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Global Burden of Acute Coronary Syndrome Recurrence: A Systematic Review and Meta-Analysis 2025

Helen Assefa Berhe[1], Mihret Derbie Asfaw[2], Amina Ali Mohammed[2], Hiwot Wondale Messelu[2], Feven Minaleshewa[3], Genet Gebremedhin Gebremariyam[4], Yoseph Teweldebrhan[5], Nejat Nuredin Ahmed[6], Tsebaot Meressa Alemayehu[4], Samuel Alemu Himbaro[1], Bedilu Zewdu Asmare[7], Hamlet Asfaw Gebreselassie[2], Hermela Aklilu Wubet[4], Abel Merhatsidk Menberu[8], Kidus Fekade Weldemicheal[4], Lisanwork Mikiyas Kebede[8], Ekram Mohammed Omer[2], Daniel Fissha Yegzaw[8], Milkias Tsigabu Araya[4], Ermias Melhig Mussa[1], Michael Asmelash Berhe[4], Mesay Ashu Lema[1]

1. Department of Medicine, Addis Ababa University, College of Medicine and Health Science, Addis Ababa, Ethiopia.
2. Department of Medicine, Hayat Medical College, Addis Ababa, Ethiopia.
3. Augustana University, Sioux Falls, South Dakota.
4. Department of Medicine, Mekelle University, College of Health Science, Mekelle, Ethiopia.
5. Georgetown American University, School of Medicine.
6. Department of Medicine, Jimma University School of Medicine, Jimma, Ethiopia.
7. Department of Medicine, Arsi University College of Medicine and Health Sciences, Ethiopia.
8. Department of Medicine, University of Gondar, College of Medicine and Health Science.

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Corresponding author:

Helen Assefa Berhe

Department of Medicine, Addis Ababa University, College of Medicine and Health Science, Addis Ababa, Ethiopia.

assefa.hellen@yahoo.com

Amina Ali Mohammed

Department of Medicine, Hayat Medical College, Addis Ababa, Ethiopia

Hiwot Wondale Messelu

Department of Medicine, Hayat Medical College, Addis Ababa, Ethiopia

ABSTRACT

Approximately 640 million people worldwide are living with heart and circulatory diseases, which contribute to nearly one in three deaths globally; this number is projected to increase further. Patients with ACS are also at significantly higher risk of experiencing recurrent cardiovascular events, particularly shortly after discharge, with identifiable subgroups facing a multifold higher risk of specific clinical endpoints. So this study is aimed to identify pooled prevalence of acute coronary syndrome recurrence. Both manual and electronic searches were used to extract studies for this meta-analysis from PubMed, Scopus, and Web of Science. Additionally, Google and Google Scholar databases were utilised to identify the eligible articles. Then identified articles were exported into EndNote software used to export, organize, and review, the eligible articles. The quality of studies was assessed by using the Joanna Briggs Institute (JBI) quality appraisal tool for prevalence study. A meta-analysis was conducted using a random-effects model in STATA Version 14 software. 12 included studies with a total of 1,120,175 participants enrolled in this study. The estimated global prevalence of acute coronary syndrome recurrence among patients with coronary syndrome, using a random-effects model, was found to be 7.65% (95% CI: 6.1–9.1). The highest prevalence was found in Europe at 12.1% (95% CI: 7.6–16.6), and North America had the lowest prevalence at 3.9% (95% CI: 1.1–6.6). Despite the significant risk of mortality associated with acute coronary syndrome, studies show a concerning high rate of recurrence among individuals who have previously experienced an acute coronary syndrome (ACS) event. Therefore, comprehensive post-event management is essential.

INTRODUCTION

Acute Coronary Syndrome (ACS) is a condition caused by the blockage of atheromatous plaques in the coronary arteries, leading to ischemia or even infarction of the heart. It almost always presents with symptoms such as unstable angina and is frequently associated with myocardial infarction, irrespective of the presence of coronary artery disease. ACS includes ST-elevation myocardial infarction (STEMI) and non-ST elevation ACS, which comprises non-ST elevation myocardial infarction (NSTEMI) and unstable angina. Recurrent acute coronary syndrome refers to the occurrence of another ACS event, such as unstable angina or myocardial infarction, after an initial ACS event (1-4).

