



Prevalence of atrial fibrillation among patients with rheumatic valvular heart disease in Ethiopia: A systematic review and meta-analysis

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ABSTRACT

Atrial fibrillation is a common complication of rheumatic valvular heart disease that increases the risk of cardioembolic events and contributes to mortality. In Ethiopia, there is a paucity of studies on the subject, with inconsistent findings between studies. Therefore, this study aimed to estimate the prevalence of atrial fibrillation and identify associated factors among patients with rheumatic valvular heart disease in Ethiopia. Searches were performed in PubMed, Cochrane Library, Google Scholar, HINARI, African Journals Online (AJOL), Europe PMC, and institutional repositories. Data were extracted using an Excel sheet and analysed using STATA version 19. Heterogeneity between studies was assessed using the I^2 statistic and Cochran's Q test. A qualitative summary of the included studies was performed, and effect sizes were pooled using a random-effects model to estimate the pooled prevalence with a corresponding 95% confidence interval. Ten studies involving 2332 participants were included in this meta-analysis. The prevalence of atrial fibrillation among patients with rheumatic valvular heart disease was 31.86% (95% CI: 17.48–46.23), with substantial heterogeneity ($I^2 = 98.72\%$). A higher prevalence was noted among older patients. In addition, mitral stenosis was found to be a statistically significant factor associated with atrial fibrillation (OR = 5.34; 95% CI: 1.88–8.79). Clinicians should actively monitor patients with rheumatic valvular heart disease, especially those with mitral stenosis, for atrial fibrillation to facilitate timely management and reduce the risk of complications. This systematic review and meta-analysis was registered in PROSPERO (CRD420251054974).

1. Introduction

Rheumatic valvular heart disease (RVHD) is a prevalent cardiac condition predominantly affecting low- and middle-income countries [1] and is a leading cause of cardiovascular morbidity in sub-Saharan African countries [2]. Atrial fibrillation (AF) is among the most common complications of chronic rheumatic valvular heart disease and increases morbidity and mortality [3,4]. The pathogenesis of AF in RVHD is a complex and multifactorial process driven by chronic hemodynamic stress. In RVHD, particularly with mitral stenosis, chronic left atrial

pressure overload leads to progressive atrial dilatation [5]. The sustained hemodynamic stress triggers structural remodeling, including cardiomyocyte degeneration and extensive interstitial fibrosis [6,7]. Furthermore, evidence indicates ongoing inflammation, which further disrupts the structural integrity of atrial myocardium and electrical coordination [8]. These changes create areas of slow and heterogeneous electrical conduction, promoting re-entrant circuits [9,10]. Studies have shown a higher risk of decompensated heart failure and cardioembolic events, such as stroke and limb ischemia, among RVHD patients with AF [4,11].

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Globally, studies have shown that more than one-third of patients with RVHD have AF, with prevalence varying according to a country's level of development [12]. Sub-Saharan African countries are among the most affected regions, with reported prevalence ranging from 10.1% to 44.4% [13,14]. In Ethiopia, rheumatic valvular heart disease is a public health concern, with reported prevalence of AF ranging widely from 4.38% to 51.2% [15–17]. Despite its clinical relevance, national estimates of the prevalence of AF and its associated factors among RVHD patients in Ethiopia are lacking. A previous global meta-analysis [12] used prevalence data from only one study conducted in Ethiopia [18] and did not provide a comprehensive estimate. Thus, this study aimed to assess the prevalence of AF and its associated factors among patients with RVHD in Ethiopia.

2. Methods

2.1. Protocol registration

The conduct and reporting of this systematic review and meta-analysis strictly adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines, and the protocol was prospectively registered in PROSPERO (CRD420251054974).

