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REVIEW ARTICLE

Resuscitation Success and Survival to Hospital Discharge Following In-Hospital Cardiopulmonary Resuscitation in Iran: A Systematic Review and Meta-Analysis

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Abstract: **Introduction:** Cardiopulmonary Resuscitation (CPR) is a critical emergency procedure that needs to be promptly administered to prevent irreversible damage and enhance the chances of survival. This systematic review and meta-analysis aimed to determine the success rate of CPR and the rate of survival to hospital discharge among patients who underwent CPR in hospitals throughout Iran. **Methods:** This study followed the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines, and the protocol was registered in International Prospective Register of Systematic Reviews (PROSPERO) (CRD420251185276). A comprehensive search was conducted without time restriction until July 2026 in PubMed, Scopus, Web of Science, Google Scholar, SID, and Magiran databases. A random-effects model was used for meta-analysis, and heterogeneity was assessed using the I^2 index. Publication bias was evaluated using Begg's test. Data analysis was performed using STATA software (version 14). **Results:** Initially, 903 records were identified, and after removing duplicates and applying screening procedures, 47 studies met the inclusion criteria. The pooled analysis revealed that the rates of successful CPR, survival to discharge among successful CPR cases, and survival to discharge among all CPR attempts were 29.48% (95% confidence interval (CI): 25.04–33.92), 32.11% (95% CI: 24.00–40.21; I^2=95.7%), and 8.63% (95% CI: 6.72–10.53), respectively. Meta-regression indicated an increasing trend over time for successful CPR, a decreasing trend for survival to discharge among cases with Return of Spontaneous Circulation (ROSC), and a significant increase in overall survival to discharge. **Conclusion:** This systematic review highlights that while the initial quality of CPR in Iran is generally satisfactory, there is a notable gap between successful resuscitation and survival to hospital discharge, primarily attributed to limitations in post-resuscitation care. Enhancing post-CPR management, expanding ICU capacity, improving team coordination, and standardizing equipment could significantly impact patient outcomes.

Keywords: Cardiopulmonary resuscitation; Survival rate; Patient discharge; Meta-analysis; Systematic review; Iran

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1. Introduction

Cardiopulmonary Resuscitation (CPR) is a crucial emergency procedure used in various critical situations, such as respiratory arrest, life-threatening arrhythmias, shock, and acute circulatory failure (1). Administering CPR promptly, especially within the "golden time" (the first 4 to 6 minutes after the incident), can prevent irreversible brain damage and significantly improve survival rates (2). One of the key measures to evaluate the effectiveness of CPR is the Return of

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Spontaneous Circulation (ROSC), which refers to the restoration of effective cardiac activity and independent circulation without the need for ongoing chest compressions or medications after resuscitation efforts (3). Globally, the ROSC rate among CPR recipients is approximately 20% to 30%. While ROSC signifies the initial success of resuscitation, it does not guarantee the patient's long-term survival (4, 5). Survival to hospital discharge is considered a reliable indicator of the final outcome of resuscitation, indicating that the patient has achieved stable circulation and completed in-hospital treatment, ultimately being discharged in a stable condition (6). Data from the American Heart Association (AHA) suggests that survival to discharge in in-hospital cardiac arrests (IHCA) is approximately 26% (7). More detailed information from registries like Get With The Guidelines shows ROSC rates of around 61.7% and survival to discharge of about 19% (8). Studies conducted in Iran also reveal varying rates of survival to hospital discharge across different populations, typically ranging from 5% to 20% (9).

Despite numerous studies being conducted in Iran on this subject, they have been carried out independently and primarily in single-center environments. Up to now, no systematic review or meta-analysis has gathered, combined, and assessed the existing evidence. Therefore, it is crucial to conduct the current study to address this research gap and offer a more precise and thorough understanding of CPR success rates in the country.

2. Methods

2.1. Study design and setting

The current systematic review and meta-analysis followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines(10). The study protocol was registered in the International Prospective Register of Systematic Reviews (PROSPERO) with the registration number CRD420251185276.

A comprehensive search was conducted across major international data resources, including PubMed, Scopus, Web of Science, and Google Scholar, as well as national Persian-language databases SID and Magiran, to identify relevant studies. Medical Subject Headings (MeSH) were utilized, keywords from related articles were reviewed, and experts in the field of CPR were consulted to ensure the completeness of search terms. Both English keywords and their Persian equivalents were used in the search process, and a tailored search strategy was developed for each database using validated keywords and appropriate Boolean operators (AND, OR, NOT). Searches were performed without time restrictions, and studies published until July 2026 were included in the analysis. An example of search strategies in different databases is listed in Table 1.

