
Chik et al. (2023)	**Good**: clear methodology; limitation in representation (only private hospitals)
Sadeghi et al. (2025)	**Moderate**: analytical survey, good reliability; self-report bias and no inferential analysis
Amoako-Mensah et al. (2023)	**Good**: exploratory methodology consistent with JBI; limited by small sample size and local context
Tomas & Kachekele (2023)	**Good**: cross-sectional with quantitative analysis; limitations in non-causal design and single-site setting

Meta Analysis

Result of Individual Studies

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Table 3 presented across various countries including Indonesia, Brazil, Saudi Arabia, Malaysia, Iran, Ghana, and Namibia consistently highlight the critical role of knowledge, training, experience, and self-efficacy in the competence and performance of nurses regarding CPR skills. Multiple Indonesian studies emphasize significant correlations between nurses' CPR knowledge, situational awareness, work experience, and training with improved self-efficacy and skill levels. Similar findings from Brazil, Saudi Arabia, Malaysia, and Namibia reinforce that retraining, education, and confidence significantly enhance CPR abilities. Barriers identified include limited facilities, insufficient training, staff shortages, and psychological factors affecting performance, as noted particularly in studies from Iran and Ghana. Overall, the evidence underscores the importance of continuous education, practical experience, and supportive environments to optimize CPR outcomes among nursing professionals.

Table 3. Result of Individual Studies

Author(s) and Year	Country	Population	Sample Size	Outcomes
Heryadi et al. (2024)	Indonesia	Cardiac arrest patients	7 patients	Nurses face challenges in managing cardiac arrest referrals, such as golden period delays, limited facilities, and insufficient CPR knowledge.
Seran et al. (2024)	Indonesia	Emergency Department (ED) nurses	37 nurses	Significant relationship between knowledge, experience, training, and CPR skills ($p < 0.05$).
Dewi & Kanita (2022)	Indonesia	ED nurses at Dr. Moewardi Hospital	51 nurses	Strong correlation between situational awareness and CPR self-efficacy ($p < 0.001$).
Rahmawati et al. (2023)	Indonesia	ED & ICU nurses at RSUD Abu Bakar	35 nurses	Significant relationship between BMI, knowledge, work experience, training, and CPR skills ($p < 0.05$).
Araujo et al. (2022)	Brazil	Nurses	56 nurses	CPR knowledge and skills improved after retraining. Key factor: retraining ($p < 0.05$).
Alaryani et al. (2021)	Saudi Arabia	Nurses at King Abdul Aziz Hospital	287 nurses	Positive correlation between knowledge and self-efficacy. Influencing factors: knowledge, education, retraining, experience, confidence ($p < 0.01$).
Chik et al. (2023)	Malaysia	Registered nurses	143 nurses	Knowledge correlated with sociodemographics; CPR skills not significantly related. Factors: training, specialization, work experience ($p < 0.05$ for some variables).
Sadeghi et al. (2025)	Iran	ED nurses	198 nurses	CPR barriers: individual/team factors, lack of training, shortage of competent staff. Factors: training, competency, education (descriptive, no p-value).
Amoako-Mensah et al. (2023)	Ghana	Nurses from NMC Ghana	13 nurses	Psychological, environmental, perceptual, and behavioral factors influence CPR performance; emotional impact significant (qualitative, no p-value).
Tomas & Kachekele (2023)	Namibia	Registered nurses at a teaching hospital	158 nurses	Significant correlation between CPR ability and competence, years of service, and experience ($p < 0.05$).

