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Research Article

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Prevalence of Hemostatic Disorders Among Patients with Cardiovascular Diseases: A Systematic Review and Meta-Analysis

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Abstract

Introduction: *Coagulation abnormalities are highly prevalent in cardiovascular diseases, contributing significantly to morbidity and mortality, especially in heart failure, atrial fibrillation, and ischemic stroke. So this study is aimed to estimate pooled Global Prevalence of Haemostatic Disorders in Patients with Cardiovascular Diseases.*

Methods and materials: *Systematic review and meta-analysis design was used to summarize the evidences from databases such as PubMed, Scopus, Web of science, African journal online, and Google scholar. The modified Newcastle-Ottawa Scale (NOS) was used to assess the quality of studies. A random-effect model was used due to heterogeneity of studies. Heterogeneity among the studies was assessed using Higgin's I^2. Stata software version 14 was used for analysis.*

Result: *Fifteen studies with, 13009 participants were included in this study. The prevalence of Haemostatic disorder ranges from 10.1% – 85.7%. The pooled global prevalence Haemostatic Disorders among patients with cardiovascular disease with a random-effects model was 41.2% (95% CI: 23.8-58.6). The highest 42.8%; (95% CI: 17.3-, 68.3) seen in Africa region and the lowest 35.4%; 95% CI: 1.5-69.4) seen in North America region.*

Conclusion: *Despite of substantial morbidity and mortality related to haemostatic disorders, this systematic review and meta-analysis demonstrates that these conditions remain highly prevalent among patients with cardiovascular disease; indicating that nearly two out of five patients with cardiovascular disease are affected. Therefore, routine screening, early detection, and appropriate management of haemostatic disorders in this population are essential.*

Keywords: *Prevalence, Haemostatic Disorders, Cardiovascular Diseases, systematic review, global.*

Introduction

Hemostatic disorders involve abnormalities in the body's blood clotting system and may result in either excessive bleeding or excessive clotting. These conditions can be inherited or acquired and may affect primary hemostasis, involving platelets and blood vessel walls, or secondary hemostasis, involving coagulation factors. The blood coagulation process is essential for maintaining normal hemostasis and preventing hemorrhage; however, excessive or inappropriate activation of this system can lead to pathological thrombosis and related complications [1, 2].

A growing body of evidence indicates that abnormalities in the coagulation and hemostatic systems play a critical role in the development, progression, and complications of cardiovascular disease. Studies have shown that a significant proportion of patients with coronary artery disease, stroke, atrial fibrillation, and heart failure exhibit abnormal hemostatic profiles, such as elevated fibrinogen, increased D-dimer levels, high factor VIII, and impaired fibrinolysis [3-7].

Coagulation abnormalities and hypercoagulable states are highly prevalent in cardiovascular diseases, contributing significantly to morbidity and mortality, especially in heart failure, atrial fibrillation, and ischemic stroke [8-10].

Although coagulation abnormalities are widely recognized in cardiovascular disease, their prevalence and patterns vary across populations and disease types, and available evidence remains fragmented. Differences in study design, patient characteristics, and diagnostic criteria have limited the ability to draw consistent conclusions. As a result, there is a lack of comprehensive synthesis of data on the global burden of coagulation abnormalities among patients with cardiovascular disease. Addressing this gap is essential to improve risk stratification, guide preventive strategies, and inform targeted therapeutic interventions aimed at reducing thrombotic complications and improving cardiovascular outcomes.

