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Prevalence and determinant of poor treatment outcome of poisoning in Ethiopia: systematic review and meta-analysis

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Abstract

Background Acute poisoning is a medical emergency that can be caused by exposure to significant levels of any chemical and has toxic consequences that typically manifest within hours of exposure, leading to significant morbidity and mortality.

Objectives This study aims to determine the pooled prevalence and determinant of poor treatment outcomes of poisoning in Ethiopia.

Methods The searches were conducted in electronic databases such as PubMed, MEDLINE, EMBASE, Science Direct, Web of Science, and Google Scholar. Original studies were selected and published until the end of December 2024, addressing the prevalence and determinant of poor treatment outcomes (death and disability) among patients. Endnote X-8 reference manager software was used to collect and organize the search outcomes and remove duplicate articles. Important data were extracted from the included studies using a format prepared in Microsoft Excel and exported to STATA 17.0 software for outcome measure analyses. The Higgins I^2 test statistics were used to examine heterogeneity, and a random-effects model was used to analyze the pooled prevalence and determinant of poor treatment outcomes.

Result Eleven research articles and 10,089 poisoned patients were included in the final analysis. This study finding showed that the pooled prevalence of poor treatment outcomes among poisoned patients was 16.13% (95% CI: 9.20, 23.05). This meta-analysis study revealed that patients living in rural areas (AOR: 2.79, 95% CI: 1.44, 5.42) and delayed time to arrival (AOR = 6.15, 95%CI: 2.46, 15.34) were determinant factors of poor treatment outcome for poisoned patients in hospitals.

Conclusion and recommendation This study findings stated that the pooled prevalence of poor treatment outcomes among patients was high. Patients living in rural areas and delayed time to arrival at health facilities were independent determinants of poor treatment outcomes.

Keywords Determinant factors, Ethiopia, Meta-analysis, Poor treatment outcome, Poisoning prevalence

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Introduction

Poisoning is a harmful condition that occurs when a toxic substance enters the body, causing damage to cells, tissues, or organs. Poisoning can be accidental or intentional and may occur through ingestion, inhalation, skin contact, or injection [1, 2]. Acute poisoning is a common reason for visits to emergency departments and hospitalizations worldwide, and it is a common cause of morbidity and mortality worldwide [3, 4]. The incidence of poisoning cases is increasing due to changes in the lifestyle and social behavior of humans [3, 5]. This human behavioral change and lifestyle occurred due to divorce, unmarried people, females, and poor socioeconomic status increasing the incidence of intentional acute poisoning [6].

Poisoning is a major public health issue worldwide. According to WHO estimates, in 2016, 6.3 million years of healthy living (disability-adjusted life years) were lost, and 106,683 fatalities were attributed to unintentional poisoning [7]. The issue is particularly prevalent and significantly worse in low- and middle-income countries (LMICs) because of loose regulations and weak healthcare systems [8]. Poisoning is one of the primary reasons people visit hospitals for emergency care in many nations [7].

In Africa, the prevalence of poisoning exposures is a serious public health issue. However, there were poison information centers in 10 out of 58 nations (17.2%). Given that poisoning instances are typically not well documented, it is challenging to get the precise number [9, 10]. The fact that only specific acute poisonings must be reported to the local or national department of health, poor mortality registration rates, and a lack of resources and expertise to diagnose poisoning are some of the causes [10, 11]. WHO estimates that in the African regions, unintentional poisoning causes 27,949,000 DALYs and 39,800 fatalities [12].

A study conducted in Ethiopia found that the majority of poisonings occurred in adults, with a death rate ranging from 2.4 to 8.6% [13]. In addition to this, the prevalence of poor treatment outcomes(death and disability) in acute poisoning was 17.6% [14] and 59.2% [15].

Previous studies were inconclusive, and the prevalence of poor treatment outcomes of acute poisoning varied across the country. Hence, this systematic review and meta-analysis study aimed to assess the pooled prevalence and determinants of poor treatment outcomes among poisoned adult patients in Ethiopia. This systematic review and meta-analysis will assist healthcare professionals, managers, policymakers, programmers, and planners in developing and applying case management and control approaches, as well as changing into practice appropriate measures and interventions, to decrease the incidence of avoidable poor treatment outcomes (death and disability) of poisoning in Ethiopia.