Factors of Influencing Nurses' Skills in Managing Resuscitation

Based on Figure 2, the combined analysis of the 10 studies that met the criteria shows considerable variability in the results. Among all studies, only Dewi & Kanita (2022) reported a significant effect with a 95% confidence interval that did not cross the null line (Estimate = 0.6838; 95% CI 0.4009–0.9667). The other studies showed relatively small effect estimates with confidence intervals crossing zero, indicating that while individual relationships were significant, the effect sizes were relatively low. Overall, the pooled meta-analysis estimate was 0.0665 (95% CI -0.0464 to 0.1794). Since the confidence interval nearly crosses zero, these results suggest that the factors reviewed—such as knowledge, training, work experience, situational awareness, and other variables—have a very small influence on nurses' CPR skills. This outcome is likely due to several factors, one of which is the high level of heterogeneity among the studies.
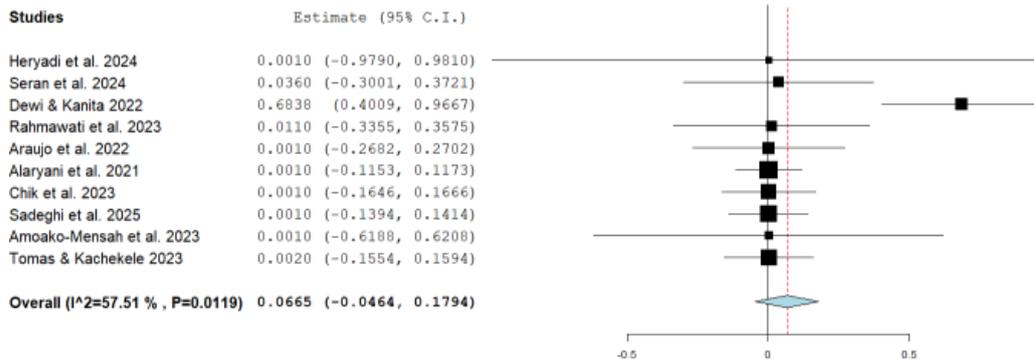

Figure 2. Forest Plot of Factor influencing Nurses doing CPR

Table 4 illustrates that the most influential indicator in this study is the research conducted by Alaryani (2021), which is supported by the fact that it used the largest sample size compared to the others and has a narrow confidence interval (CI) of 0.23.

Table 4. Weight of factor influencing Nurses Skills in Managing Resuscitation

Author(s), Year	Weight
Heryadi et al. (2024)	1.25%
Seran et al. (2024)	7.36%
Dewi & Kanita (2022)	9.09%
Rahmawati et al. (2023)	7.07%
Araujo et al. (2022)	9.60%
Alaryani et al. (2021)	17.28%
Chik et al. (2023)	14.54%
Sadeghi et al. (2025)	15.95%
Amoako-Mensah et al. (2023)	2.87%
Tomas & Kachekele (2023)	14.99%
	100.00%

Heterogeneity and Subgroup Analysis

Figure 3 illustrated subgroup analysis indicated that work experience was not significantly associated with CPR skills (pooled estimate 0.053; 95% CI -0.034 to 0.141; I^2 = 14.98%, p = 0.319), whereas training demonstrated a larger positive effect direction, though still not statistically significant (pooled estimate 0.237; 95% CI -0.116 to 0.589) with very high heterogeneity (I^2 = 91.92%, p < 0.001). Overall, the combined estimate across all factors was 0.133 (95% CI -0.024 to 0.291) with substantial heterogeneity (I^2 = 83.56%, p < 0.001), indicating that conclusions should be drawn cautiously. These findings suggest that work experience was relatively consistent across studies but yielded a small and nonsignificant effect, likely because experience without updated knowledge or structured training may be insufficient to improve CPR skills. In contrast, training appeared to have a greater impact; however, the high heterogeneity reflects variability in the types of training (e.g., formal courses, retraining sessions, or brief workshops), methods of skill evaluation, and differences in hospital settings. This underscores the importance of standardizing both training programs and CPR skill assessment tools to generate more consistent and generalizable evidence.
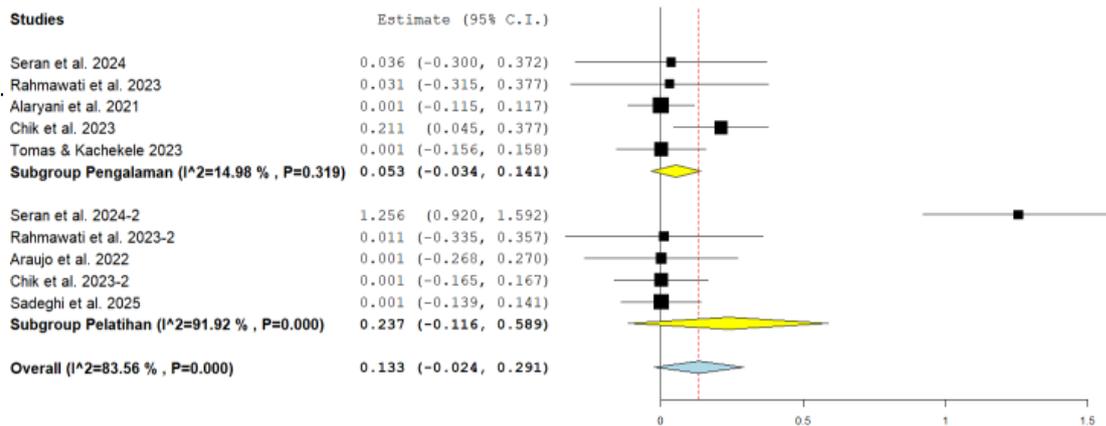
Figure 3. Subgroup analysis based on experiences and training of Factor Among Nurses doing CPR