2.2. Search strategy and sources

Two independent reviewers conducted database searches in PubMed, Google Scholar, Europe PMC, AJOL, Cochrane Library, and HINARI from May 24, 2025, to June 3, 2025. Additionally, grey literature was searched in the institutional repositories of Addis Ababa University and Jimma University. The search was conducted without restrictions on publication year. For the Google Scholar search, we used the search syntax: allintitle: Ethiopia ("atrial fibrillation" OR AF) AND ("rheumatic heart disease" OR "rheumatic valvular heart disease"). For PubMed searches, the search syntax (((("atrial fibrillation") OR ("AF")) AND ("rheumatic heart disease")) OR ("rheumatic valvular heart disease")) AND (Ethiopia) was used. The PRISMA 2020 guidelines were used to report the study selection steps.

2.3. Eligibility criteria

For this study, cross-sectional, case-control, and cohort studies, as well as baseline prevalence data from clinical trials, were eligible if they reported the prevalence or provided sufficient data to calculate the prevalence of AF among RVHD patients in Ethiopia. Studies conducted outside Ethiopia, those that did not report the outcome of interest, case reports, conference proceedings, abstracts without a retrievable full article, and studies without original data were excluded.

2.4. Quality appraisal

Quality appraisal was performed by two independent reviewers using the Joanna Briggs Institute (JBI) checklist for prevalence and analytical cross-sectional studies [19]. Studies were classified as good, moderate, and poor quality if they scored ≥ 7 , 4–6, and ≤ 3 , respectively [20].

2.5. Data extraction

The identified studies were imported into Rayyan AI and independently screened by two reviewers based on predefined eligibility criteria. After duplicates were removed, studies were first screened based on their titles and abstracts. Subsequently, a full-text review was conducted, and data extraction was carried out by two reviewers using a pre-prepared data extraction table. Disagreements were resolved through discussions with a third reviewer. Data regarding the first

author's name, year of publication, geographic region where the study was conducted, study design, population subgroup, sample size, prevalence of AF, number of cases with the outcome, and associated factors reported as odds ratios with 95% confidence intervals were collected from the included studies. When prevalence was not reported, we calculated the prevalence from data presented in frequency tables.

2.6. Data processing and analysis

The extracted data were exported and analyzed using STATA version 19. Some prevalence estimates lacked 95% confidence intervals, and imputation was performed. Heterogeneity among studies was evaluated using Cochran's Q test and the I^2 statistic. A random-effects model was used, and the results were presented in a forest plot. Meta-regression was conducted using sample size and year of publication as covariates. Subgroup analysis was conducted based on age categories. A leave-one-out sensitivity analysis was conducted to assess the effect of a single study on the overall pooled estimate. Publication bias was assessed using a funnel plot and Egger's test. To identify factors associated with AF, we considered variables that were significantly associated with AF in at least two studies.

3. Results

3.1. Search results and overview of included studies

After database searches, we identified 324 articles, of which 66 duplicate records were removed. After screening the titles and abstracts, 228 irrelevant articles were removed, and 30 studies were included in the full-text review. Subsequently, 20 articles were excluded after a full-text review. Of the excluded studies, 2 did not meet the eligibility criteria for publication type, 1 had no retrievable full text, 8 did not report the outcome of interest, and 9 did not involve the eligible study population (i.e., were conducted outside Ethiopia or among patients without RVHD). Finally, 10 articles met the eligibility criteria and were included in the analysis (Fig. 1).

3.2. Description of included studies

This review included 10 cross-sectional studies with 2332 participants. Among these, 5 were conducted in Addis Ababa [17,18,21–23], 2 in Amhara [16,24], 1 in Harari [25], and 2 in Oromia [26,27]. Moreover, 3 studies were conducted among adolescents and adults [22,24,27], 4 studies included adults only [16,23,25,26], 2 included the pediatric age group [17,21], and 1 study included all age groups [18]. In addition, 2 of the studies were from grey literature sources [22,25]. In the quality appraisal, all studies scored 50% or above (Table 1). All studies used a standard 12-lead ECG or documentation of a prior AF diagnosis in the medical chart.