Approximately 640 million people worldwide are living with heart and circulatory diseases, which contribute to nearly one in three deaths globally; this number is projected to increase further. In Africa alone, 1.8 million deaths occur due to heart and circulatory diseases. Deaths from cardiovascular disease

(CVD) remain alarmingly high and are projected to reach 23 million worldwide by 2030 (5, 6). Furthermore, evidence suggests a significant difference in mortality rates for recurrent ACS compared to patients without recurrent ACS. Individuals who experience recurrent myocardial infarction (re-MI) are at an increased risk of death and worse health outcomes (7-10).

Recent medical advancements in the management of coronary syndrome have greatly improved diagnosis, treatment, and patient outcomes. Innovative approaches have included robotic surgery, nanotechnology, stem cell therapy, and other relevant advancements (11-13).

Despite these medical advances, coronary artery disease continues to be a leading cause of morbidity and mortality globally, highlighting the limitations of the traditional ischemia-centric model. Even with optimal pharmacological and invasive therapies, the incidence of recurrent ischemic events and mortality remains high, necessitating ongoing research to prevent and improve outcomes for patients with ACS (14, 15).

Moreover, various studies indicate that acute coronary syndrome increases the risk of cognitive impairment, raises healthcare costs for patients, and diminishes their quality of life (16-19). Patients with ACS are also at significantly higher risk of experiencing recurrent cardiovascular events, particularly shortly after discharge, with identifiable subgroups facing a multifold higher risk of specific clinical endpoints (20). This study aims to estimate the pooled burden of acute coronary syndrome recurrence.

Objective of the Review

To identify pooled prevalence of acute coronary syndrome recurrence.

METHODS

The below mentioned criteria were used to select the studies included in this systematic review and meta-analysis.

- All published articles conducted regarding the burden of recurrent acute coronary syndrome among adult patients with acute coronary syndrome.
- Studies that reported the prevalence of recurrent acute coronary syndrome studies published in English until June 2025 were included in this study. Studies that don't report overall recurrence of acute coronary syndrome was excluded.

Information Sources, Search Strategy, and Study Selection

Both manual and electronic searches were used to extract studies for this meta-analysis. First Medical Subject Heading terms were used to retrieve studies from PubMed. The search strategies were carried out using controlled vocabularies (MeSH) terms. The synonym of coronary syndrome was identified. Then, the search string was established using the databases. Articles were searched by title and abstract. Finally "AND" and "OR", were used to combine the search terms. The search string was expressed as "recurrence" OR "reoccurrence" AND "coronary syndrome" OR "myocardial infarction "OR "MI" AND "prevalence" OR "incidence" OR "proportion", OR "occurrence", OR "epidemiology" AND "global ": then, other databases, namely, Scopus, Web of Science, and JStore, databases, were utilized to identify related articles and Google and Google Scholars for gray literature. Finally, the identified articles were exported into EndNote software used to export, organize, and review, the eligible articles. The search limiters, such as study design, age group, and language of publication were used.

Reporting

Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) statement 2020 guidelines were used to report this study (21).

Study Population

Adult patients with acute coronary syndrome.

Data Collection Process and Data Items

To avoid missing information, data extraction was performed by all authors independently by using a data extraction format prepared in a Microsoft Excel 2013 spreadsheet containing the author's name, publication year, study design, sample size, study area, and prevalence acute coronary syndrome recurrence.

The Outcome of the Review

- The global prevalence of acute coronary syndrome recurrence.
- In this study, acute coronary syndrome recurrence was measured as the re-occurrence of a group of conditions that include ST-elevation myocardial infarction (STEMI), non-ST elevation myocardial infarction (NSTEMI), and unstable angina among previously managed adult population.

Quality Assessment

The Joanna Briggs Institute (JBI) quality appraisal tool for prevalence studies was used to assess the quality of the studies (22). To assess the methodological quality of a study in terms of the possibility of bias in its design, conduct and analysis by using the following parameters: inclusion , study subjects and the setting clearly mentioned, used valid measurements, objective clearly set, confounding factors identified and controlled, the outcomes measured in a valid and reliable way, and appropriate statistical analysis method used. If the quality assessment indicator score was 50% or higher, then the study was considered low risk. The quality was assessed independently by all authors and discussed for any discrepancy.