Bias Publication

Figure 4 illustrates the results of the publication bias analysis, showing that the majority of included studies reported significant results (p < 0.05), while only a few did not present effect sizes or reported non-significant outcomes. The funnel plot demonstrates asymmetry, likely due to substantial heterogeneity and the predominance of studies indicating a positive effect of training, knowledge, and experience on CPR skills. This suggests that the pooled effect estimate in the meta-analysis may be slightly inflated due to the presence of publication bias.
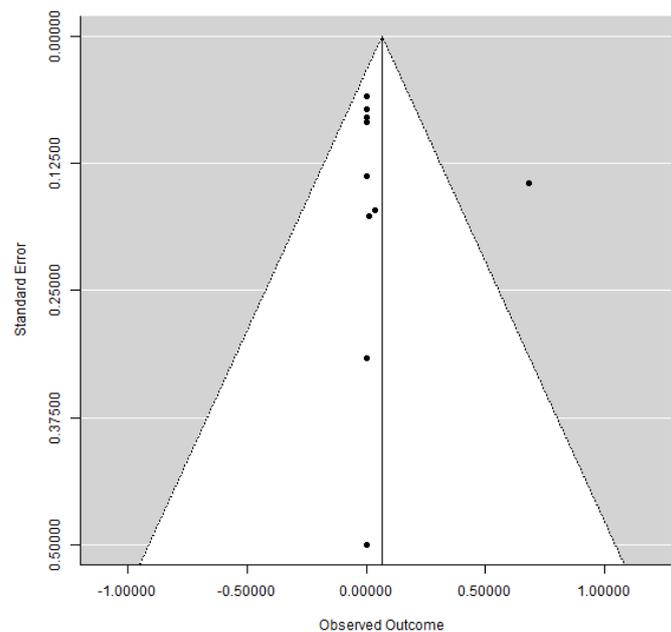
Figure 4. Funnel Plot of Bias Publication

DISCUSSION

Sociodemographic of Individual Studies

Table 3 illustrates these studies from Indonesia (Dewi & Kanita, 2022; Heryadi et al., 2024; Rahmawati et al., 2023; Seran et al., 2024) primarily focus on nurses in emergency departments (ED) and intensive care units (ICU), revealing that knowledge, work experience, training, and situational awareness significantly influence CPR skills. Challenges such as limited facilities and understanding of the golden period were also identified as barriers (Heryadi et al., 2024). In Brazil, Araujo et al., (2022) emphasized the importance of retraining to enhance CPR competence. Alaryani et al., (2021) in Saudi Arabia found correlations between knowledge, education, and self-efficacy, reinforcing the urgency of continuous training. Chik et al., (2023) in Malaysia reported that sociodemographic factors such as specialization and work experience affect CPR knowledge but do not directly influence skills. Sadeghi et al., (2025) in Iran identified structural barriers,

including lack of training and competent personnel. Meanwhile, studies in Ghana and Namibia (Amoako-Mensah et al., 2023; Tomas & Kachekele, 2023) highlighted the influence of psychological factors, experience, tenure, and emotional impact on CPR skills.