3.3. Meta-analysis of atrial fibrillation among patients with rheumatic valvular heart disease in Ethiopia

We included 10 studies to estimate the pooled prevalence of AF. Given the substantial heterogeneity ($I^2 = 98.72\%$), a random-effects model was used, and the pooled prevalence was 31.86% (95% CI: 17.48–46.23) (Fig. 2). Subgroup analysis was performed based on age group. A lower prevalence was observed among studies involving children only (4.86%, $I^2 = 10.90\%$) compared with studies involving adults (40.12%), and the difference in pooled prevalence between age categories was statistically significant ($p < 0.001$) (Fig. 3). Further subgroup analysis of high-quality studies showed a prevalence of 29.2% (95% CI: 13.3–48.3). We conducted a meta-regression using sample size and year of publication as covariates to identify potential sources of heterogeneity, and neither variable was a significant source of heterogeneity (Table 2). The robustness of the estimates was assessed using a leave-

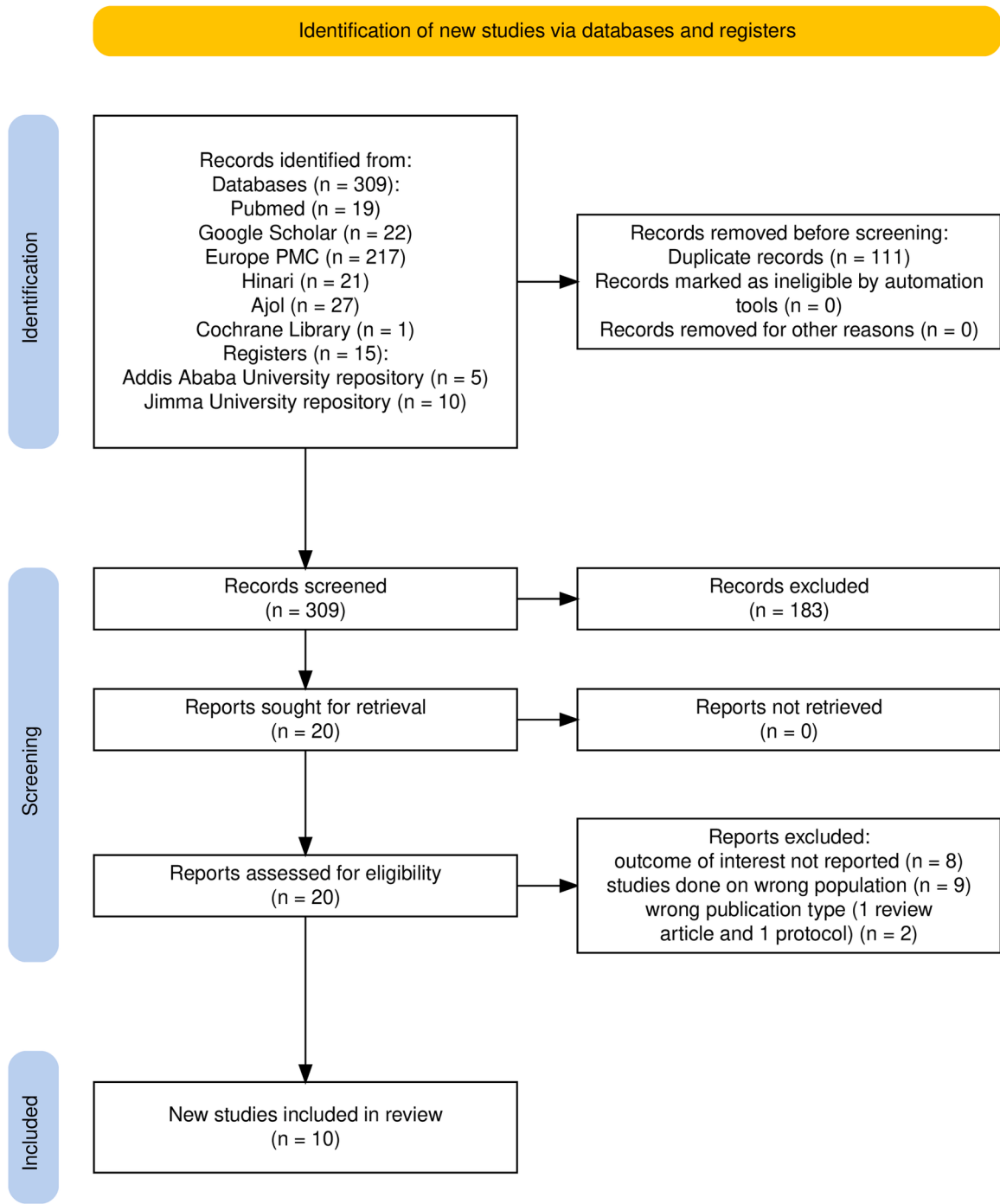


Fig. 1. PRISMA study selection flow for the prevalence of atrial fibrillation among patients with rheumatic valvular heart disease in Ethiopia: a systematic review and meta-analysis.

one-out analysis, which showed a stable pooled prevalence, with no individual study exerting a significant influence on the overall estimate (Fig. 4).

3.4. Meta-analysis of factors associated with atrial fibrillation among patients with rheumatic valvular heart disease in Ethiopia