2.2. Inclusion criteria

2.2.1 PEO framework

P (Population): Patients who experienced cardiac arrest in-hospital in Iran and received CPR.

I/E (Intervention): Administration of CPR according to standard clinical protocols.

O (Outcomes): ROSC, survival to hospital discharge.

Inclusion criteria This systematic review and meta-analysis included studies that reported the prevalence of the primary outcomes related to in-hospital CPR. These outcomes included: ROSC or successful CPR; Survival to hospital discharge for patients experiencing cardiac or respiratory arrest in-hospital in Iran, reported based on either the number of successful CPR attempts or the total number of resuscitation attempts. The systematic review and meta-analysis excluded review articles; case reports; and letters to the editor.

2.3. Study selection

After completing the data resources search, all retrieved articles were imported into EndNote X7 to facilitate the management of search results. Duplicates were removed, and the titles and abstracts of the remaining studies were screened according to the eligibility criteria to identify potentially relevant articles. Subsequently, two independent reviewers (AS and HE), who were proficient in both English and Persian, carefully examined the full texts of all potentially eligible studies. Finally, studies that satisfied the inclusion criteria were chosen for inclusion in the systematic review and meta-analysis.

2.4. Quality assessment

During this phase, two reviewers conducted an independent evaluation of the methodological quality of the chosen studies. The Appraisal Tool for Cross-Sectional Studies (AXIS) was utilized for this purpose (11). The AXIS tool assigns a score between 0 and 20, with studies scoring 12 or above deemed to have adequate quality and thus eligible for inclusion in the meta-analysis.

2.5. Data extraction

Data extraction was conducted by two researchers separately. The extracted data included details about each study, such as the author's name, publication year, study location, total CPR attempts, successful CPRs, success rate, patient discharge rate based on successful CPRs, and hospital discharge rate based on total CPR patients. The collected data was recorded in a data extraction form and analyzed using the STATA statistical software.

2.6. Statistical analysis

Data on successful CPR rates, survival to hospital discharge based on successful CPR, survival to hospital discharge based on the total number of patients who received CPR, and sample size (total number of CPR attempts and number of successful CPRs) were collected from each study. The variance

for each study was determined using the binomial distribution. A weighted mean was calculated to combine the estimates of successful CPR, discharge based on successful CPR, and discharge based on the total number of CPR attempts across studies. Each study was weighted based on the inverse of its variance. A random-effects model was used for the meta-analysis. Heterogeneity among studies was assessed using the I^2 statistic, with values <25%, 25–50%, 50–75%, and >75% indicating no heterogeneity, moderate heterogeneity, substantial heterogeneity, and considerable heterogeneity, respectively (12). Publication bias was evaluated using Begg's test. Meta-regression was conducted to explore the relationship between successful CPR rate, survival to hospital discharge (based on successful CPR), survival to hospital discharge (based on total CPR attempts), and the year of study. All analyses were performed using STATA software (version 14).

3. Results

3.1. Characteristics of included studies

Initially, 903 records were retrieved from targeted information sources. After removing duplicates, 806 articles were screened based on titles and abstracts. 62 studies were selected for full-text assessment, and after a detailed review, 47 studies met the eligibility criteria and underwent quality appraisal. All 47 studies demonstrated acceptable methodological quality and were included in the meta-analysis (Figure 1). All included studies were observational in design. The studies included a total of 19,765 patients in Iranian hospitals who underwent CPR, with 5,628 patients experiencing successful resuscitation. Additional characteristics of the included studies are presented in Table 2.

3.2. Quality assessment

All included studies achieved an AXIS score greater than 12, indicating adequate methodological quality. The detailed quality assessment scores for each study are presented in Table 2.

3.3. Meta-analysis

Based on the meta-analysis findings, the pooled rate of successful CPR was 29.48% (95% confidence interval (CI): 25.04–33.92; I^2 = 98.4%). In addition, the pooled survival-to-discharge rate among patients who achieved successful CPR was 32.11% (95% CI: 24.00–40.21; I^2 = 95.7%). Furthermore, the pooled survival-to-discharge rate based on the total number of patients who underwent CPR was 8.63% (95% CI: 6.72–10.53) (Figures 2). The high I^2 values indicate considerable heterogeneity among the included studies.

3.4. Meta-regression

Meta-regression analysis findings revealed a rising trend in the success rate of CPR over time. Conversely, the survival-to-discharge rate, calculated based on the number of successful CPRs, displayed a declining trend. Moreover, the survival-to-discharge rate, determined by the total number of CPR attempts, showed a significant increase (Figure 3).