Methods

Review protocol

This systematic review and meta-analysis were based on the recommended methodology and followed the Preferred Reporting Items for Systematic Review and Meta-analysis (PRISMA) 2020 checklist, which was used for conducting and reporting this review [16]. PRISMA flow diagram was used to show the process of identification, screening for eligibility, and final inclusion (Fig. 1). It was registered with the International Prospective Register of Systematic Reviews (PROSPERO) (registration number: CRD420251004184).

Eligibility criteria

Original research articles reporting the poor clinical outcomes (death and disability) of poisoning conducted in Ethiopia and published in English until the end of December 2024 were included in this study. However, studies that didn't report poor treatment outcomes and missed poor treatment outcomes or vague studies results were excluded from this review. Review articles, case reports, case series, grey literature, and letters to editors were also excluded.

Data source and search strategy

Studies were searched using PubMed, MEDLINE, EMBASE, Science Direct, Web of Science, and Google Scholar until December 2024, following the PRISMA 2020 guidelines. Every publication was analyzed critically and considered for inclusion in this research. The search terms used were "poor treatment outcome", "disability", "death", "prevalence", "mortality", emergency department", "Epidemiology", acute poisoning", "poison", and "Ethiopia". These search strategies were developed using keywords Medical Subjects Headings (MeSH) and "AND" and "OR" Boolean operators.

Study selection

EndNote software version 8 was used to export the records that were obtained from various databases. Independent reviewers G.G.A., B.S.S., and A.A.C. initially reviewed the original papers found in the literature search based on their titles and abstracts before including them in the systematic review. Full-text review was available to research that cleared the abstract and title screening procedures. The full texts of the papers that qualified for inclusion in the final analysis were assessed by the independent reviewers, G.G.A., B.S.S., and A.A.C. The inclusion and exclusion criteria were used to resolve the dispute. Data include the author's name, year of publication, study's region, prevalence of poor clinical outcomes,