Of the included studies, 3 reported factors associated with AF among patients with RVHD [16,23,24]. Three factors (age, mitral stenosis, and left atrial size) were identified in at least two studies. However, the categories and comparator groups differed among studies for age group and left atrial size. Thus, we pooled only the odds ratios for mitral

stenosis. The presence of mitral stenosis was associated with 5.34-fold higher odds of having AF among patients with RVHD (95% CI: 1.88–8.79) (Fig. 5).

3.5. Publication bias assessment

The funnel plot showed a slight asymmetry towards the right (Fig. 6). However, Egger’s test showed no statistically significant evidence of publication bias (p = 0.578).

Table 1
Summary of included studies for prevalence of atrial fibrillation among patients with rheumatic valvular heart disease in Ethiopia: a systematic review and meta-analysis.

First author	Year	Region	Study design	Study population	Sample size	Prevalence (%)	Lower 95% CI	Upper 95% CI	Quality score
Mengie et al.	2024	Amhara	Cross-sectional	Adolescents and adults	410	43.00	38	48	87.5%
Berhanu et al.	2024	Oromia	Cross-sectional	Adults	115	19.10	12.1	26.1	77.77%
Beyene et al.	2025	Amhara	Cross-sectional	Adults	402	51.20	46.7	55.7	87.5%
Tadele et al.	2013	Addis Ababa	Cross-sectional	Pediatrics	365	4.38	2.38	6.38	87.5%
Mulugeta et al.	2020	Oromia	Cross-sectional	Adolescents and adults	47	48.90	34.9	62.9	55.55%
Yadeta et al.	2019	Addis Ababa	Cross-sectional	Adults	500	46.80	42.3	51.3	87.5%
Yifru et al.	2023	Harari	Cross-sectional	Adults	110	42.72	33.72	51.72	55.55%
Desta et al.	2023	Addis Ababa	Cross-sectional	Pediatrics	44	9.10	0.6	17.6	55.55%
Getnet et al.	2020	Addis Ababa	Cross-sectional	Adolescents and adults	256	32.42	26.92	37.92	66.66%
Guteta et al.	2016	Addis Ababa	Cross-sectional	All ages	105	21.90	13.9	29.9	77.7%