3.5. Publication bias

The Begg's test results did not show any statistically significant evidence of publication bias for the successful CPR rate (Begg's test: P = 0.949), survival-to-discharge rate using the number of successful CPRs (Begg's test: P = 0.267), or survival-to-discharge rate using the total number of CPR attempts (Begg's test: P = 0.42).

4. Discussion

The results of this systematic review and meta-analysis, which included 47 studies and nearly 20,000 patients, provide a comprehensive picture of CPR outcomes in Iran. According to the findings, the overall rate of successful CPR in the country is 29.48%, and the survival-to-discharge rate among patients who achieved ROSC is 32.11%, while survival to discharge based on all resuscitated patients is 8.63%. Comparison of these figures with global data shows that CPR outcomes in Iran are similar to global averages in some respects but weaker in others. For example, a global systematic review of out-of-hospital cardiac arrest (OHCA) reported a survival-to-discharge rate of approximately 8.8%, which is very close to Iran's estimate for all resuscitated patients. Moreover, the global mean ROSC rate (29.7%) is almost identical to that reported in Iran (29.48%) (4). Despite these similarities, international studies generally report slightly higher survival-to-discharge rates than those observed in Iran. According to the findings of Iranian studies, the final outcome of resuscitation depends not only on the technical quality of CPR but also on three major categories of determinants.

First, the structure and capacity of post-resuscitation care play a central role (13-15).

Second, adherence to international guideline recommendations particularly regarding the timing of CPR initiation, duration of resuscitation efforts, and the quality of interventions is critical. Several Iranian studies have demonstrated a substantial gap between real-world CPR performance and guideline-based standards (13-18). In this regard, the study by Bolandparvaz provides highly informative evidence that clearly illustrates this discrepancy. The study reported that resuscitation efforts extending beyond 30 minutes were almost never associated with survival to discharge; that the timing of CPR initiation, the time to first defibrillation shock, and the total duration of resuscitation were all significantly associated with survival; and that delayed access to a defibrillator or having the device located outside the immediate reach of the resuscitation team was one of the major contributors to poor outcomes. These findings align directly with the core principles emphasized by AHA guidelines, including immediate chest compressions, early defibrillation, and avoidance of prolonged, low-quality resuscitation (15).

The third group of contributing factors relates to patient

characteristics, including advanced age, comorbidities, and non-shockable initial rhythms (13, 14, 18-21). The interplay of these factors largely explains the considerable heterogeneity across studies as well as the relatively low survival-to-discharge rate in Iran compared with some other countries. Although the initial performance of CPR in Iran appears broadly comparable to global averages, the major challenges emerge in the post-resuscitation phase a stage that plays a decisive role in determining final outcomes. It is precisely at this point that structural shortcomings of the healthcare system become most influential, including shortages of skilled staff during evening and night shifts, delays in transferring patients to the ICU, and limited availability of advanced post-resuscitation monitoring and care. Findings from domestic studies support this interpretation. For example, Goodarzi and colleagues reported that CPR outcomes were significantly poorer during night shifts, likely due to differences in team expertise, experience, and operational efficiency across different times of the day (14).

The meta-regression results of this study showed that the rate of successful resuscitation (ROSC) in Iran has increased in recent years. A substantial part of this upward trend can be attributed to the gradual improvement in operational quality of CPR. Findings from more recent Iranian studies indicate a marked rise in the use of advanced assessment tools, such as point-of-care ultrasonography during resuscitation (POCUS/CASE), as reported in several domestic trials. For instance, studies by Bolvardi et al. (22), Masoumi et al. (23), and Seyed Hosseini et al. (24) demonstrated that the use of ultrasonography during CPR facilitates earlier recognition of shockable rhythms, detection of cardiac activity, and identification of reversible causes of arrest, ultimately increasing the likelihood of ROSC. In addition, some Iranian studies have reported shorter physician and resuscitation team response times in recent years. As noted by Ezzati et al. (16), reduced time to physician arrival at the patient's bedside is associated with improved ROSC outcomes. An increase in refresher training courses and greater adherence to AHA guideline-based education has also contributed to this trend. Compared with the early 2000s, studies such as those by Mansouri (25) and Montazer (26) suggest improvements in compression quality, familiarity with guidelines, and team coordination. Another factor that may explain the increasing ROSC trend is the enhancement of hospital rapid-response systems. Several academic centers in Iran have recently established Rapid Response Teams, implemented electronic early-warning systems, and standardized CPR documentation. Studies by Goodarzi et al. (14) and Nazarpour et al. (27) have indicated that strengthening early detection of clinical deterioration and improving response structures can increase the likelihood of successful resuscitation. Overall, domestic evidence suggests that the gradual expansion of intra-resuscitation diagnostic tools, faster team response, and improved training standards have significantly contributed to the increasing ROSC trend (27).