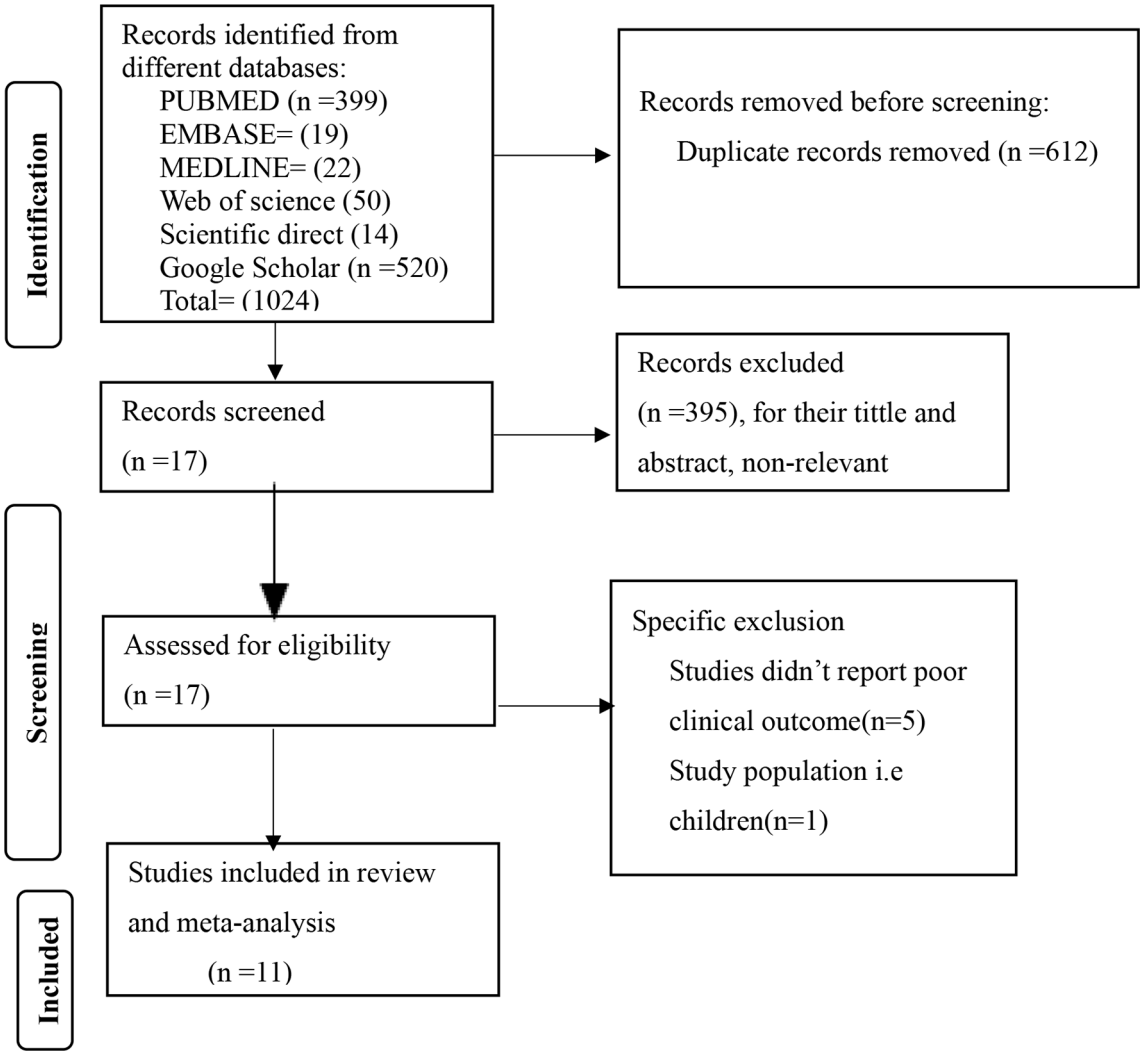

Fig. 1 PRISM Flow chart of selection process studies in Ethiopia

sample size, study design, and study population, which were extracted using Microsoft Excel 2019. The extracted data was cross-checked for possible variances by two separate reviewers (G.G.A. and B.S.S.), and any inconsistencies were resolved by reexamining the entire text. Then, the retrieved data was reviewed by all authors to verify its accuracy and detect any mistakes.

Data extraction and study quality assessment

Endnote X-8 reference manager software was used to import the retrieved studies, and duplicates were removed. The quality of the articles was assessed using the Newcastle Ottawa Quality Assessment Scale (adapted for cross-sectional studies) [17]. Disagreements were resolved by inviting a first author (G.G.A.) to participate. The articles were critically appraised by the following criteria from the tool: representativeness of the sample (1 score maximum), sample size (1 score maximum), non-respondent (1 score maximum), ascertainment of exposure (2 score maximum), comparability of outcome based on study design (2 score maximum), outcome assessment (2 score maximum), and statistical analysis (1 score maximum). All studies assessed through the tool with a score of ≥ 5 was included in this systematic review and meta-analysis. After the quality rating, no study was dismissed.

A data extraction format was developed in Microsoft Excel to extract the study characteristics and outcomes. The Excel spreadsheet includes the first author's name, sample size, publication year, region, study design, study population, study period, prevalence of poor treatment outcome, and associated factors. The PECO statement states: Patients are the population; emergency room admissions are the exposure; Ethiopian hospitals are the context; and poor treatment outcomes (death and disability) are the result.

Table 1 General characteristics of the included studies and quality assessment

Author name	Year of publication	Region	Study area	Study design	Study population	Sample size	Prevalence	Quality scores
Tefera GM, et al. [25]	2020	Oromia	AURH and AGH	Cros-sectional	Adult	7883	12.7	8
Waktola LG, et al. [14]	2023	Amhara	GCSH	prospective observation	Adult	233	17.6	8
Rada GB, et al. [22]	2023	Amhara	Selected hospitals	Cros-sectional	Adult	400	18	8
Teym A, et al. [23]	2024	Amhara	DCSH	Cros-sectional	Adult	315	17.5	7
Asrei AB, et al. [24]	2024	Amhara	Selected hospital	Cros-sectional	Adult	442	17.6	8
Nigussie S, et al. [28]	2022	Harar	HFCSH	Cros-sectional	Adult	175	16.7	7
Bareda G, et al. [15]	2021	Oromia	MKCSH	Cros-sectional	Adult	76	59.2	7
Shumet a, et al. [21]	2022	Amhara	FHCSH	Cros-sectional	Adult	121	62	7
Tadesse B, et al. [27]	2023	Harar	HFCSH and JRH	Cros-sectional	Adult	135	11.1	7
Woyessa AH, et al. [26]	2020	Oromia	Selected hospital	Cros-sectional	Adult	211	7.1	8
Zemedie B, et al. [10]	2021	Addis Ababa	ABETH	Cros-sectional	Adult	98	10.2	7

AURH: Ambo university referral hospital, AGH: Ambo General Hospital ABETH: Addis Ababa Burn, Emergency, and Trauma Hospital, HFCSH: Hiwot Fana Comprehensive Specialized Hospital, DCSH; Debre Markos Comprehensive Specialized Hospital, GCSH: Gondar Comprehensive Specialized Hospital

Data analysis

STATA version 17 statistical software was used for the analysis, and heterogeneity was checked across studies by computing the I2 statistical test, and scores 0%, 25%, 50%, and 75% correspond to no, low, moderate, and high level of heterogeneity, respectively [18]. A random-effects model was used to analyze the pooled estimated prevalence with 95% confidence intervals (CI). Potential publication bias was checked by the funnel plot for visual inspection [19] and Egger's test rank tests [20]. A forest plot was used to report the estimated pooled prevalence of poor treatment outcomes among poisoned patients in Ethiopia.