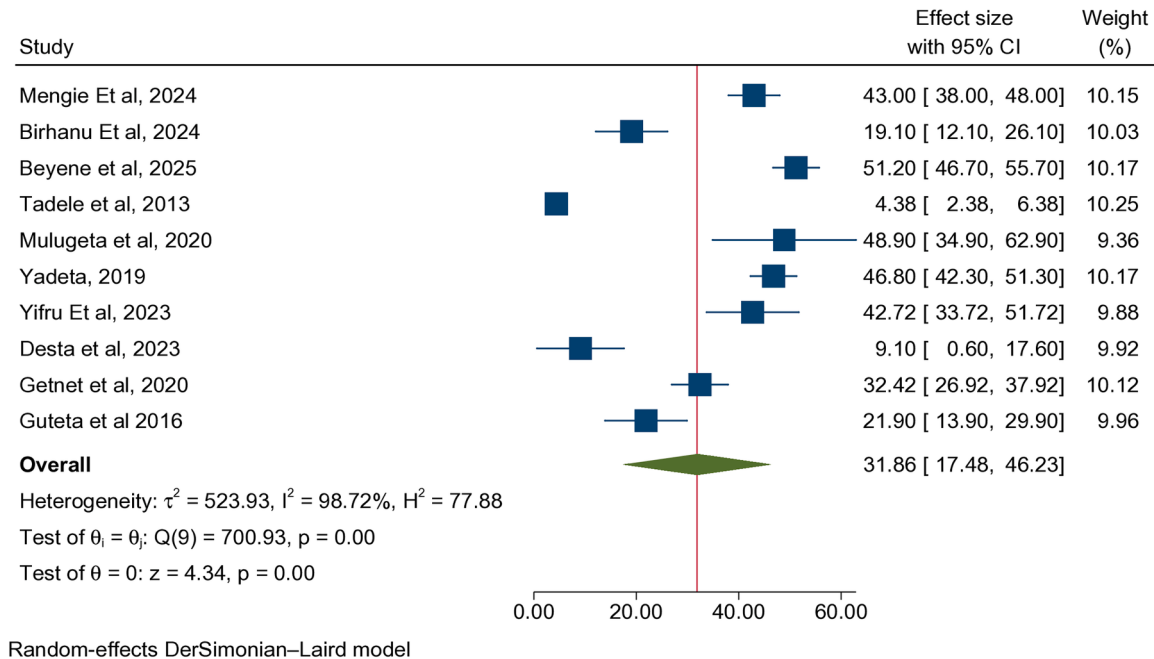


Fig. 2. Pooled prevalence of atrial fibrillation among patients with rheumatic valvular heart disease in Ethiopia.

4. Discussion

This systematic review and meta-analysis estimated the pooled prevalence of AF among patients with RVHD in Ethiopia to be 31.86%. This finding is comparable to findings from studies conducted in Nepal (36.3%) [28] and a previous global meta-analysis (32.86%) [12]. However, it is higher than the prevalence reported by studies conducted in Nigeria (10.1%) [14], Uganda (13.9%) [29], India (23.9%) [30], and Korea (20.5%) [31]. The comparatively higher AF prevalence observed in our study could be related to the high burden of rheumatic heart disease in Ethiopia [1]. Moreover, all included studies were conducted in tertiary care settings, where advanced cardiac conditions are treated, which could explain the observed high prevalence. Furthermore, the prevalence of atrial fibrillation was higher among adults and adolescents than among pediatric groups. A previous global meta-analysis showed that the prevalence of atrial fibrillation increased with increasing time since diagnosis [12]. The late detection of valvular pathologies and limited capacity for early surgical interventions in sub-Saharan countries, such as Ethiopia, could also explain the observed discrepancies between these age groups [32,33].

Furthermore, mitral stenosis was a statistically significant factor associated with AF. This is consistent with the findings of previous studies conducted globally, which reported higher odds of AF among those with mitral stenosis [28]. This finding is in line with the known

pathophysiological mechanism, whereby chronic left atrial pressure overload secondary to mitral valve stenosis causes electrical remodeling and predisposes patients to arrhythmias such as AF [3].

This study had some limitations that should be considered. First, all included studies were cross-sectional, which limits causal inferences. Second, although subgroup analyses and meta-regression were performed to identify potential sources of heterogeneity, substantial heterogeneity persisted. This suggests that unmeasured clinical factors such as variation in disease severity, duration since RHD diagnosis, and other unmeasured epidemiological factors may have contributed to the observed between-study differences. Therefore, the pooled estimate should be interpreted as an exploratory summary measure rather than a precise national prevalence estimate, and caution is warranted in generalizing this finding to all Ethiopian RVHD patients. Pooling of evidence regarding the factors associated with atrial fibrillation was limited by the availability of data and inconsistencies in the categorical classification of identified factors. Lastly, all studies were conducted in large referral hospitals where a higher level of care is provided for advanced cardiac disease, and the findings could be biased toward an overestimation of the true prevalence.