Methods and materials

Study design and Search strategy

Systematic review and meta-analysis design were used to summarize the evidences. Databases such as PubMed, Scopus, Web of science, African journal online, and Google scholar were utilized to extract eligible studies. As the study was meta-analysis of prevalence study the Cochrane acronym POCC (population, Outcome, Condition, and Context) was employed to guide the retrieval of studies from mentioned databases, using appropriate medical subject heading (MeSH) terms and Boolean operators "AND" and "OR". The search terms included "Cardiovascular Diseases OR "Heart Diseases OR coronary artery disease OR myocardial infarction OR stroke OR hypertension OR atrial fibrillation OR heart failure AND Blood Coagulation Disorders OR hemostatic disorder OR haemostatic disorder OR coagulation disorder OR coagulopathy OR platelet disorder OR thrombosis AND Prevalence OR epidemiology OR incidence OR frequency AND Global. Additionally, manual searching and references of retrieved articles were reviewed to get additional studies. The researchers reported the findings in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) 2020 guidelines [11] (Supplementary file 1).

Eligibility criteria

- Studies including patients of any age (adult and/or pediatric) diagnosed with cardiovascular diseases, including (Heart Diseases OR coronary artery disease OR myocardial infarction OR stroke OR hypertension OR atrial fibrillation OR heart failure, congenital heart disease)
- Studies reporting at least one of the following hemostatic disorders (Coagulopathy, Coagulation abnormalities, Hemostatic abnormalities)
- Studies reporting prevalence estimates of hemostatic disorders or Studies providing sufficient data to calculate prevalence
- Observational studies, including: Cross-sectional studies, Cohort studies (baseline prevalence data), Surveillance or registry-based studies
- Both published and unpublished studies conducted in any geographical location and any healthcare setting (inpatient, outpatient, community-based)
- Studies published in English language regardless of year of publication.

Data extraction

The data extraction was conducted in pairs. The extracted data was recorded in a Microsoft Excel 2013 spreadsheet and included the following information: author's name, publication year, study design, sample size, setting, and prevalence of Haemostatic Disorders in Patients with Cardiovascular Diseases.

Data outcome and effect measure

The primary outcome of this review is to assess the Prevalence of Haemostatic Disorders in Patients with Cardiovascular Diseases. A proportion was used to measure the effect for the prevalence.

Quality assessment of studies

The researchers utilized the modified Newcastle-Ottawa Scale (NOS) for cross-sectional studies to assess the quality of studies. The scale consists of three components: Selection, Comparatively and outcome assessment methods, with a total score of 10 points [12]. Studies that scored five or higher on the NOS were included in the analysis [13]. The quality assessment was independently conducted by the authors, and any discrepancy in the result was resolved through careful examination of the studies by all authors together.

Data analysis and synthesis methods

Stata software version 14 was used for analysis. A random-effect model was used due to heterogeneity of studies, which varied across factors such as study setting, patient's characteristics, demographics, and different risks for the outcome. Heterogeneity among the studies was assessed using Higgin's I^2 to quantify between-study heterogeneity. An I^2 test statistics of < 50 was declared as low heterogeneity, 50–75% was moderate, and $> 75\%$ was high heterogeneity [14]. Subgroup analysis was conducted based on region. The funnel plot and Egger's test were utilized to check for publication bias subjectively and objectively; while sensitivity analyses were performed to assess robustness of the synthesized results.

Results

Selection of the studies

The search strategy retrieved a total of 4872 published articles: 3032 from PubMed, 1073 from Scopus, 571 from web of science, 134 from African journal online and 62 from Google Scholar. After removing duplicates using reference management software, 4687 articles remained. Then 3497 articles were removed by their title and abstract. Following further screening, 609 articles were assessed for eligibility. Out of these, 594 articles were excluded because they didn't meet the inclusion criteria. Finally, fifteen studies were included in the analysis (Fig. 1).