Outcome measurement

This study gathered and analyzed data from various studies conducted in Ethiopia to determine primary outcome measures (pooled prevalence poor treatment outcome (death and disability)). In addition to this, determinant of poor treatment outcomes was accessed. Factors reported in at least two studies were considered for pooled analysis to increase the validity of this study.

Results

Search result

Initially, 1024 articles were identified through searches of different databases. Of the identified studies, 612 were removed because of duplication. After removing duplications and conducting a full article review, 11 studies were included for the final systematic review and Meta-analysis (Fig. 1).

Study characteristics and quality assessment

Of the 11 studies included in the final analysis, one study was from Addis Ababa city [4], five studies from the Amhara region [14, 21–24], four studies from Oromia region [15, 25, 26]and two studies from the Harar region [27, 28]. In terms of study design, ten studies employed a retrospective cross-sectional study design [4, 15, 21–28] and one was conducted using a prospective cross-sectional design [14] (Table 1).

Pooled prevalence of poor treatment outcomes

In this systematic review and meta-analysis study using a forest plot, the pooled prevalence of poor treatment outcomes among poisoned patients in Ethiopia was 16.13% (9.20,23.05), which is estimated by a random-effect model (Fig. 2).

Publication bias

The presence of publication bias was evaluated using Egger's and Begg's tests, which indicated that there is no significant publication bias. In addition to the statistical tests, a funnel plot was used, and it is symmetrical (Fig. 3).

Factors associated with poor treatment outcome

The pooled effect of two studies was reported on the association between being living rural area and poor treatment outcome of poisoned patients in the hospital. This meta-analysis study showed that patients living in rural areas were 2.79 times more likely (AOR: 2.79, 95% CI: 1.44, 5.42) to develop poor treatment outcomes as compared to those living in urban areas. Additionally, patients who delayed their arrival time at the health facilities were 6.15 times more likely (AOR = 6.15, 95%CI: 2.46, 15.34) to experience poor treatment outcomes compared to those without a delayed time to arrival to health facilities. There was no observed heterogeneity, I-squared = 0% (Fig. 4).