Correlation between Nurses' Skills in Managing Resuscitation and Training

Figure 5 illustrates a small effect between nurses' skills in managing resuscitation patients and training. Training can enhance nurses' competencies, deepen their understanding, and improve their soft skills, thereby increasing their readiness to manage in-hospital cardiac arrest (IHCA) patients (Lubis, 2023). (Rahmawati et al., 2023) reported a correlation between Basic Life Support (BLS) training and nurses' skills in handling cardiac arrest patients. CPR skills should not be limited to critical care nurses alone; rather, all nurses are required to be competent in providing basic life support. Consequently, BLS certification is mandated for nurses as a prerequisite (Chik et al., 2023).
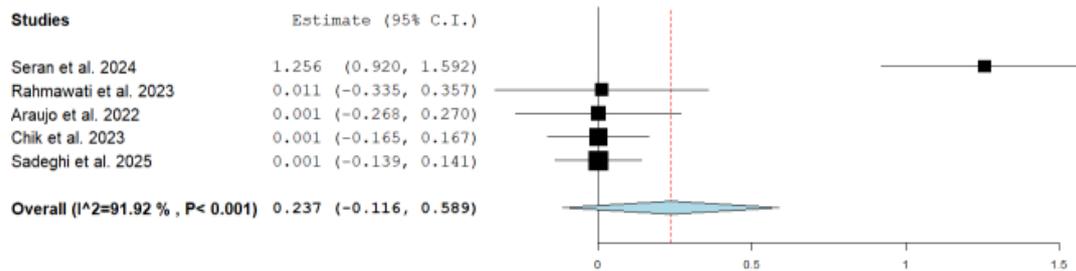

Figure 5. Plot of effect size between Nurses' Skills in Managing Resuscitation and Training

Correlation between Nurses' Skills in Managing Resuscitation and Work Experiences

Figure 6 illustrates a small effect between nurses' skills in managing resuscitation patients and their work experience. Nurses' work experience can influence their resuscitation skills, especially for those working in the ICU or Emergency Department (ED), as they more frequently encounter in-hospital cardiac arrest (IHCA) patients and thus perform CPR more often throughout their careers. This repeated exposure naturally enhances their skills over time (Chik et al., 2023). Similarly, (Rahmawati et al., 2023) found a significant relationship between work experience and nurses' CPR skills. Experience gained in the ED and ICU allows nurses to become familiar with the CPR algorithms, thereby improving their proficiency in performing resuscitation.
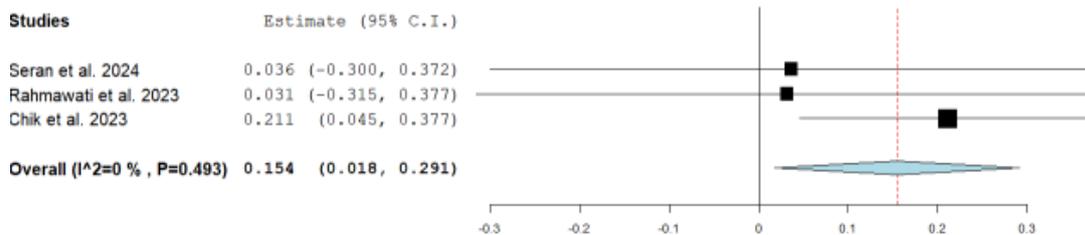

Figure 6. Plot of Effect size between Nurses' Skills in Managing Resuscitation and work experience

Correlation between Nurses' Skills in Managing Resuscitation and Area Specialization

Figure 7 illustrates a small effect between nurses' skills in managing resuscitation patients and their area of work specialization. Work areas such as the Emergency Department (ED) and Intensive Care Unit (ICU) can influence nurses' abilities in handling in-hospital cardiac arrest (IHCA) patients. This is because nurses working in the ED and ICU encounter cardiac arrest cases more frequently, requiring them to possess more advanced life support skills. ICU nurses have a fivefold higher likelihood than ward nurses to encounter IHCA patients, which results in higher qualifications in knowledge and skills compared to ward nurses (Chik et al., 2023). There is a significant correlation between work specialization and nurses' CPR skills. Nurses working daily in the ICU or ED regularly face cardiac arrest patients and often undergo advanced training, such as Advanced Life Support (ALS), enhancing their competency in managing cardiac arrest cases. Furthermore, the competencies of nurses in critical wards also develop through experience. Initially, ward nurses may perform resuscitation adequately, but over time, through observation and increased frequency of performing CPR—especially when compared to ICU nurses—their competencies improve significantly (Mensah et al., 2023).
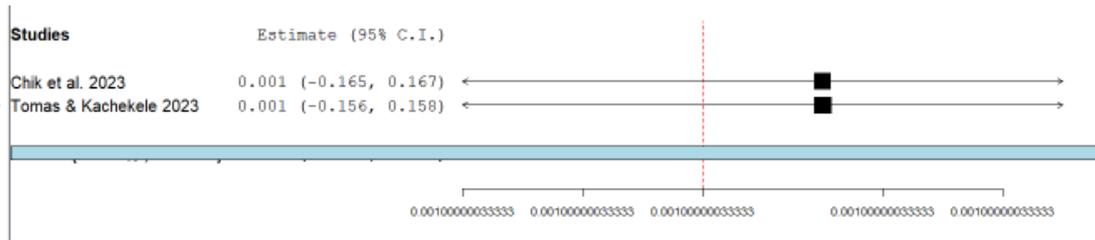
Figure 7. Plot of effect size between Nurses' Skills in Managing Resuscitation and Area Specialization