Despite these limitations, this systematic review and meta-analysis provides an important synthesis of the available evidence on AF among patients with RVHD in Ethiopia and addresses a notable gap in the national literature. The substantial between-study heterogeneity and

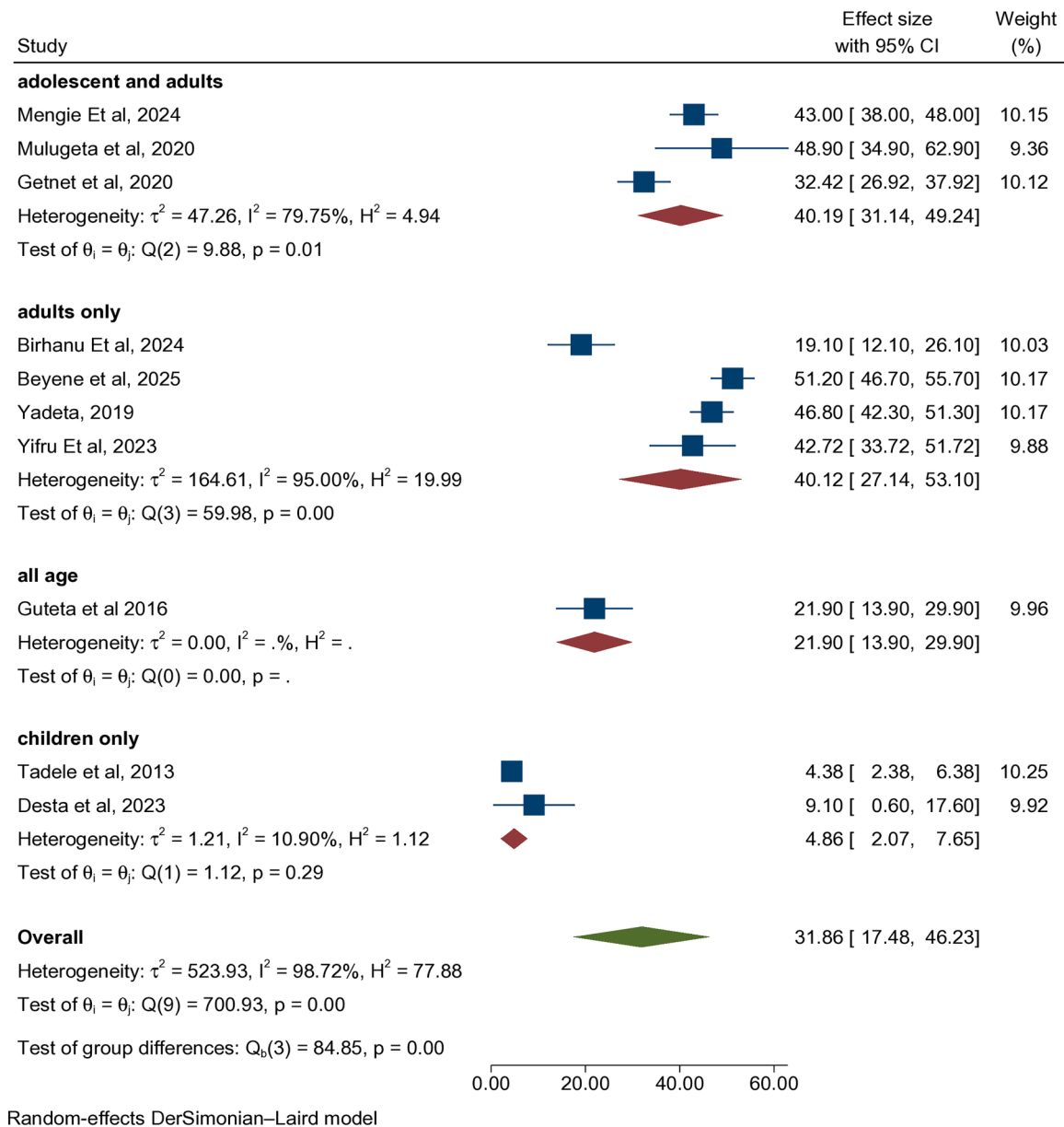


Fig. 3. Pooled subgroup prevalence of atrial fibrillation among patients with rheumatic valvular heart disease in Ethiopia based on age groups.