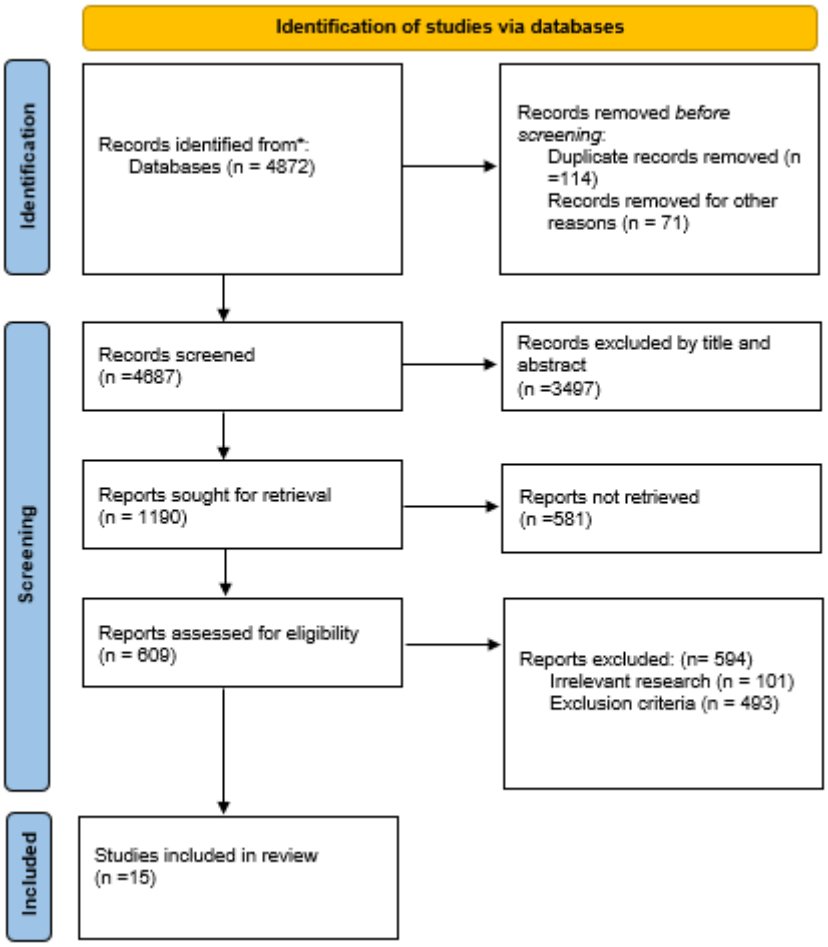

Fig. 1: PRISMA flowchart diagram of the study selection process.

Characteristics of included studies

Fifteen studies [15-29] with, 13009 participants and mostly conducted in Ethiopia [15–19, 24] were included in this study. The sample size ranges from 90 [25] to 7528 [21] participants. Among included studies the prevalence of Haemostatic disorder ranges from 10.1% [29] – 85.7% [29]. All studies had good methodological quality (Table 1).

Table 1: Characteristics of the included studies in the systematic review and meta-analysis.

Authors Name	Study area	Study design	Sample size	Prevalence with 95% CI
Aynalem M, (2022)	Ethiopia	Cross-sectional	988	85.7(83.5-87.8)
Aynalem M, (2021)	Ethiopia	Cross-sectional	384	65.9(61.1-70.6)
Kassa M,(2025)	Ethiopia	Cross-sectional	180	69.2(62.4-75.9)
Alemayehu E, (2024)	Ethiopia	Cross-sectional	124	20.2(13.1-27.2)
Getawa S, (2023)	Ethiopia	Retrospective	245	12.2(8.1-16.2)
Kuczaj A, (2025)	Poland	cohort	113	64.6(55.7-73.4)
Long Y,(2021)	USA	Retrospective	7528	67.9(66.8-68.90
COLON-OTERO GE, (1987)	USA	Cross-sectional	235	19(13.9-24.0)
Kontras SB, (1966)	USA	Cross-sectional	145	15(9.1-20.8)
Alemu N, (2025)	Ethiopia	Cross-sectional	180	60(52.8-67.1)
Awolola OO, (2016)	Nigeria	Cross-sectional	90	6.7(1.53-11.8)
Priyadarshini GP,(2014)	India	Cross-sectional	100	34(24.7-43.2)
Tapia M, (2011)	USA	Retrospective	103	65.6(56.4-74.7)
Mokhtar GM, (2012)	Egypt	Cross-sectional	687	23(19.8-26.1)
Mojadidi MK, (2016)	USA	Retrospective	1907	10.1(8.74-11.4)

Systematic review and meta-analysis

A DerSimonian and Laird random-effects model was fitted to determine the pooled effect size.