Publication Bias and Heterogeneity

To assess the existence of publication bias, funnel plots graphically and Egger's test objectively utilized. A p-value< 0.05 was used to declare the statistical significance of publication bias. I2 test statistics were used to check the heterogeneity of studies. I2 test statistics of < 50, 50–75% and > 75% was declared as low, moderate and high heterogeneity respectively (23).

Data Synthesis and Analysis

STATA™ Version 14 software were used to conduct the analysis. The heterogeneity test was conducted by using I-squared (I2) statistics. The pooled prevalence of acute coronary syndrome recurrence was computed out using a random-effects (DerSimonian and Laird) method. To minimize the potential random variations between studies; the sources of heterogeneity were analyzed using subgroup analysis, and meta-regression. A sensitivity analysis was also conducted.

RESULTS

Study Selection

Initially, a total of 9,840 studies were retrieved from both database searches and manual investigations. After reviewing these, 1,038 duplicate and irrelevant articles were identified and removed. This left 8,802 articles, which were screened by title, resulting in the removal of 7,698 irrelevancies. From the remaining articles, 1,104 were sought for retrieval, but 267 of these could not be obtained. Subsequently, 837 full-text articles were assessed for eligibility, and 849 were excluded because they did not report the outcome of interest. Ultimately, 12 studies met the inclusion criteria and were enrolled in the analysis (Figure 1).

