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SYSTEMATIC REVIEW

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Epidemiology and clinical implications of atrial fibrillation among stroke patients in Ethiopia: a comprehensive systematic review and meta-analysis

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Abstract

Background Atrial fibrillation (AF) is a significant risk factor for stroke, imposing a substantial burden on healthcare systems. While studies have shown varying AF prevalence among stroke patients, limited pooled data exists in low-resource settings like Ethiopia. This hinders our understanding of the problem's extent and limits effective prevention and management strategies. Therefore, this systematic review and meta-analysis aimed to determine the pooled prevalence of atrial fibrillation among stroke patients in Ethiopia.

Methods The searches were carried out in electronic databases such as PubMed/MEDLINE, EMBASE, Science Direct, Web of Science, and Google Scholar. Observational study designs were selected, and studies published until 30 November 2023 addressing the prevalence of atrial fibrillation among stroke patients were identified. Endnote citation manager software version X_9 for Windows was used to collect and organize the search outcomes and remove duplicate articles. The relevant data were extracted from the included studies using a format prepared in Microsoft Excel and exported to STATA 18.0 software for the outcome measures analyses and subgrouping.

Results Twenty-three research articles were included in the final analysis. These studies evaluated a total of 4,544 stroke patients, of whom 529 were diagnosed with atrial fibrillation (AF). The overall pooled prevalence of AF among stroke patients was 13% [95% CI: (10%, 17%)]. Subgroup analysis by region revealed that the highest pooled prevalence of AF was 16% [95% CI: (8%, 25%)] in the Amhara region, followed by the Oromia region at 15% [95% CI: (7%, 23%)]. In Addis Ababa City, the pooled prevalence of AF among stroke patients was 11% [95% CI: (7%, 15%)]. The Tigray region reported a pooled prevalence of 9% [95% CI: (6%, 11%)]. However, one study from the Southern Nations, Nationalities, and Peoples' Region reported a lower prevalence of AF among stroke patients at 7% [95% CI: (3%, 11%)].

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Conclusion In summary, the study revealed that AF is prevalent among stroke patients in Ethiopia, with regional differences in prevalence. The high prevalence of AF emphasizes the necessity for effective management strategies to prevent recurrent strokes.

Systematic review registration number PROSPERO CRD: CRD42024581661.

Keywords Atrial fibrillation, Ethiopia, Stroke, Systematic review, Meta-analysis

Introduction

Atrial fibrillation (AF), a common cardiac arrhythmia characterized by irregular and rapid heartbeats, significantly impacts stroke risk and outcomes. As the most prevalent sustained cardiac arrhythmia [1–3], AF poses a major global health threat. Its association with stroke, a leading cause of mortality and morbidity worldwide, underscores its clinical significance [4, 5]. The literature extensively documents the clinical impact of AF among stroke patients. Numerous studies highlight AF's substantial contribution to stroke incidence, severity, and outcomes [5–8]. It increases the risk of stroke by nearly five times, and projections indicate a further rise in this risk, potentially reaching up to 25 [9]. Epidemiological evidence consistently supports AF as a leading cause of ischemic stroke, particularly in older adults [10, 11]. Beyond its impact on stroke incidence and severity, AF is also associated with a higher risk of recurrent stroke and other cardiovascular events. Patients with AF are more likely to experience recurrent strokes, exacerbating the overall burden of AF-related stroke [12–14].

The economic burden of AF-related stroke is substantial, with significant healthcare costs associated with the management and treatment of stroke patients with AF. These costs encompass hospitalization, rehabilitation, long-term care, and medications [15–17]. Moreover, the burden extends beyond the individual patient, affecting families and caregivers who often face emotional, financial, and social challenges in caring for stroke survivors with AF [18, 19].