Correlation between Nurses' Skills in Managing Resuscitation, Educational Knowledge, and Competency Levels

Figure 8 illustrates a small effect between nurses' skills in managing resuscitation and their educational level, knowledge, and overall competence. According to Bandura's theory, individuals with higher education are more likely to engage in learning and problem-solving, which enhances their clinical skills. Nurses with higher education levels tend to demonstrate better clinical competencies, particularly in performing CPR correctly. These competencies, in turn, contribute to greater self-confidence when managing resuscitation cases (Muthmainnah & Firman, Maulani, 2023).

High competence is influenced by various factors, one of which is a higher level of education. Individuals with advanced education are generally better equipped to perform complex tasks, including those required in emergency care. In the context of nursing, a higher level of education is correlated with increased knowledge, skills, and capabilities. This aligns with the understanding that improved education can enhance self-efficacy, particularly in performing cardiopulmonary resuscitation (CPR) (Dewi & Kanita, 2022).

A higher educational background can also improve a nurse's knowledge, which in turn influences their CPR skills. Nurses must understand both the theory and practice of managing cardiac arrest cases, which often requires formal training such as Basic Life Support (BLS) and Advanced Life Support (ALS). Nurses with strong theoretical foundations and hands-on experience are more capable of handling cardiac arrest situations effectively. Moreover, frequent exposure to such cases helps reinforce knowledge and skills over time (Chik et al., 2023).

This is consistent with Seran et al., (2024), who reported a significant correlation between nurses' knowledge levels and the implementation of the Code Blue system. When the Code Blue protocol is effectively applied, it contributes to high-quality CPR performance and increases the likelihood of Return of Spontaneous Circulation (ROSC). In conclusion, education and knowledge play a critical role in enhancing nurses' competencies, especially in the execution of CPR procedures.
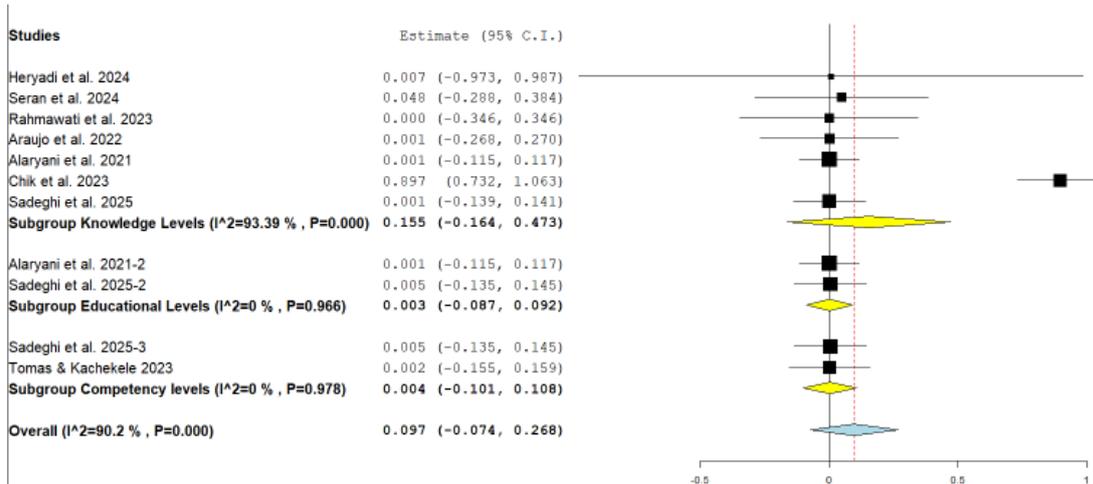

Figure 8. Plot of effect size between Nurses' Skills in Managing Resuscitation, Educational Knowledge, and Competency Levels

Correlation between Nurses' Skills in Managing Resuscitation and Self-Efficacy

Figure 9 demonstrates a small but notable association between nurses' resuscitation skills and their level of self-efficacy. High self-efficacy enhances motivation, decision-making, and the ability to manage stress in emergency situations such as cardiac arrest. Nurses with strong self-efficacy tend to remain calm

and solution-focused, thereby facilitating timely intervention and potentially reducing patient mortality (Bandura, 1997; Juniana & Subandi, 2022). Another important psychological factor is situational awareness. Dewi and Kanita (2022) found that during critical events, situational awareness increases and directly reinforces self-efficacy. The interplay between these two factors encourages prompt and effective action in high-pressure clinical settings.