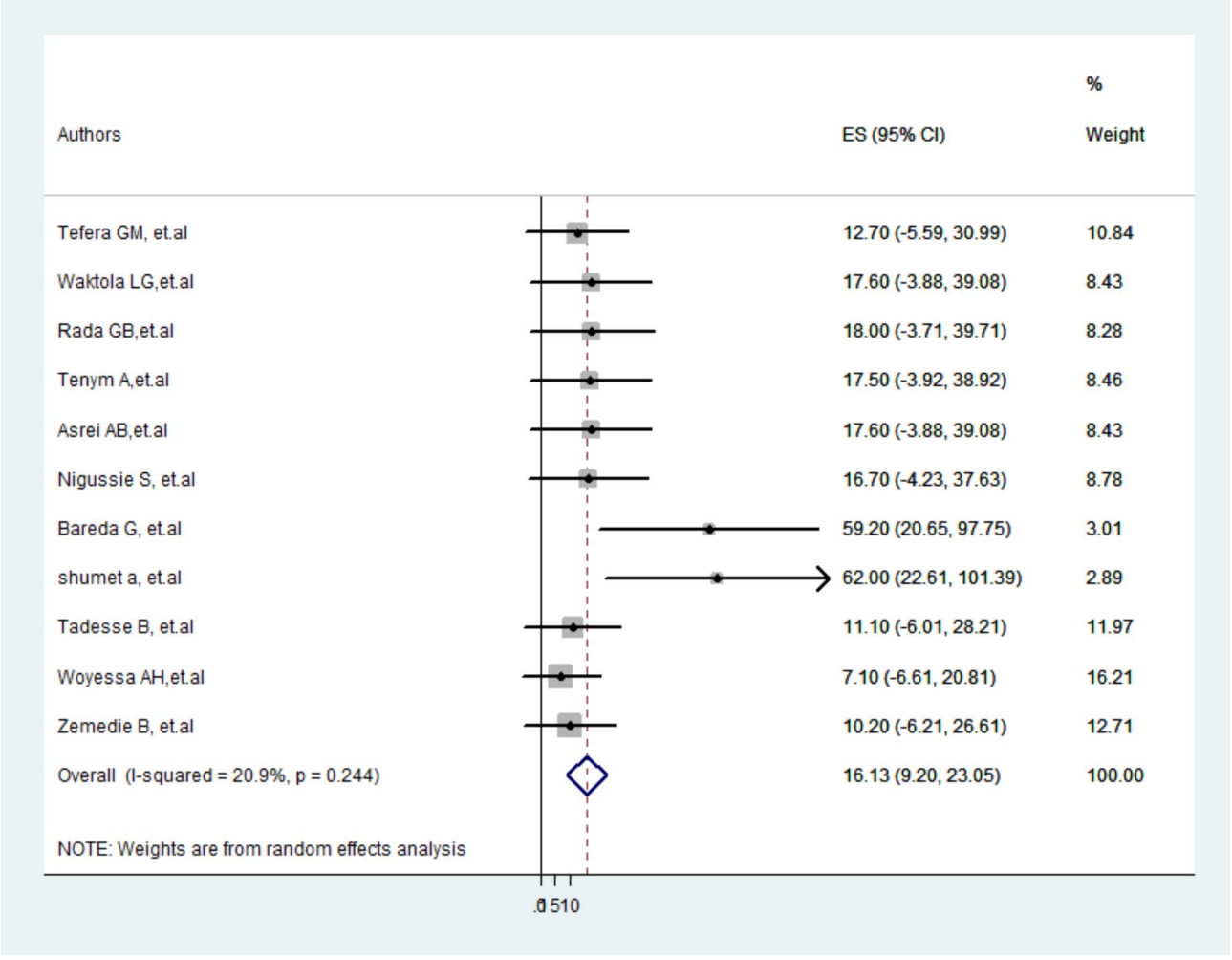

Fig. 2 Forest plot to shows the pooled prevalence of poor treatment outcomes in Ethiopia

Sensitivity analysis

By excluding each study individually, a leave-out-one sensitivity analysis was used to determine the effect of a single study on the pooled prevalence of poor treatment outcomes of poisoning in Ethiopia. According to our findings, no single study had a significant impact on the pooled prevalence of poor treatment outcomes of poisoning in Ethiopia (Fig. 5).

Discussion

This systematic review and meta-analysis showed that the pooled prevalence of poor treatment outcomes was 16.13%. This finding was higher than the study reported in a systematic review and meta-analysis in Thailand (7%) [29]. Additionally, our study finding is higher than the studies found in Sweden (0.88%) [30], Uganda (2%) [31], Switzerland (0.26%) [32], Bulgaria (2.4%) [33], Denmark (4%) [34], England (8.7%) [35] and Nigeria (7.61) [36]. However, our study finding was lower than the study reported in the systematic review and meta-analysis in Iran(27%) [37]. One explanation for this discrepancy could be found in developed nations, where paramedics start lifesaving procedures at the patient's home before transporting them to the hospital in fully equipped ambulances. In contrast, the majority of patients in our traditional route of transportation sometimes without any life-saving measures before arrival at the hospital. This leads to a high number of patients who arrive with problems and a low survival rate [7, 25, 38]. Additionally, it could be due to the differences in the study design, study population, study period, and study area.

This systematic review and meta-analysis revealed that patients living in rural areas were 2.79 times more likely to experience poor treatment outcomes compared to those living in urban areas. This study finding is in line with the study reported from America, which showed that those living in rural areas experience higher rates of poor treatment outcomes as compared to those living in urban areas [33]. This could be because rural areas being far from health care facilities can cause delays in receiving