In low- and middle-income countries like Ethiopia, the impact of AF-related stroke may be particularly pronounced due to limited healthcare resources. Inadequate access to specialized care, diagnostic tools, and medications can further exacerbate the outcomes of AF-related stroke in these settings [20]. Given the significant burden of atrial fibrillation among stroke patients, there is a critical need for research and healthcare interventions to improve management and outcomes. This includes enhancing stroke prevention strategies, optimizing AF management for stroke patients, and improving access to quality care for individuals with AF in Ethiopia and similar settings [14, 20–23].

The complex interplay between AF and stroke underscores the urgent need for effective prevention and management strategies. Understanding the prevalence of AF among stroke patients is essential for comprehending the burden of AF-related stroke and developing targeted interventions [24, 25]. It is a complex condition influenced by a multitude of factors that can be categorized as either modifiable or non-modifiable. Non-modifiable risk factors include age, with the risk increasing significantly after the age of 60; genetics, where a family history of AF can elevate the risk; and structural abnormalities of the heart, such as enlarged chambers or valve issues [26–28].

Modifiable risk factors, which individuals can change or manage to lower their risk of AF, encompass high blood pressure, heart disease (including coronary artery disease and heart failure), and certain surgical procedures or illnesses (e.g., pneumonia). Additional modifiable factors include obesity (particularly when associated with hypertension or heart disease), smoking, excessive alcohol consumption, chronic stress and anxiety, sleep apnea, and stimulant intake (e.g., caffeine). Certain medications, such as beta-blockers and calcium channel blockers, can also help mitigate the risk [26, 27, 29]. It is crucial to recognize that the risk of AF often stems from a combination of these factors. Individuals with multiple risk factors are at greater risk overall. By actively addressing modifiable risk factors through lifestyle changes and medical interventions, individuals can significantly decrease their likelihood of developing atrial fibrillation.

Existing studies have demonstrated a high prevalence of AF among stroke patients, emphasizing its significant burden on the healthcare system The prevalence of AF among stroke patients varies widely across studies, and there is a need to synthesize the available evidence to obtain a more accurate estimate. However, the availability of pooled data on AF prevalence in low-resource settings, such as Ethiopia, remains limited. This lack of comprehensive data hinders our understanding of the true extent of the problem and limits the development of effective prevention and management strategies. To address this knowledge gap, this systematic review and meta-analysis aimed to determine the pooled prevalence of atrial fibrillation among stroke patients in Ethiopia. By providing a comprehensive overview of the available evidence, this study seeks to inform healthcare policy and guide future research efforts to improve the management of AF-related stroke in the Ethiopian context.

Methods

Reporting

This systematic review and meta-analysis were based on the recommended methodology and followed the Preferred Reporting Items for Systematic Review and Meta-Analysis for (PRISMA) 2020 [30] (Fig. 1) and the Meta-analysis of Observational Studies in Epidemiology (MOOSE) guideline [31]. The results were reported based on the PRISMA statement and the article screening and selection process were demonstrated through a PRISMA flow diagram (Supplementary file 1). It was registered with the International Prospective Register of Systematic Reviews (PROSPERO) (registration number: *CRD42024581661*).

Search strategy

We used different electronic biomedical databases and indexing services such as Google Scholar, Science Direct, Web of Sciences, EMBASE, and PubMed/MEDLINE to explore relevant studies. Potentially applicable studies were manually searched for using a list of references from the retrieved studies. Only studies published in English until 30 November 2023, were considered for inclusion in this review. The Condition, Context, and Population (CoCoPo) framework was used to develop an appropriate search strategy for database searching. The search strategy included keywords or indexing terms related to AF. The search terms used were "magnitude", "prevalence", "epidemiology", "burden" "atrial fibrillation", "stroke", "Cerebrovascular events", "Cerebrovascular accidents", "Ethiopia" (Supplementary file 2). Studies that assessed the prevalence of AF were considered relevant. The search strategy was based on keywords using "Medical Subjects Headings (MeSH)" and "All fields" by linking "AND" and "OR".