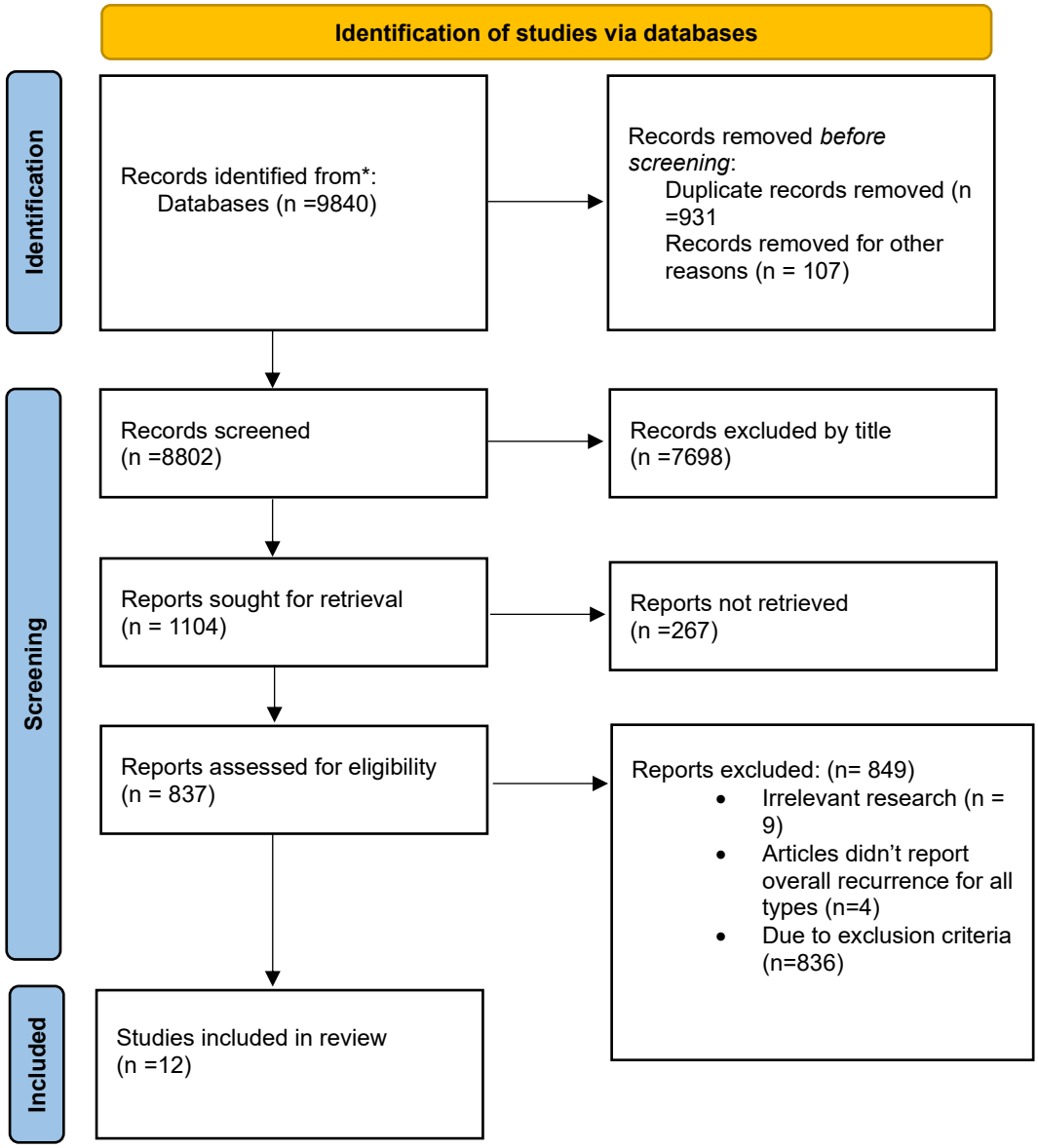

Figure 1. PRISMA flow diagram of study selection for global prevalence of recurrent acute coronary syndrome among adult patients with acute coronary syndrome.

Study Characteristics

The 12 included studies (24-35) encompassed a total of 1,120,175 participants. Most of these studies were cross-sectional in design and published from 2002 onwards. The sample sizes varied, ranging from 429 (24) to 884931 (31). The majority of the studies were conducted in Asia. Among the included studies, the prevalence of recurrent acute coronary syndrome ranged from 2.1% (28) to 14.1% (35) (Table 1).

Table 1: Characteristics of the Included Studies in the Systematic Review and Meta-Analysis.

Authors Name	Publication Year	Study area	Study design	Sample size	Prevalence%(95%CI)
Alamaw AW,	2023	Ethiopia	Cross-sectional	429	12.35(9.2-15.4)
Song J,	2021	China	Cross-sectional	3387	2.5(1.9-3.0)
Nakatani D,	2013	Japan	Cohort	7870	4.5(4.0-4.9)
Yudi MB,	2019	Australia	Cross-sectional	9615	12.5(11.8-13.1)
Al Saleh AS,	2017	Gulf	Cross-sectional	7925	2.1(1.7-2.4)
Lee SH,	2022	Korea	Cohort	9869	3.6(3.2-3.9)
Buch P,	2002	Denmark	Cross-sectional	166472	8.4(8.2-8.5)
Wang Y,	2020	USA	Cross-sectional	884931	5.3(5.2-5.3)
Radovanovic D,	2016	Switzerland	Cross-sectional	19665	14(13.5-14.4)
Nair R,	2021	USA	Cross-sectional	6626	2.5(2.1-2.8)
Cao CF,	2016	China	Cross-sectional	1686	12.2(10.6-13.7)
Kikkert WJ,	2014	Holland	Cross-sectional	1700	14.1(12.4-15.7)

Prevalence Acute Coronary Syndrome Recurrence

The estimated global prevalence of acute coronary syndrome recurrence among patients with coronary syndrome, using a random-effects model, was found to be 7.65% (95% CI: 6.1–9.1). The heterogeneity index (I^2) was 99.8% (p = 0.000) (Figure 2).