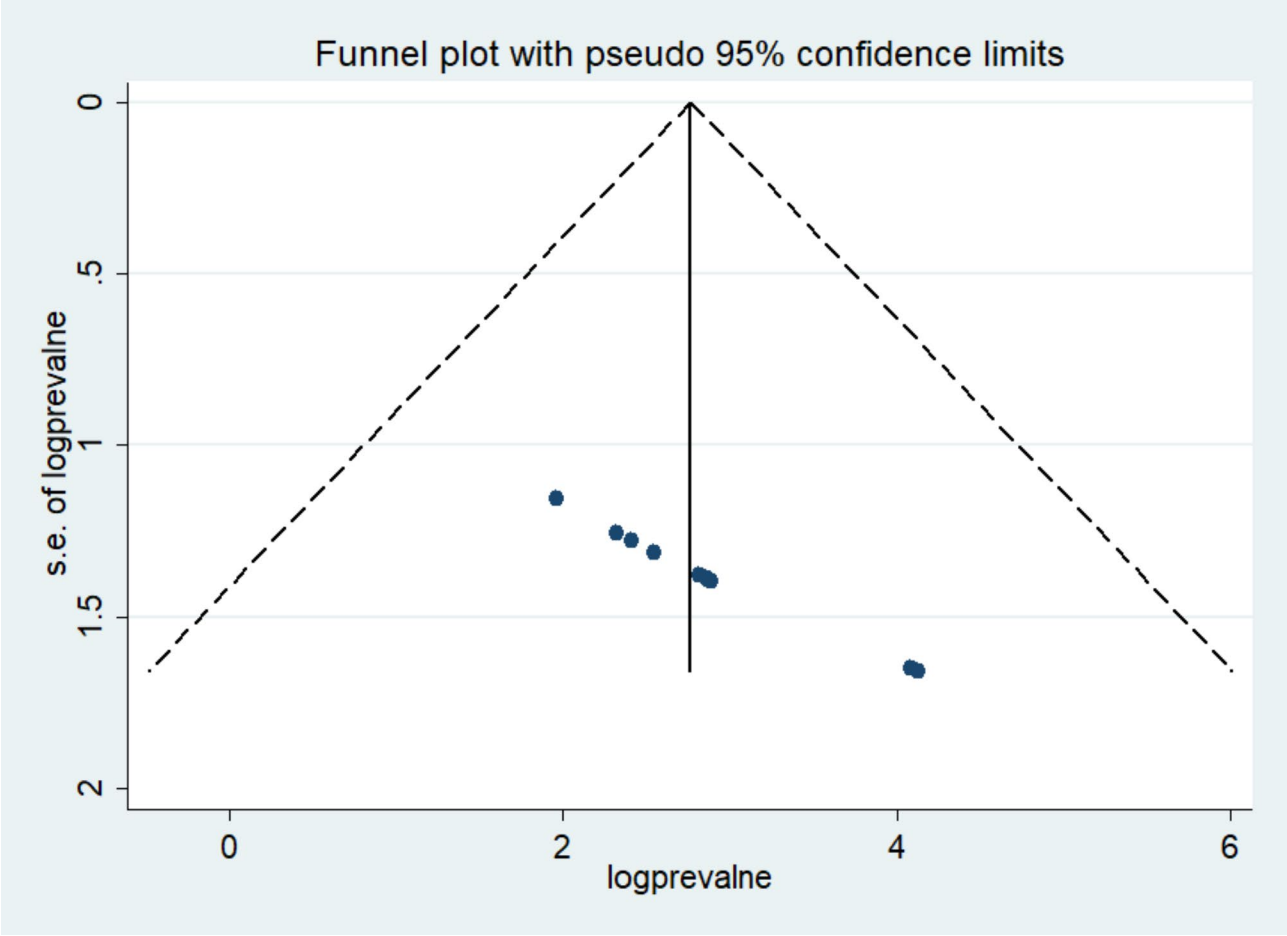

Fig. 3 Funnel plot to illustrate the presence of publication bias

emergency care, which could result in increased poor treatment outcome [39]. In addition to the above reason, people living in rural areas are less likely to seek medical attention and have not been presented in the hospital immediately [40].

According to this meta-analysis, delayed time to arrival at healthcare facilities was the independent predictor of poor treatment outcomes among poisoned patients. This study finding is in agreement with a study report found in England, which indicated that as the delayed time to reach the health facilities increases poor treatment outcome [41]. Evidence currently available suggests that delayed time to arrival to hospitals might be the independent predictors for patient poor treatment outcomes [42].

Limitations of the study

Limitation of this study: We limited the search to articles that were written in the English language. Due to these relevant articles that were published in others than English language was not included. The study's findings may have limited generalizability outside Ethiopia.

Conclusion and recommendation

The finding of this study revealed that the pooled prevalence of poor treatment outcomes of poisoned patients in Ethiopia was high. Patients living in rural areas and delayed their arrival time at health facilities were independent determinants of poor treatment outcomes among poisoned patients. Training health care providers, establishing health facilities and poison treatment centers in rural areas for prevention and reducing poor treatment outcomes associated with poisoning. Additionally, improving treatment protocol at health facilities will help to reduce poor treatment outcomes (mortality and disability) in Ethiopia.