Psychologically, self-efficacy and situational awareness influence nurses' social behavior within healthcare teams. Nurses with high self-efficacy are more proactive, more confident in assuming leadership roles, and more effective in team communication during CPR. This aligns with social cognitive theory, which posits that professional behavior is shaped by the interaction between individual cognition and the social environment (Bandura, 2001; Gist & Mitchell, 1992). Therefore, psychological readiness is not solely an individual trait but is also influenced by team dynamics and organizational culture (Endsley, 1995).
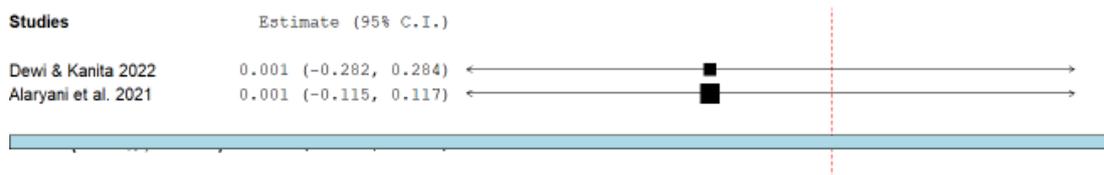

Figure 9. Plot of effect size between Nurses' Skills in Managing Resuscitation and Self-Efficacy

Correlation between Nurses' Skills in Managing Resuscitation and Retraining

Figure 10 illustrates a small effect between nurses' skills in managing resuscitation and the role of retraining. Retraining can positively influence nurses' confidence in performing resuscitation procedures and serves as a method for updating and refining techniques to improve effectiveness in managing emergency situations that require CPR (Araujo et al., 2022). Without regular retraining, nurses' resuscitation skills tend to decline over time. This finding aligns with Nicolau et al., (2024), who reported a decrease in nurses' CPR performance, particularly in chest compression accuracy—such as incorrect depth and improper hand placement. This deterioration was attributed to the lack of post-training feedback and the infrequent occurrence of cardiac arrest cases in general ward settings. Retraining is therefore essential to maintain clinical competency and ensure high-quality resuscitation interventions in emergency care.
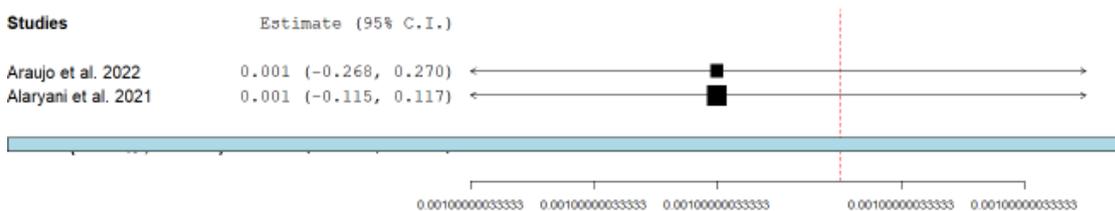

Figure 10. Plot of effect size between Nurses' Skills in Managing Resuscitation and Retraining

Correlation between Nurses' Skills in Managing Resuscitation and Work Environment

Figure 11 illustrates that the effect size of the work environment falls within the moderate category (CI = 0.478). The work environment is a critical factor in supporting nurses during resuscitation efforts. Inadequate environments and facilities can directly contribute to mortality in cardiac arrest patients. For instance, the unavailability—or disorganized placement—of essential drugs such as cardiac stimulants and stabilizers may delay urgent interventions (Sadeghi et al., 2025). Although these medications may be available, poor organization can hinder rapid access, which is crucial in emergency situations.