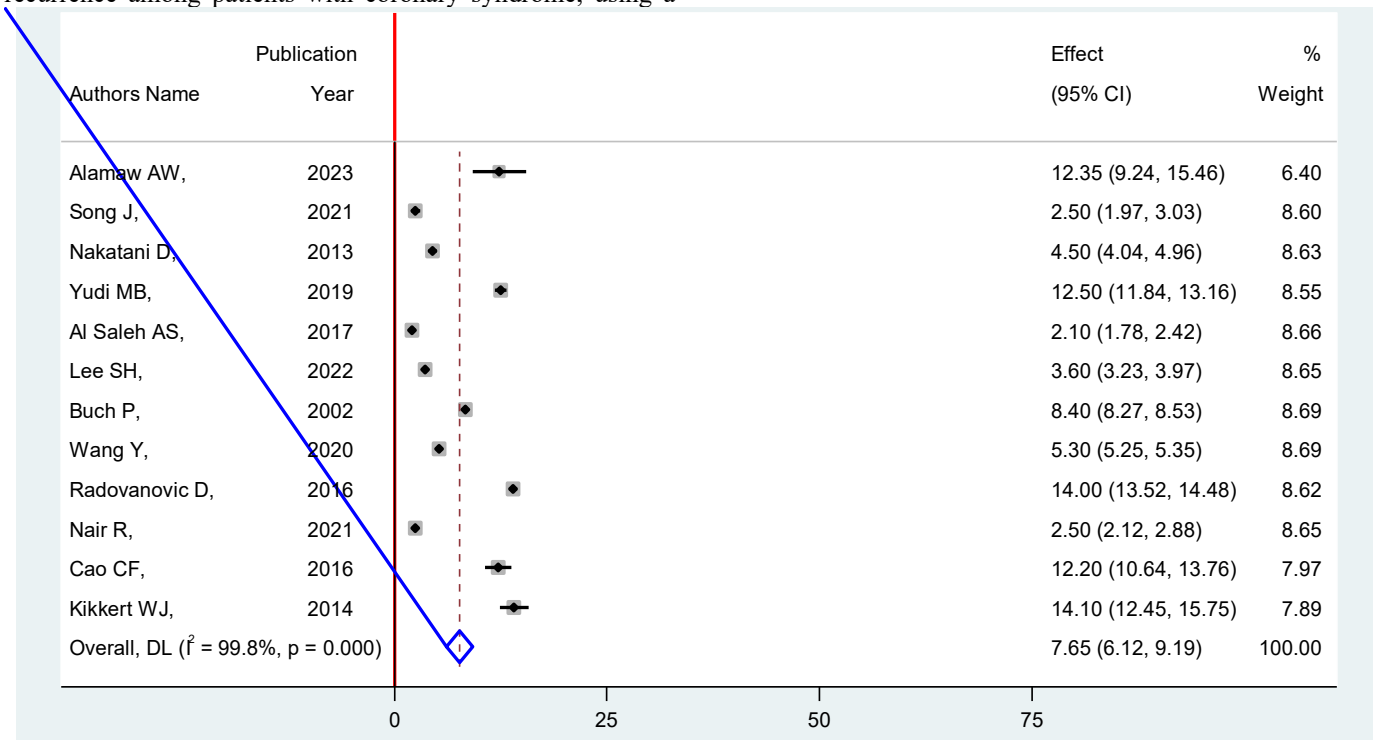

Figure 2. Forest plot showing the global prevalence of recurrent acute coronary syndrome among adult patients with acute coronary syndrome.

Subgroup Analysis

The study included five out of seven regions worldwide, as three regions were excluded due to a small number of studies from Africa and Australia. The subgroup analysis showed that the highest prevalence was found in Europe at 12.1% (95% CI: 7.6–16.6, I^2 = 99.6%), while North America had the lowest prevalence at 3.9% (95% CI: 1.1–6.6, I^2 = 99.5%) (Figure 3).