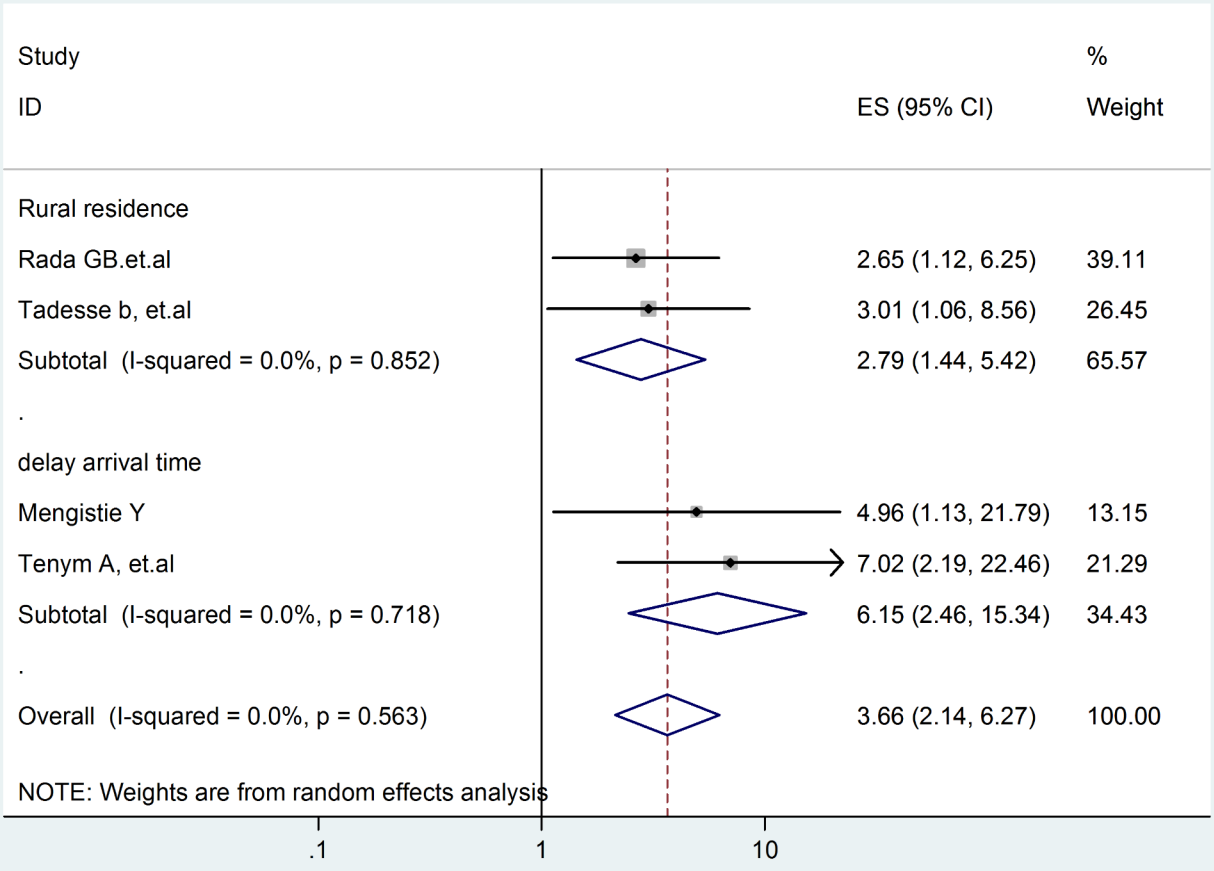

Fig. 4 Determinants of poor treatment outcome among poisoned patients in Ethiopia