Accordingly, the pooled global prevalence Haemostatic Disorders among patients with cardiovascular disease with a random-effects model was 41.2% (95% CI: 23.8-58.6) with heterogeneity index (I^2) of 99.8% (p <0.001) (Fig. 2).

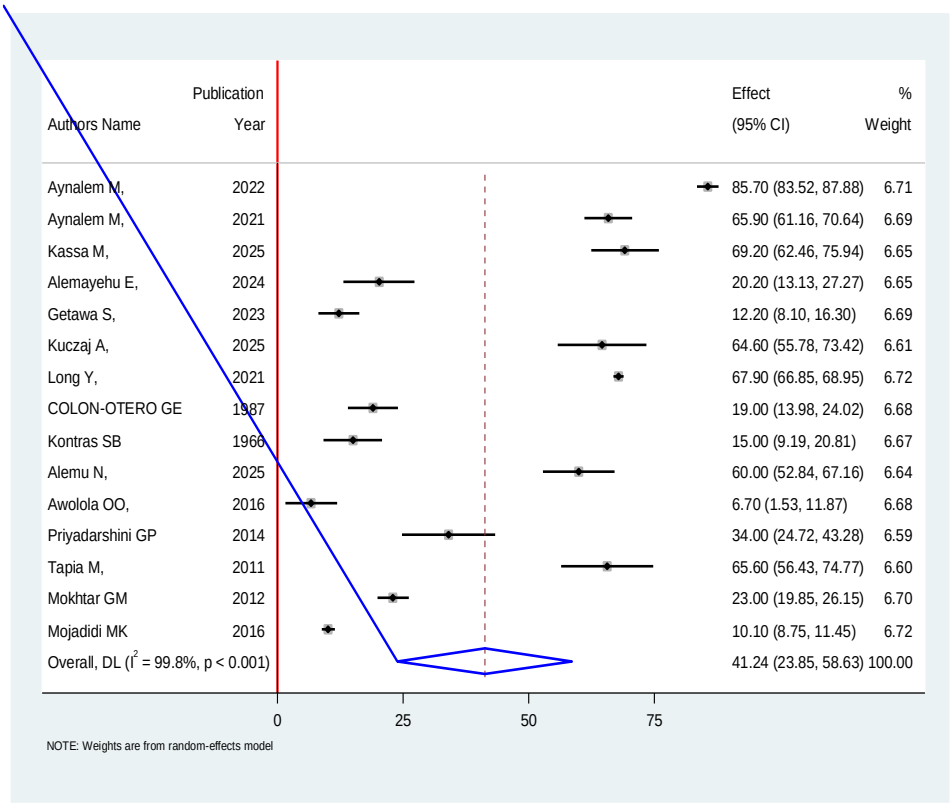

Fig 2: Forest plot showing the global pooled Prevalence of Haemostatic Disorders in Patients with Cardiovascular Diseases.

To adjust and minimize the reported heterogeneity of this study (I^2=99.8%); we performed a subgroup analysis based on the region. The subgroup analysis result is only valid for studies conducted more than once in mentioned region. Accordingly, the highest 42.8%; (95% CI: 17.3-, 68.3), I^2 = 99.7%) seen in Africa region and the lowest 35.4%; 95% CI: 1.5-69.4), I^2 = 99.4%) seen in North America region (Fig. 3).