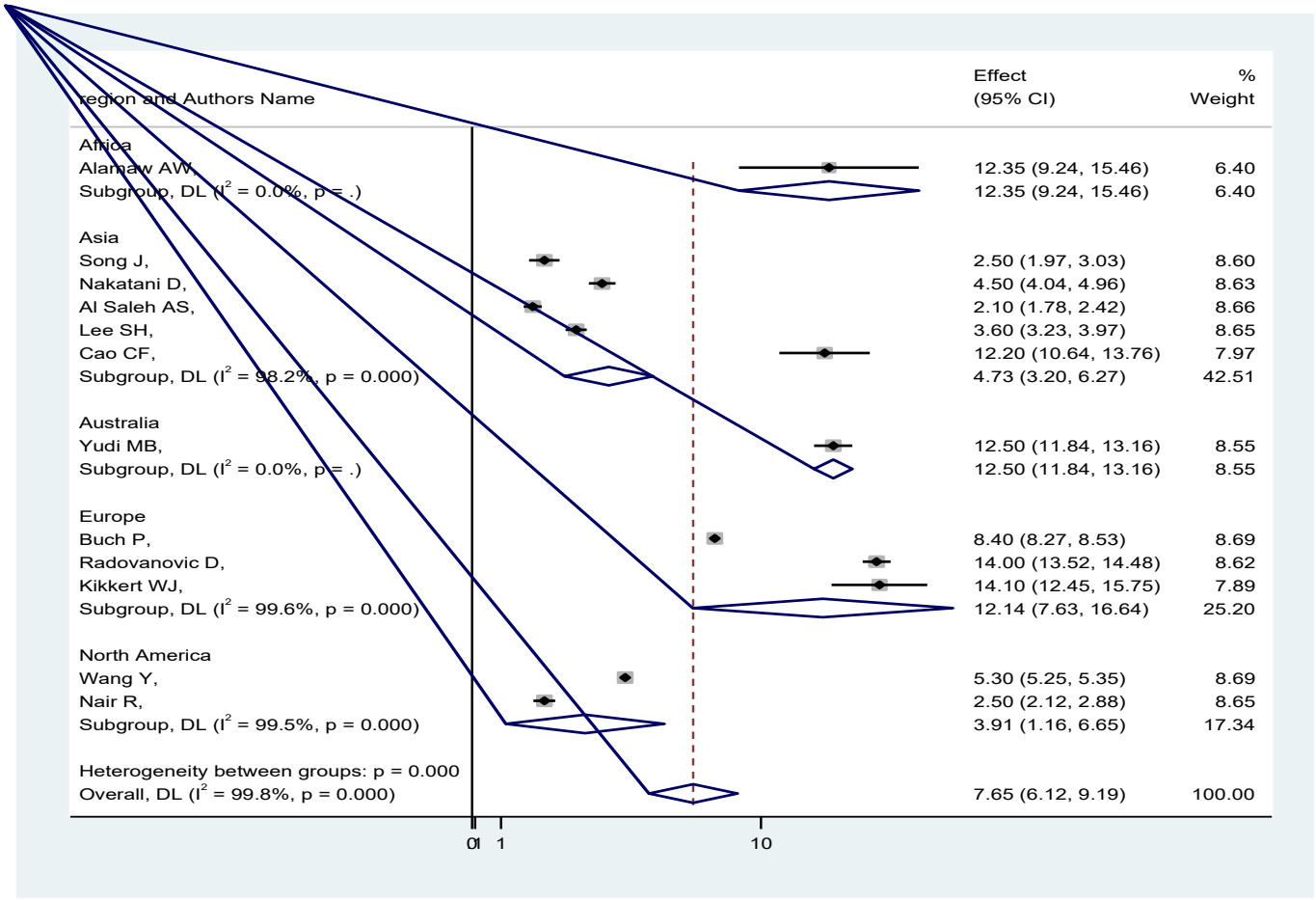

Figure 3. Subgroup analysis of prevalence of recurrent acute coronary syndrome among adult patients with acute coronary syndrome by region.

Heterogeneity and Publication Bias

A meta-regression was performed to identify potential sources of heterogeneity, using sample size and publication year as covariates (Table 2). The results indicated that neither sample size nor publication year had a significant impact on heterogeneity among the studies. To assess publication bias, both Egger's test and a graphical funnel plot were used. Egger's test revealed no significant evidence of publication bias (P = 0.909). However, visual inspection of the funnel plot indicated an asymmetrical distribution, suggesting the presence of publication bias (Figure 4).

Table 2: Meta-Regression Analysis of Factors Affecting Between-Study Heterogeneity.

Heterogeneity source	Coefficients	Std. Err.	P-value
Publication year	-0.1956048	0.3313374	0.569
Sample size	$2.82e^{-06}$	$6.16e^{-06}$	0.658