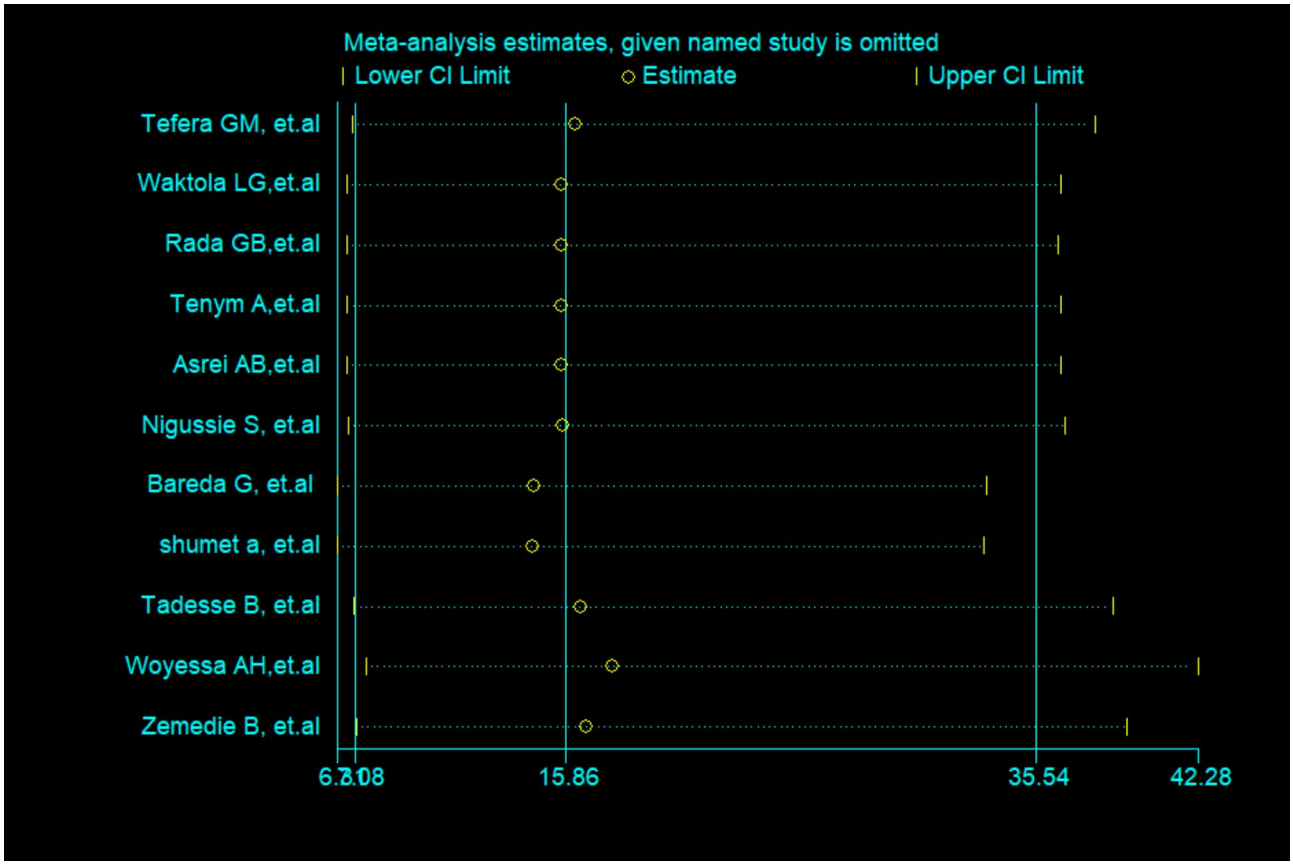

Fig. 5 Sensitivity analysis for single study effect of estimated pooled prevalence of poor treatment outcomes of poisoning in Ethiopia

Abbreviations

ABETH	Addis ababa burn emergency and trauma hospital
AGH	Ambo general hospital
AOR	Adjusted odds ratio
AURH	Ambo university referral hospital
CI	Confidence interval
DCSH	Debre markos comprehensive specialized hospital
GCSH	Gondar comprehensive specialized hospital
HFCSH	Hiwot fana comprehensive specialized hospital
PRISMA	Preferred reporting items for systematic reviews and meta-analyses
WHO	World health organization

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Author contributions
G.G.A.: Writing review & editing, writing original draft, visualization, supervision, software, methodology, formal analysis, data curation, conceptualization and revising. B.S. S and A.A.C.: Writing review & editing, writing original draft, methodology, formal analysis, software, data curation and revising. Finally, all authors agreed to submit it to the current journal, gave final approval of the version to be published, and agreed to be accountable for all aspects of the work.

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Data availability
All data associated data and supporting information of findings of this study are available in this systematic review and meta-analysis.

Declarations

Ethical approval
Not applicable, because the study is a systematic review and meta-analysis.

Consent to participate
Not applicable, because the study is a systematic review and meta-analysis.

Consent for publication
Not applicable.

Clinical trial number
Not applicable.

Competing interests
The authors declare no competing interests.

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