Additionally, equipment failures such as malfunctioning monitor electrodes can obstruct timely resuscitative actions, further increasing the risk of patient mortality (Amoako-Mensah et al., 2023). Medical facilities and equipment play a vital role in supporting nurses to perform life-saving procedures. (Tsima et al., 2019) emphasize that inadequate infrastructure and equipment in managing in-hospital cardiac arrest (IHCA) can lead to negative outcomes, including death. Emergency trolleys, which are expected to contain essential ABCDE tools and medications, must be well-managed and organized. Failure to do so can significantly impair emergency care delivery, particularly in cases involving cardiac arrest.
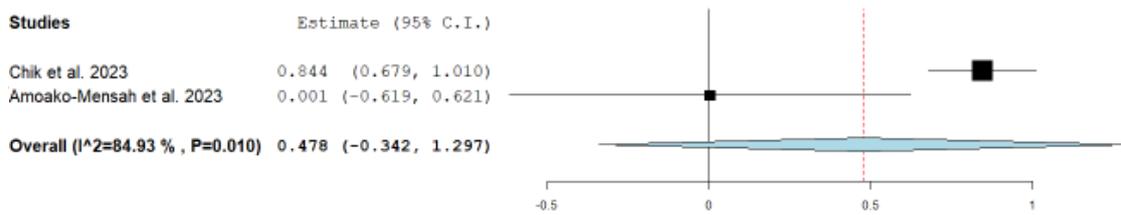
Figure 11. Plot of Correlation between Nurses' Skills in Managing Resuscitation and Work Environtment

Correlation between Nurses' Skills in Managing Resuscitation Length of Services and BMI

Figure 12 illustrates that the effect size for length of service falls in Tomas study within the moderate category (CI = 0.692). Length of service is associated with increased exposure to clinical experiences, which can enhance nurses' competence and skills in managing cardiac arrest cases. According to (Hutabarat, 2022), the longer a nurse has worked, the more opportunities they have had to encounter critical cases, thereby improving their proficiency in performing CPR. This is supported by findings from Tomas & Kachekele, (2023), who noted that nurses with longer work experience tend to develop accurate and high-quality CPR techniques over time. Although their initial performance may lack precision, continued practice and repeated exposure allow them to build familiarity and confidence, ultimately improving their resuscitation skills in emergency situations.
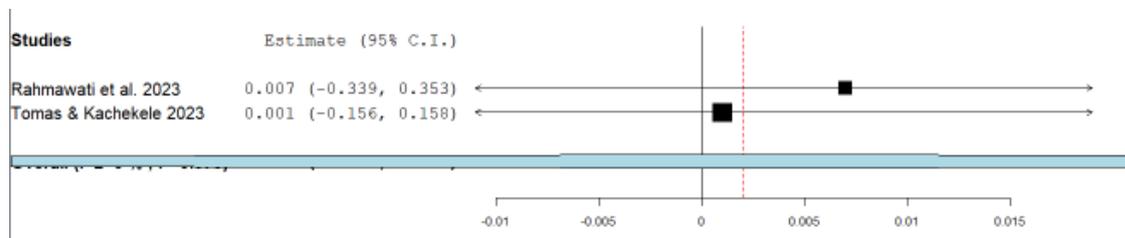

Figure 12. Plot of effect size between Nurses' Skills in Managing Resuscitation, Length of services, and BMI

Figure 12 illustrates that the effect size of Body Mass Index (BMI) on nurses' CPR skills falls in Rahmawati's Study within the small category (CI = 0.308). BMI is commonly used to assess nutritional status, but in this context, it is associated with physical capability during CPR performance. Nurses with higher BMI may possess greater physical strength, which could contribute to improved stamina and effectiveness when performing chest compressions (Rahmawati et al., 2023). According to (Ristanto, 2023), there is a positive correlation between BMI and CPR quality, indicating that nurses with higher BMI tend to perform higher-quality resuscitation. Ristanto also states that individuals with a healthy BMI generally possess better endurance due to stronger heart and respiratory functions, as well as improved performance of the CPR. This is further supported by Rahmawati et al., (2023), who reported a significant correlation between BMI and CPR skills among nurses managing critically ill patients at Drs. H. Abu Hanifah General Hospital. The study reported a prevalence odds ratio (POR) of 1.923 (95% CI = 1.320–2.803), suggesting that nurses with normal BMI were 1.9 times more likely to be less skilled in performing CPR compared to those who were overweight. This may be attributed to the fact that higher BMI is associated with greater ease in achieving the recommended chest compression depth of 5–6 cm, a critical factor in the effectiveness of CPR.