However, despite rising ROSC rates, survival to discharge among patients with ROSC has declined over time. This pattern likely reflects increasing systemic pressures on Iran's healthcare system in recent years. Studies conducted during the COVID-19 pandemic strongly support this interpretation. For example, Goodarzi et al. (13) reported that near-full ICU occupancy, staff fatigue and burnout, delays in CPR initiation due to PPE use, shortages of experienced staff, suboptimal shift rotation, and substantial system overload were all associated with significant reductions in survival to discharge—even among patients who initially achieved ROSC. This pattern is not unique to Iran and aligns with global evidence. A large US study reported a 34–40% decline in survival to discharge among IHCA patients during the pandemic (28) , while studies from Italy (29) and China (30) also documented severe reductions in survival even in cases with initial ROSC due to system strain, limited ICU capacity, and delayed team response. These global findings clearly demonstrate that deficiencies in post-resuscitation care under systemic stress exert the greatest impact on survival. Therefore, the declining trend in survival to discharge observed in the meta-regression is likely a reflection of these structural and organizational constraints in recent years, particularly during the pandemic. Regarding publication bias, although Begg's test in this study did not reveal statistically significant evidence of bias, qualitative analysis of publication patterns suggests that the risk of publication bias remains notable. CPR-related research in Iran is predominantly conducted in large academic hospitals and well-equipped teaching centers. Smaller hospitals, resource-limited facilities, or units with poorer CPR performance are less likely to publish their results or may not have the research capacity to conduct such studies. This publication pattern may lead to an overestimation of national ROSC and survival rates, as data disproportionately reflect higher-performing centers. Moreover, most studies included in this meta-analysis were retrospective, cross-sectional, and hospital-based, with primary focus on immediate outcomes such as ROSC. More definitive outcomes, such as survival to discharge, 30-day survival, or neurological results, were rarely reported.

Recent improvements in operational aspects of CPR in Iran, such as enhanced training programs and faster response times, have been noted. However, these advancements can only lead to improved survival rates if post-resuscitation care is also optimized. Issues such as limited ICU capacity, variable team performance, delays in patient transfer, and the lack of standardized monitoring systems are key barriers to achieving better outcomes (21, 22, 31). The decline in survival rates during periods of healthcare strain, like the COVID-19 pandemic, underscores the systemic nature of these challenges. To enhance CPR outcomes in Iran, it is crucial to focus on improving post-resuscitation care, expanding ICU capacity, strengthening rapid response teams, and standardizing essential processes and equipment. Establishing a national CPR registry, implementing guideline-based

retraining programs, and ensuring adequate staffing levels, especially during critical shifts, are essential steps to bridge the existing gap and enhance the quality of resuscitation services in Iran.

5. Limitations

While this study is the most comprehensive systematic review and meta-analysis on CPR outcomes in Iran, it is important to acknowledge several limitations when interpreting the results. Firstly, there was significant heterogeneity among the included studies due to differences in patient populations, resuscitation settings, illness severity, initial cardiac rhythms, and CPR quality. This heterogeneity could impact the pooled estimates and the generalizability of the findings. Secondly, many studies focused on immediate outcomes like ROSC, rather than more definitive endpoints such as survival to discharge, neurological outcomes, or long-term survival. This selective reporting raises concerns about potential publication bias, as studies with favorable immediate outcomes may be more likely to be published. Despite these limitations, this meta-analysis offers a valuable overview of CPR outcomes in Iran and can guide future efforts to enhance resuscitation quality and post-resuscitation care nationwide.

6. Conclusions

While the quality of initial CPR in Iran is generally satisfactory and comparable to global standards in terms of ROSC, there remains a significant disparity between successful resuscitation and survival to hospital discharge. This gap is primarily attributed to challenges in post-resuscitation care and structural limitations within the healthcare system.

7. Declarations

7.1. Acknowledgments

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7.2. Authors contributions

All authors contributed to the study design, data collection, and drafting of the manuscript. All authors critically revised the manuscript, read, and approved the final version.

7.3. Funding

This research has not received any funding.

7.4. Ethics approval and consent to participate

The present study was approved by the Ethics Committee of Shahid Beheshti University of Medical Sciences, Tehran, Iran (IR.SBMU.RIGLD.REC.1404.074).

7.5. Consent for publication

Not applicable.

7.6. Using artificial intelligence chatbots

No artificial intelligence (AI) chatbots were used in the study design, data analysis, or manuscript writing. Grammarly was used solely for English language editing.