Data extraction and quality assessment

Endnote citation manager for Windows Version X_9 (Thomson Reuters, Philadelphia, PA, USA) was used to import the retrieved studies, and duplicates were removed. Two independent reviewers (MM and TM) screened all the articles for the eligibility criteria. Reviewers began by screening the abstract and title, followed by full-text screening. The quality of the articles was

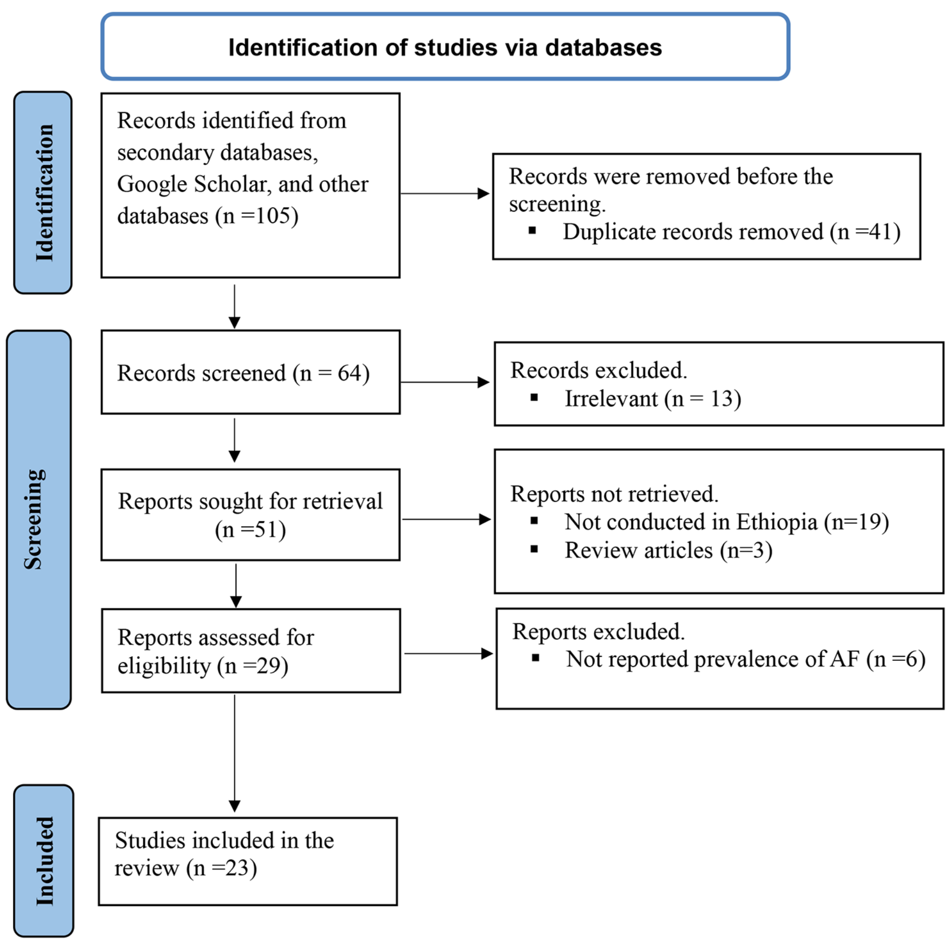

Fig. 1 PRISMA flowchart showing the search and study selection strategy

assessed by using the Newcastle-Ottawa Quality Assessment Scale (adapted for cross-sectional studies) [32] (Supplementary file 3). Disagreements were resolved by inviting a third investigator to participate (YS). 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 the included 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. Microsoft Excel with a standardized extraction format was used by two investigators for the data extraction. The Excel spreadsheet includes the first author's name, sample size, publication year, region, study design, and prevalence of AF.