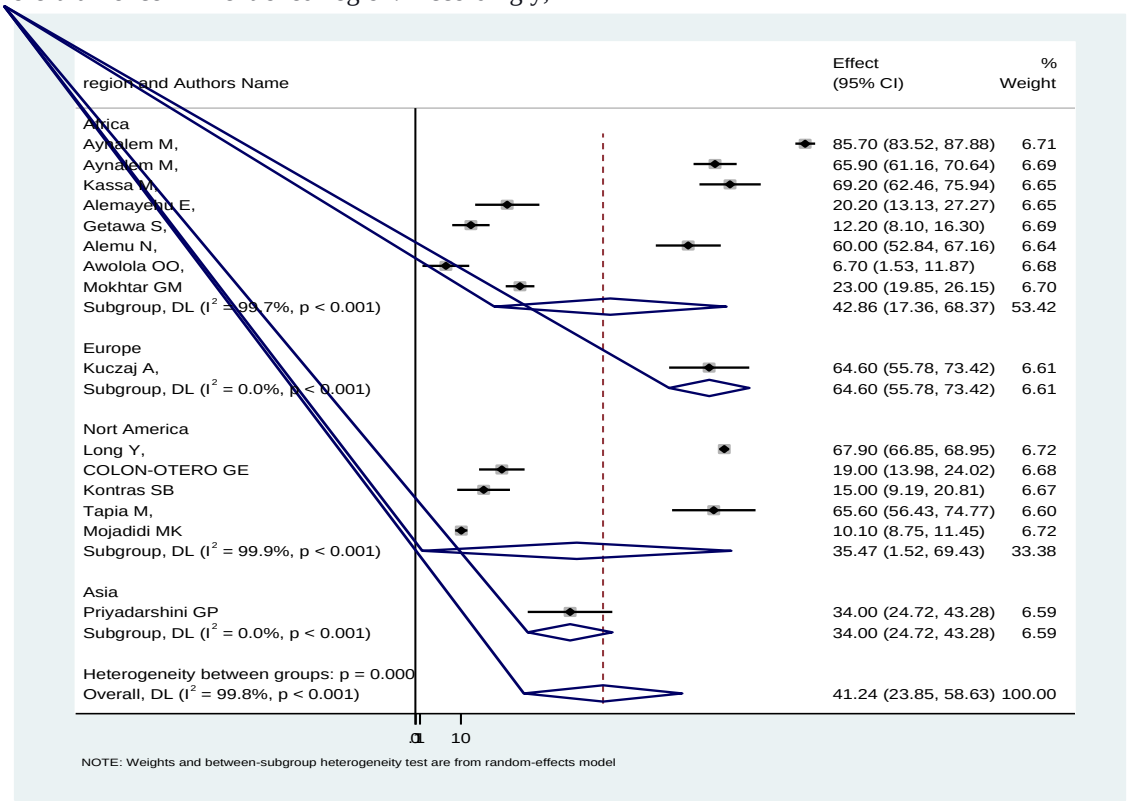

Fig 3: Subgroup analysis of global Prevalence of Haemostatic Disorders in Patients with Cardiovascular Diseases.

To identify the source reported heterogeneity meta-regression was conducted using sample size and publication year as a covariate. It was indicated that there is no effect of sample size and publication year on heterogeneity between studies with a P-value of 0.698 & 0.846 respectively.

Furthermore, the presence of publication bias was assessed using Egger's regression test and visual inspection of a funnel plot. Egger's test showed a statistically significant evidence of publication bias (0.678). The visual inspection of the funnel plot suggested an asymmetrical distribution of studies with studies unevenly distributed or more points are clustered on the right side around the pooled estimate, suggesting potential publication bias (Fig.4).