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Table 1: Search strategies used in types of databases

Databases	Search strategy
PubMed (n = 83)	((“Cardio-Pulmonary Resuscitation” OR “Cardio Pulmonary Resuscitation” OR “Cardiopulmonary Resuscitation” OR CPR OR “Mouth-to-Mouth Resuscitation*” OR “Mouth to Mouth Resuscitation” OR “Code Blue” OR “Basic Cardiac Life Support” OR “Advanced Cardiac Life Support” OR “Cardiopulmonary-Cerebral Resuscitation” OR BLS OR ACLS OR resuscitation OR “Rescue Breathing” OR “Cardiac Arrest” OR “Life-saving Technique*” OR “In-Hospital Cardiac Arrest” OR IHCA OR “Chest Compression” OR “Cardiac Arrest” OR “Advanced Life Support” OR “Heart Arrest” OR “Basic Life Support”) AND (“Resuscitation Outcome” OR “Survival Rate” OR “Successful Resuscitation” OR “Neurological Outcome” OR “Long-term Survival” OR “Return of Spontaneous Circulation” OR ROSC OR “Post-Resuscitation Syndrome”) AND (IRAN))
SCOPUS (n=803)	(ALL(“Cardio-Pulmonary Resuscitation”) OR ALL(“Cardio Pulmonary Resuscitation”) OR ALL(“Cardiopulmonary Resuscitation”) OR ALL(CPR) OR ALL(“Mouth-to-Mouth Resuscitation*”) OR ALL(“Mouth to Mouth Resuscitation”) OR ALL(“Code Blue”) OR ALL(“Basic Cardiac Life Support”) OR ALL(“Advanced Cardiac Life Support”) OR ALL(“Cardiopulmonary-Cerebral Resuscitation”) OR ALL(BLS) OR ALL(ACLS) OR ALL(resuscitation) OR ALL(“Rescue Breathing”) OR ALL(“Cardiac Arrest”) OR ALL(“Life-saving Technique*”) OR ALL(“In-Hospital Cardiac Arrest”) OR ALL(IHCA) OR ALL(“Chest Compression”) OR ALL(“Cardiac Arrest”) OR ALL(“Advanced Life Support”) OR ALL(“Heart Arrest”) OR ALL(“Basic Life Support”)) AND (ALL(“Resuscitation Outcome”) OR ALL(“Survival Rate”) OR ALL(“Successful Resuscitation”) OR ALL(“Neurological Outcome”) OR ALL(“Long-term Survival”) OR ALL(“Return of Spontaneous Circulation”) OR ALL(ROSC) OR ALL(“Post-Resuscitation Syndrome”)) AND (ALL(IRAN))
WOS (n = 17)	(TS=(“Cardio-Pulmonary Resuscitation”) OR TS=(“Cardio Pulmonary Resuscitation”) OR TS=(“Cardiopulmonary Resuscitation”) OR TS=(CPR) OR TS=(“Mouth-to-Mouth Resuscitation*”) OR TS=(“Mouth to Mouth Resuscitation”) OR TS=(“Code Blue”) OR TS= (“Basic Cardiac Life Support”) OR TS=(“Advanced Cardiac Life Support”) OR TS= (“Cardiopulmonary-Cerebral Resuscitation”) OR TS=(BLS) OR TS= (ACLS) OR TS= (resuscitation) OR TS= (“Rescue Breathing”) OR TS=(“Cardiac Arrest”) OR TS=(“Life-saving Technique*”) OR TS=(“In-Hospital Cardiac Arrest”) OR TS=(IHCA) OR TS= (“Chest Compression”) OR TS= (“Cardiac Arrest”) OR TS= (“Advanced Life Support”) OR TS=(“Heart Arrest”) OR TS=(“Basic Life Support”)) AND (TS=(“Resuscitation Outcome”) OR TS=(“Survival Rate”) OR TS=(“Successful Resuscitation”) OR TS=(“Neurological Outcome”) OR TS=(“Long-term Survival”) OR TS=(“Return of Spontaneous Circulation”) OR TS=(ROSC) OR TS=(“Post-Resuscitation Syndrome”)) AND (TS=(IRAN))

WOS: web of science.