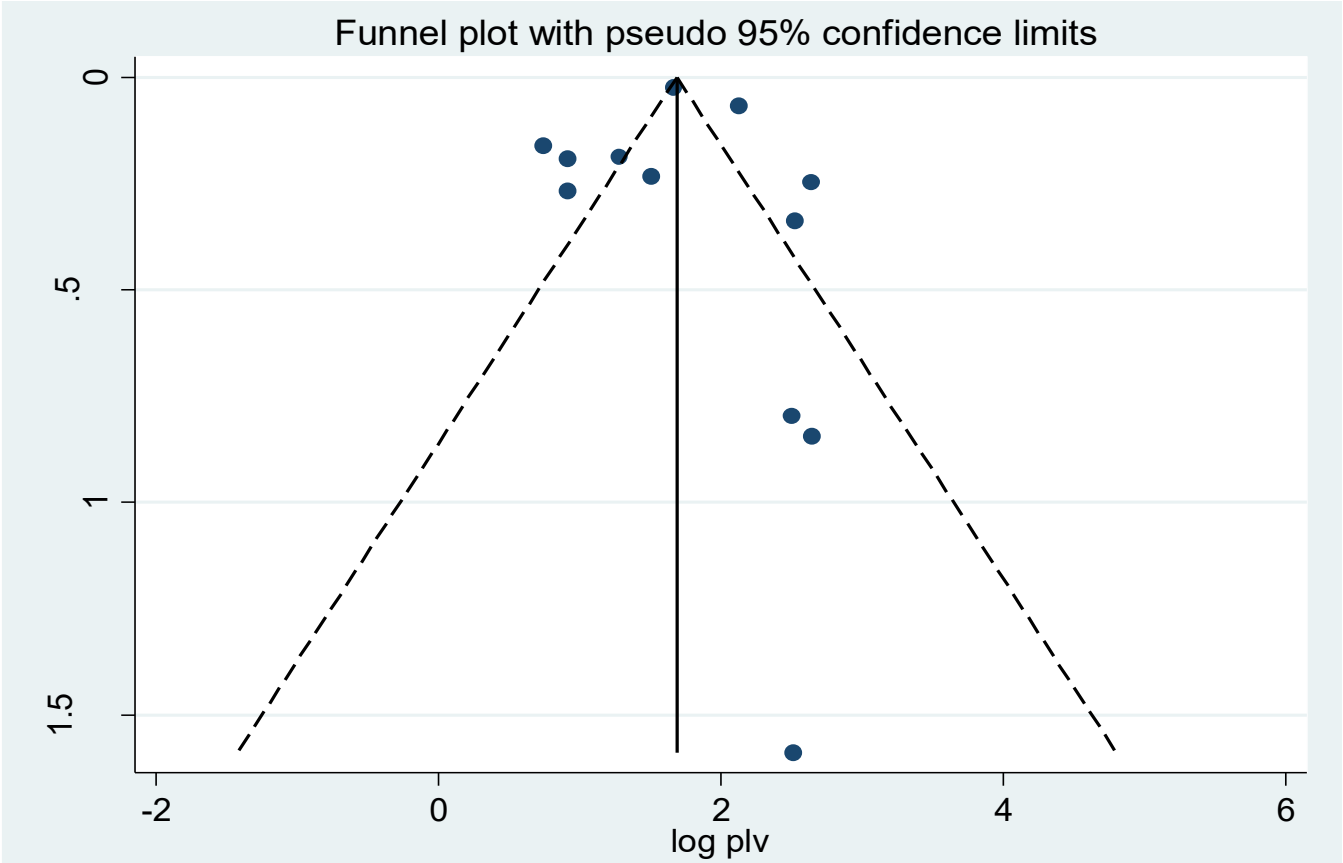

Figure 4. Funnel plot to test publication bias in 12 studies with 95% confidence limits.

Sensitivity Analysis

A sensitivity analysis was conducted by removing studies one at a time to evaluate the impact of individual studies on the overall effect estimate. The results indicated that removing any single study did not significantly influence the pooled prevalence (Figure 5).