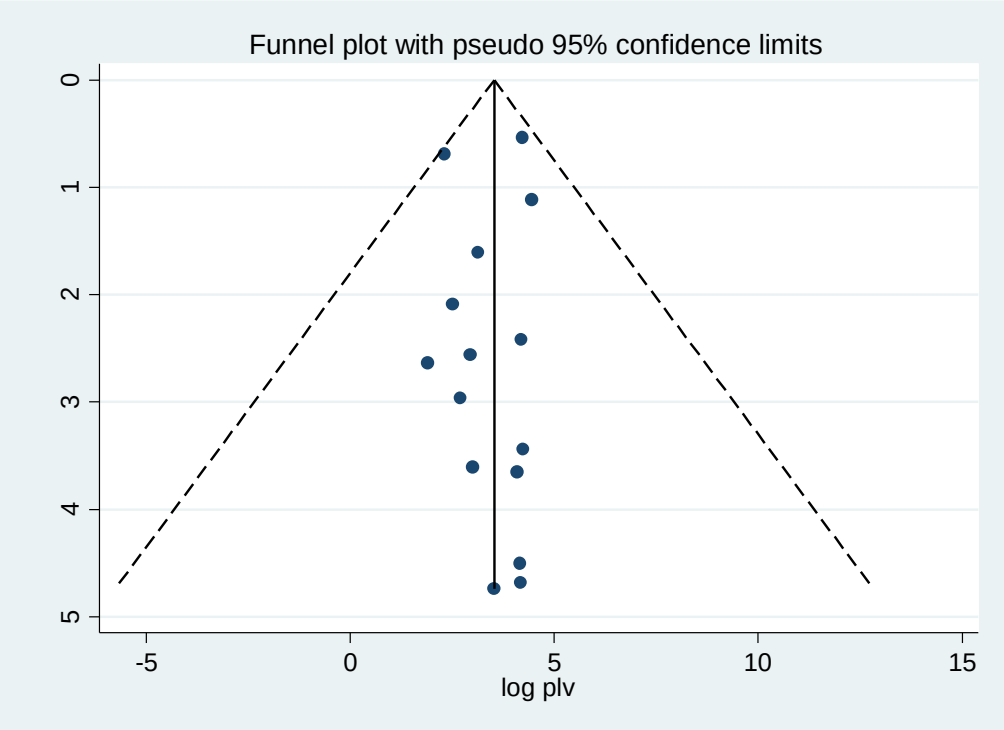

Fig 4: Funnel plot to test publication bias in 15 studies with 95% confidence limits.

Sensitivity analysis

Sensitivity analysis was carried out by removing studies step by step to evaluate the effect of a single study on the overall effect estimate. The result indicated removing a single study did not have a significant influence on pooled prevalence (Fig. 5). The exclusion of studies with the largest and smallest sample size had no significant effect on overall prevalence of Haemostatic disorder among patients with cardiovascular disorder.