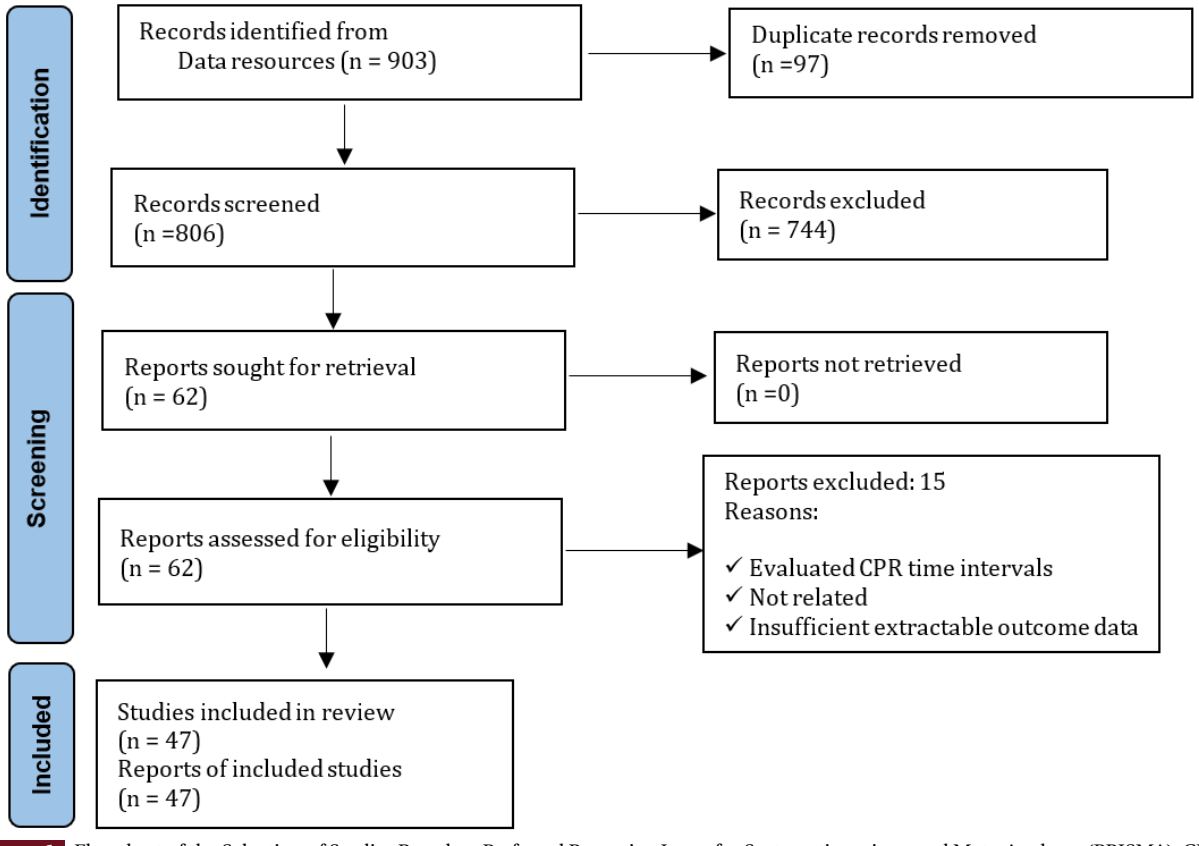

Figure 1: Flowchart of the Selection of Studies Based on Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA). CPR: Cardiopulmonary resuscitation.