Correlation between Nurses' Skills in Managing Resuscitation and Gender

Figure 13 illustrates that the effect size of gender on nurses' CPR skills falls within the small category. Data analysis by Rahmawati et al., (2023) indicated that gender does not have a significant correlation with CPR skills. Both male and female nurses have equal opportunities and frequency in handling resuscitation cases, particularly in ICU settings, where regular exposure enhances confidence and knowledge. This supports the theory that frequent CPR practice leads to better skill retention and improved patient outcomes (Chik et al., 2023; Rahmawati et al., 2023). Although gender is often assumed to influence CPR performance—typically favoring males due to greater physical strength—findings are mixed. Heydari et al., (2021) and (Rupérez, (2024) reported that male nurses tend to perform chest compressions more effectively, likely due to greater muscle mass and body surface area, enabling higher compression rates (up to 200 times in two minutes). However, Rahmawati et al., (2023) found no such disparity, emphasizing that both genders demonstrate comparable CPR skills when given equal exposure and practice opportunities.
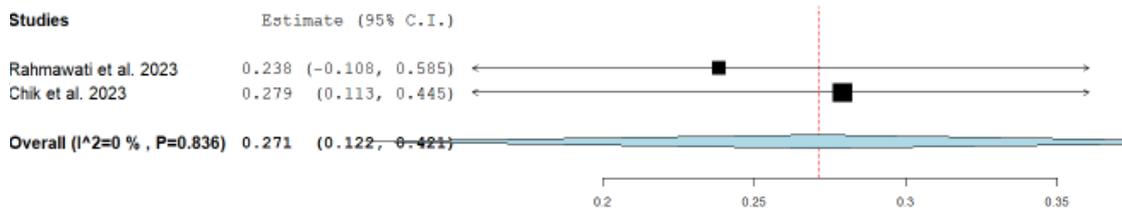
Figure 13. Plot of effect size between Nurses' Skills in Managing Resuscitation and Gender

Strengthen and limitations

This review's main strength lies in its use of a systematic review and meta-analysis approach, integrating evidence across diverse countries and clinical settings to provide a comprehensive overview of factors influencing nurses' CPR skills. The study selection process adhered to PRISMA guidelines, and methodological quality was assessed using the JBI appraisal tools, enhancing the overall validity. The inclusion of a wide range of influencing factors—such as training, work experience, clinical specialization, education, knowledge, situational awareness, and work environment—further enriches the understanding of determinants of CPR competency. However, this study also has limitations. High heterogeneity across included studies—regarding study design, outcome measurement methods, and clinical contexts—complicates the interpretation of pooled results. Several studies used cross-sectional designs, limiting the ability to establish causal relationships. Additionally, some articles did not report effect sizes in detail (e.g., providing only p-values), which restricted their inclusion in the meta-analysis. Publication bias was also identified, as studies with significant findings were more likely to be published, potentially inflating the estimated effect sizes.

Clinical Implications

The findings of this study indicate that work experience alone is insufficient to ensure nurses' proficiency in performing CPR; it must be supported by structured and repeated training (retraining). This underscores the necessity for hospital policies to implement regular CPR training programs that adhere to international standards, such as the American Heart Association (AHA) guidelines. These programs should employ objective-based evaluations, such as Objective Structured Clinical Examinations (OSCE) or manikin feedback, and ensure that all nurses working in Emergency Departments (ED) and Intensive Care Units (ICU) receive equal opportunities for skills refreshment. Another important implication is the need to pay attention to the work environment and the availability of adequate resuscitation facilities to enable timely and effective CPR interventions. Consequently, these findings can serve as a foundation for hospital management and healthcare regulators to improve the quality of emergency care services.

CONCLUSION

The results of this systematic review and meta-analysis indicate that nurses' skills in performing cardiopulmonary resuscitation (CPR) are influenced by various factors, including training, work experience, area of specialization, education, knowledge, situational awareness, work environment, and body mass index. However, the combined meta-analysis estimates reveal a relatively small and non-significant effect, accompanied by high heterogeneity among the studies. Work experience alone is insufficient to guarantee CPR proficiency; it must be supported by structured and repeated training and retraining. Therefore, interventions such as regular CPR training programs based on international standards, along with the provision of adequate resuscitation facilities, are essential to enhance nurses' competencies and improve the quality of emergency care services.

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