Table 2
Meta-regression for potential factors associated with heterogeneity between studies.

Source	Coefficient	Standard error	p-value
Year of publication	0.0221	0.0130	0.089
Sample size	0.00038	0.00029	0.205

limited number of available studies, however, limit the strength of implications for clinical practice. Furthermore, the limited evidence on clinically relevant factors associated with AF and inconsistencies in their measurement and classification limit the development of clinically meaningful risk-stratification approaches for Ethiopian patients with RVHD. Future research should prioritize prospective, multicenter studies using standardized definitions and assessment methods for demographic, clinical, and echocardiographic factors. Studies should also investigate disease duration, valvular lesion severity, and inflammatory biomarkers as potential predictors of AF.

5. Conclusion

Atrial fibrillation affects nearly one-third of patients with rheumatic valvular heart disease in Ethiopia, and mitral stenosis is a statistically significant factor associated with atrial fibrillation. We recommend routine electrocardiographic evaluation of patients with RVHD to detect AF early and treat them according to accepted guidelines to prevent AF-associated morbidity and mortality. Furthermore, clinicians should vigilantly monitor patients with RVHD and mitral stenosis for signs of AF. In the future, longitudinal studies should be conducted using standardized definitions of exposure variables to determine the predictors of AF in RVHD.

CRediT authorship contributions

Robel Tibebe Kasaye: Conceptualization, Project administration, Methodology, Writing – original draft, Writing – review & editing, Data curation, Validation, Software, Formal analysis. Paulos Mengistu Abebe: Writing – review & editing, Data curation, Validation, Formal analysis.

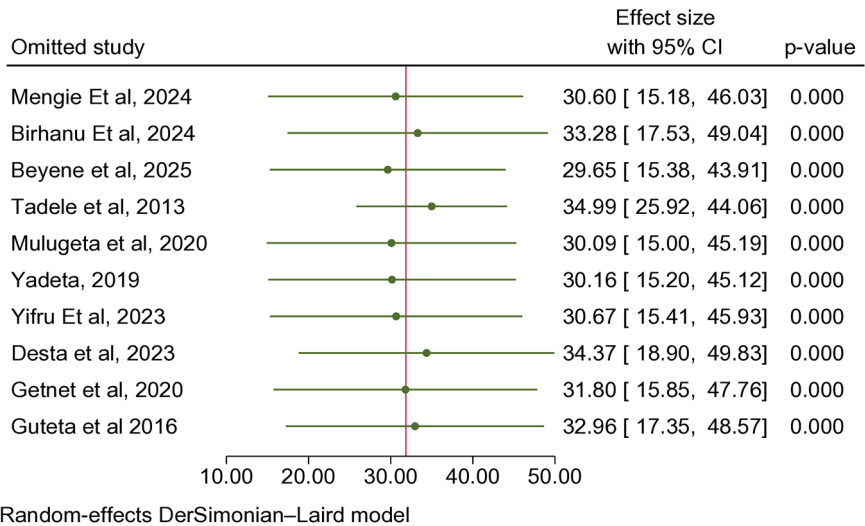


Fig. 4. Leave-one-out meta-analysis for the pooled prevalence of atrial fibrillation among patients with rheumatic valvular heart disease in Ethiopia.