Table 2: Characteristics of the studies included in the meta-analysis

First author	Year	Location	AXIS Score (0–20)	Sample (n)	Success rate N (%)	Discharge (%)	
						Of success cases	Total
Assar(18)	2016	Ahvaz	16	279	138 (49.4)	23.9	11.8
Alizadeh(17)	2016	Tehran	16	813	334 (41.1)	29.04	12.05
Bolandparvaz(32)	2009	Shiraz	17	600	271 (45.1)	6.6	3
Bolandparvaz(15)	2008	Shiraz	16	459	47 (10.6)	4.3	0.4
Hajbaghery(21)	2005	Kashan	17	206	41 (19.9)	26.8	5.3
Goodarzi(14)	2014	Kermanshah	17	320	49 (15.3)	69.4	10.6
Goodarzi(13)	2023	Kermanshah	17	1253	192 (15.3)	24.48	3.8
Goodarzi(31)	2021	Hamadan and Kermanshah	19	487	44 (9)	22.7	2%
Ghasemzadeh(33)	2018	Rasht	16	100	50 (50)	NR	NR
Gharib(34)	2024	Tehran	15	122	49 (40.2)	NR	NR
Ezzati(16)	2020	Kermanshah	15	143	39 (26.6)	NR	NR
Bolvardi(22)	2016	Mashhad	15	159	56 (35.2)	NR	NR
Safari(35)	2025	Tehran	18	614	184 (29.96)	NR	NR
Rahsepar(36)	2025	Tehran	15	149	96 (64.4)	37.5	24.2
Rafati(37)	2011	Tehran	15	2262	741 (32.8)	NR	NR
Nazarpour(19)	2022	Rasht	18	1565	667 (42.6)	22	9.4
Heydari(38)	2025	Isfahan	17	154	38 (24.7)	23.7	5.8
Mir Mohammad Sadeghi(39)	2021	Isfahan	18	142	41 (28.87)	NR	NR
Mehdizadeh(20)	2023	Tehran	15	1320	49 (3.7)	NR	NR
Masoumi(23)	2021	Isfahan	17	151	36 (23.8)	19.4	4.6
Montazer(26)	2014	Sari	15	307	78 (25.4)	80.8	20.5
Ziapour(40)	2023	Kermanshah	16	497	114 (22.9)	NR	NR
Jaberi(41)	2011	Zanjan	15	302	72 (23.8)	13.9	3.3
Mansouri(25)	2017	Isfahan	16	211	66 (31.7)	40.9	12.7
Norozi(27)	2023	Ilam	16	152	37 (24.3)	NR	NR
Seyedhosseini(24)	2023	Tehran	18	32	12 (37.5)	50	18.8
Omidi(42)	2018	bam	17	478	89 (18.6)	NR	NR
Nazri(43)	2018	Zahedan	15	199	73 (36.7)	11	4
Moghadamnia(44)	2022	Rasht	18	1008	351 (34.8)	NR	NR
Farzaneh(45)	2015	Ardabil	16	217	63 (29)	NR	NR
Arhami(46)	2017	Tehran	18	855	364 (42.58)	27.8	11.82
Tavakolian(47)	2021	Mashhad	18	394	96 (24.4)	NR	NR
Saghafinia(48)	2010	Tehran	18	290	95 (30.4)	36.8	12
Nekoofard(49)	2012	Tehran	15	185	32 (17.2)	NR	NR
Hajzargarbashi(50)	2019	Isfahan	15	190	55 (28.9)	18.2	5.3
Moezzi(51)	2020	Ahvaz	17	587	152 (25.89)	NR	NR
Azimi(52)	2010	Hamedan	17	372	126 (34)	32.5	11
Nasiripour(53)	2012	Alborz	17	588	188 (32)	NR	NR
Salari(54)	2010	Tehran	17	250	71 (28.4)	25.4	7.2
Sadeghi(55)	2022	Marvdasht	16	234	114 (48.7)	NR	NR
Dabbagh(56)	2010	Tehran	15	124	33 (26.6)	NR	NR
				54	7 (13)	NR	NR
Abrishami (57)	2007	Tehran	15	71	45 (63.4)	NR	NR
Barzigar(58)	2024	Rasht	16	77	11 (14.3)	NR	NR
Homayounfar(59)	2002	Hamedan	15	101	21 (20.8)	NR	NR
Keivanpazhoh(60)	2011	Urmia	17	74	28 (28.8)	35.7	13.5
Ahmed (61)	2025	Tehran	18	264	NR	NR	21.2
Haghighi(62)	2017	Tabriz	17	354	73 (21)	NR	NR

NR: Not Reported; AXIS: Appraisal Tool for Cross-Sectional Studies.

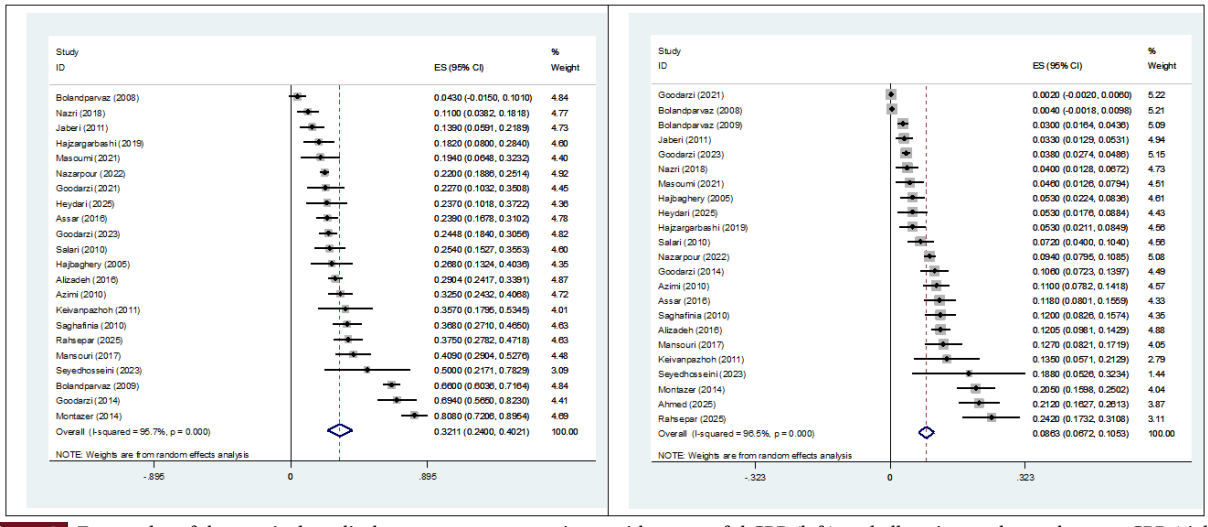

Figure 2: Forest plot of the survival-to-discharge rate among patients with successful CPR (left) and all patients who underwent CPR (right) in the included studies. Data are presented with 95% confidence intervals (CIs). CPR: Cardiopulmonary resuscitation; ES: effect size.