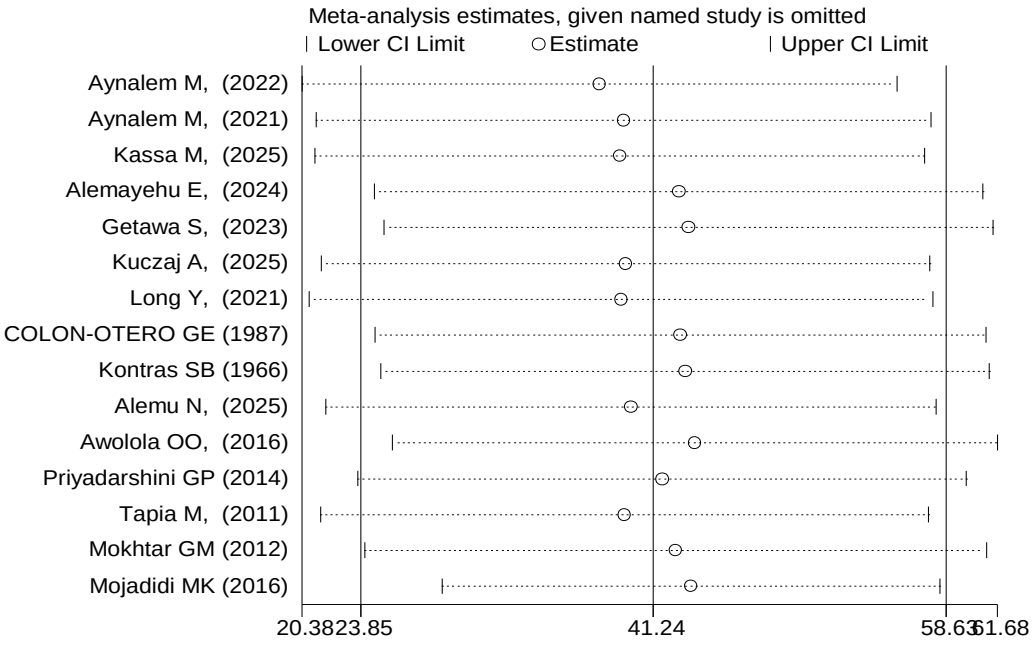

Fig. 5: Sensitivity analysis of pooled global Prevalence of Haemostatic Disorders in Patients with Cardiovascular Diseases for each study being removed one at a time.

Discussion

This systematic review and meta-analysis aimed to synthesize available evidence on the prevalence of Haemostatic Disorders among patients with cardiovascular diseases. These results are consistent with current understanding of cardiovascular disease as not only a disorder of the vasculature but also a condition closely linked to dysregulation of the coagulation system.

In this systematic review and meta-analysis, the global pooled prevalence of Haemostatic disorders among patients with cardiovascular disease was 41.2% (95% CI: 23.8–58.6), indicating that a substantial proportion of cardiovascular patients experience abnormalities in the hemostatic system. This finding supports existing evidence that cardiovascular disease is closely associated with dysregulation of coagulation and fibrinolysis pathways [30, 31]. The pooled prevalence observed in this study is consistent with previous reports demonstrating a high frequency of pro-thrombotic states in patients with coronary artery disease, atrial fibrillation, stroke, and heart failure.

Several studies have reported elevated fibrinogen and D-dimer levels, increased coagulation factor activity, platelet dysfunction, and impaired fibrinolysis among cardiovascular patients, all of which contribute to a hypercoagulable state and increased thrombotic risk. These coagulation abnormalities have been shown to play a central role in thrombus formation and are strongly associated with adverse cardiovascular outcomes, including myocardial infarction and ischemic stroke [32, 33].

The subgroup analysis result is only valid for studies conducted more than once in mentioned region. Accordingly, the highest 42.8%; (95% CI: 17.3-, 68.3), I^2 = 99.7%) seen in Africa region and the lowest 35.4%; 95% CI: 1.5-69.4), I^2 = 99.4%) seen in North America region. These differences might be explained variation in population characteristics, comorbid conditions, healthcare access, diagnostic capacity, and laboratory standards across regions may influence the detection and reporting of haemostatic disorders.

Limitation of the study

This systematic review and meta-analysis faced limitations. First, the presence of significant heterogeneity and publication bias means that the results should be interpreted with caution. Secondly, we encountered difficulties in comparing our results due to the absence of regional and worldwide systematic reviews and meta-analyses.

Conclusion

Despite of substantial morbidity and mortality related to haemostatic disorders, this systematic review and meta-analysis demonstrates that these conditions remain highly prevalent among patients with cardiovascular disease; indicating that nearly two out of five patients with cardiovascular disease are affected. Therefore, routine screening, early detection, and appropriate management of haemostatic disorders in this population are essential. Furthermore strengthening preventive strategies and integrating haemostatic assessment into cardiovascular care may help reduce complications and improve clinical outcomes.

Declarations

Ethic approval and consent to participant
Not applicable

Consent for publication
Not applicable

Availability of data and materials
The data analyzed during the current systematic review and meta-analysis is fully available with reasonable request.

Competing interests
all the authors declare that they have no competing interests

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