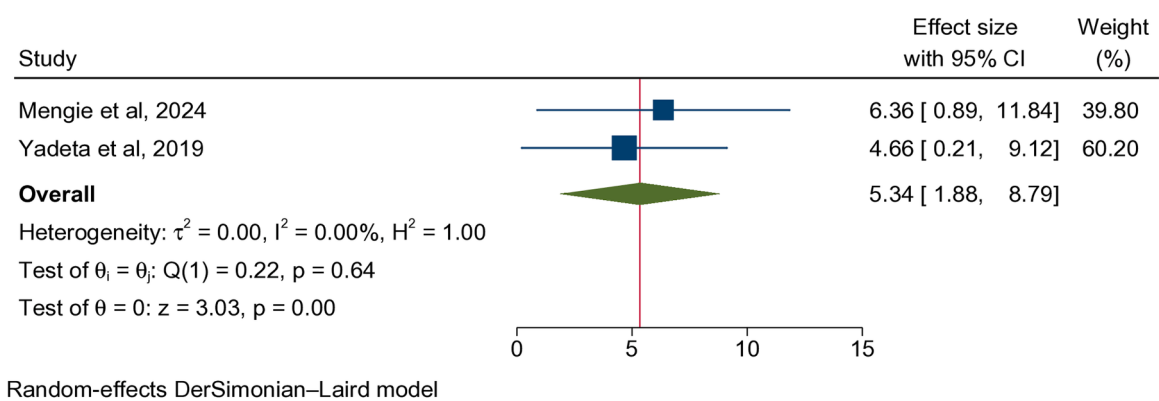


Fig. 5. Association between mitral stenosis and atrial fibrillation among patients with rheumatic valvular heart disease in Ethiopia.

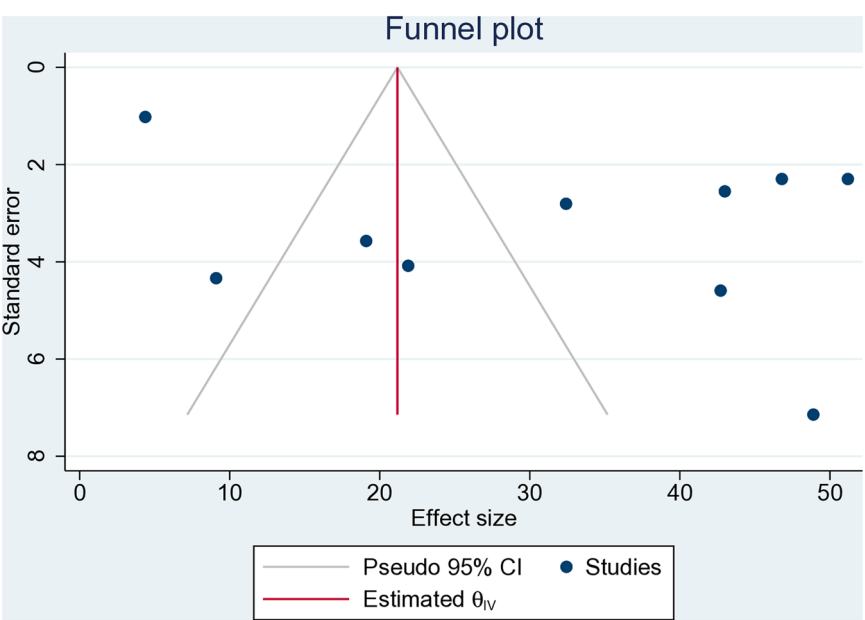


Fig. 6. Funnel plot for assessment of publication bias among studies included in the meta-analysis of the prevalence of atrial fibrillation among patients with rheumatic valvular heart disease in Ethiopia.

Yegeta Wondafrash Habte: Writing – review & editing, Visualization, Data curation. Mahlet Minwuyelet Dagne: Writing – original draft, Resources, Formal analysis. Alazar Addisu Likassa: Writing – review & editing, Data curation, Visualization. Sofonyas Silesh Sinshaw: Writing – review & editing, Data curation, Resources. Bemnet Getahun Wassie: Writing – review & editing, Data curation, Resources. Kibruyisfaw Weldeab Abore: Supervision, Writing – review & editing, Software, Formal analysis, Validation, Visualization.

Consent for Publication

Not applicable

Ethical considerations

This study is a systematic review and meta-analysis of publicly available, published data. Ethical approval was therefore not required.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.glmedi.2026.100255](https://doi.org/10.1016/j.glmedi.2026.100255).

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