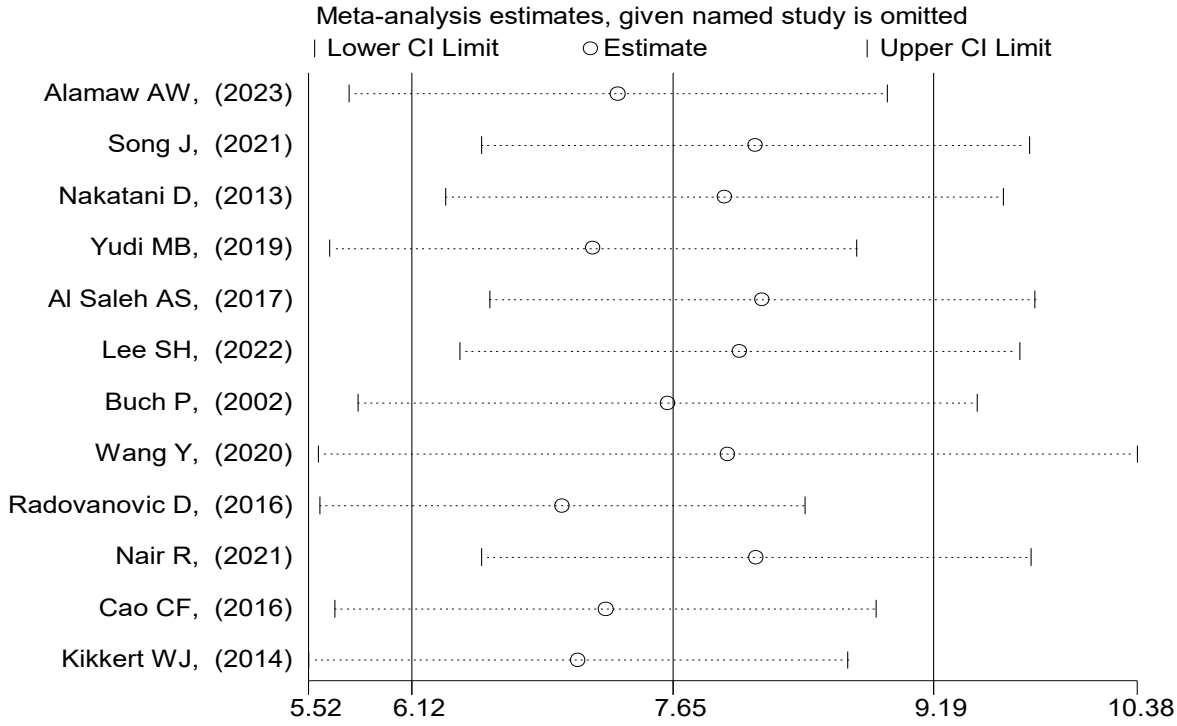

Figure 5. Sensitivity analysis of pooled prevalence of recurrent acute coronary syndrome among adult patients with acute coronary syndrome for each study being removed one at a time.

DISCUSSION

Acute coronary syndrome (ACS) encompasses various conditions that arise from reduced blood flow to the heart. One of the primary causes of these syndromes is thrombosis, which frequently occurs due to atherosclerotic plaques. However, not all cases of ACS are linked to atherosclerosis; non-atherosclerotic mechanisms, such as coronary artery spasms, also play a significant role in triggering acute coronary events (36). Diagnosis is typically established during the initial contact with the patient, based on the clinical presentation, electrocardiogram results, and levels of myocardial necrosis markers (37).

This systematic review and meta-analysis offers essential insights into the global prevalence of ACS recurrence, which is a significant health concern. The overall estimated pooled global prevalence of ACS recurrence, using a random-effects model, is 7.65% (95% CI: 6.1 - 9.1). Due to limited comprehensive epidemiological data, the prevalence of ACS recurrence can vary significantly by region. Countries classified as low- and middle-income tend to experience a higher burden of this condition compared to higher-income regions. This highlights the importance of considering local health contexts when addressing health issues like ACS recurrence (38, 39). Additionally, the variation in recurrence rates may be associated with individual genetic differences; studies have shown that genetic risk scores, which include 47 known coronary artery disease risk single-nucleotide polymorphisms, are related to recurrent ACS (40).

According to subgroup analysis, the highest prevalence was observed in Europe at 12.1% (95% CI: 7.6 - 16.6, $I^2 = 99.6\%$), while the lowest was in North America at 3.9% (95% CI: 1.1 - 6.6, $I^2 = 99.5\%$). The difference between these two regions may reflect various factors, including disparities in healthcare systems, population demographics, disease prevalence, or other environmental and social determinants that could influence the outcomes analyzed. Understanding these regional differences is crucial for developing public health strategies and interventions tailored to specific geographic areas. It may also prompt discussions about the quality and accessibility of healthcare services in different regions.

Limitation

This systematic review and meta-analysis examined the global burden of acute coronary syndrome recurrence; however, it faced several limitations. First, the presence of significant heterogeneity and publication bias means that the results should be interpreted with caution. Secondly, the lack of studies in certain regions of the world makes it challenging to generalize the findings. Finally, we encountered difficulties in comparing our results due to the absence of regional and worldwide systematic reviews and meta-analyses.

CONCLUSION

Despite the significant risk of mortality associated with acute coronary syndrome, studies show a concerning high rate of recurrence among individuals who have previously experienced an acute coronary syndrome (ACS) event. Therefore, comprehensive post-event management is essential. This includes regular follow-ups, educational programs focused on lifestyle changes, and potentially rehabilitation programs.

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