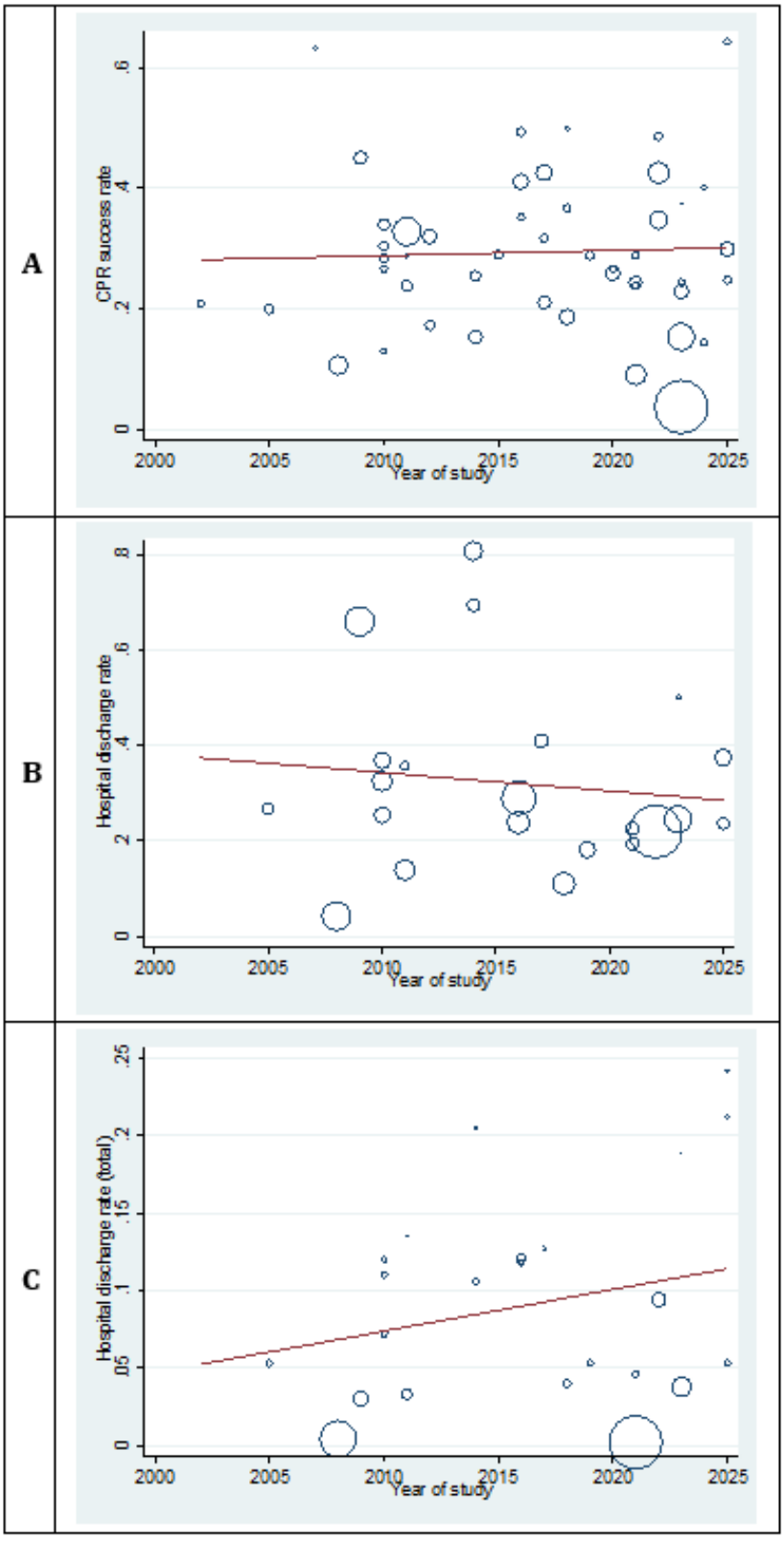

Figure 3: A: Meta-regression of the successful cardiopulmonary resuscitation (CPR) rate by year of study; B: Meta-regression of the survival-to-discharge rate based on successful CPR by year of study; C: Meta-regression of the survival-to-discharge rate based on the total number of CPR attempts by year of study.