Eligibility criteria (inclusion and exclusion criteria)

The following criteria were used to include studies:1) study type: observational studies; 2) study period: studies published until 30 November 2023; 3) study area: studies conducted in Ethiopia; 4) Population: people diagnosed with stroke and aged ≥ 18 years; and 5) Published in the English language. Observational studies were included to ensure a focus on real-world data and provide valuable insights into the prevalence of AF among stroke patients in the setting. Case reports, case series, review articles, and letters to editors were excluded. The exclusion of case reports, case series, review articles, and letters to editors helps to maintain the focus on empirical data and avoid potential biases associated with these study types. The CoCoPo format was described as follows:

- Condition (Co): Studies that assessed the prevalence AF among stroke patients.
- Context (Co): studies conducted in Ethiopia.
- Population (Po): studies that were done among adult stroke patients.

Statistical analysis

STATA version 18 Statistical software (Stata Corp, College Station, Texas, USA) was used for the analysis, and heterogeneity was checked across studies by computing the I^2 statistical test. We assumed no, low, medium, and high heterogeneity across studies if the I^2 values were 0%, 25%, 50%, and 75%, respectively. A random effects model was used to analyze the pooled estimated prevalence with 95% confidence intervals (CI) using the "metaprop" command. Funnel plots for visual inspection and Egger's and Begg's rank tests were used to assess the evidence of publication bias. A forest plot was used to report the estimated pooled prevalence of AF.

Outcome measurement

The study aimed to gather and analyze data from various studies conducted in Ethiopia to determine the pooled prevalence of AF among stroke patients. A systematic approach was employed to identify relevant studies and extract data on outcome measurements, including the prevalence of AF among stroke patients. Statistical methods were then used to combine the data from different studies and estimate the overall prevalence of AF. The critical variables were such as potential risk factors and common medications that serve as prophylaxis to prevent AF not covered in this review. While these variables were not explicitly reported in the primary studies, future research could explore additional factors, such as potential risk factors (e.g., age, hypertension, diabetes, smoking) and the use of common medications (e.g., anticoagulants, beta-blockers) to prevent AF.

Results

Search results

Initially, a total of 105 articles were identified through searches of different databases. Of the identified studies, 41 were removed due to duplication. Thirteen were excluded after reviewing their abstracts and titles. The full texts of the remaining fifty-one articles were sought for retrieval, of which 22 were removed and the remaining (n=29) included full assessment based on the eligibility criteria. We again excluded (n=6) articles, which didn't report the outcome of interest. Finally, the review included 23 studies conducted between 2015 and 2023. Figure 1 illustrates the process of the literature review, screening, and eligibility assessment of the study articles.

Characteristics of the included studies

Of the 21 studies included in the final analysis, eight were from the Amhara region [33–40], and five were from Addis Ababa city [41–45] and the other six were from Oromia region [46–51]. There were three articles each from the Tigray region [52–54]. Only one study was from the South Nations, Nationalities, and Peoples Region (SNNPR) [55]. There were no studies reported from other administrative regions of the country. In terms of study design, ten studies employed a retrospective cross-sectional study design [33, 34, 36–38, 42–44, 46, 50, 53], ten were conducted using a prospective cross-sectional design [35, 39–41, 47–49, 52, 54, 55], and one study used a prospective cohort [45] and the other two retrospective cohort design [34, 51] (Table 1).

Table 1 Baseline characteristics of the included studies

Author, publication year	Study design	Region	Facility Name	Mean age (years)	Gender (Female)	Sample size	AF cases (*n*)
Ameha, 2020 [42]	Retrospective cross-sectional	Oromia	JMC	62:33 ± 15:77	32.7	220	12
Ayalew, 2017 [37]	Prospective cross-sectional	Addis Ababa	TASH	53 ± 17	44	104	7
Ayehu, 2019 [38]	Retrospective cross-sectional	Addis Ababa	TASH	52.49 ± 17.53	42.9	170	23
Belayneh, 2019 [43]	Prospective cross-sectional	Oromia	AURH	63.36 ± 12.60	50.5	111	22
Beza, 2016 [36]	Prospective cross sectional	Amhara	FHRH	Na	36.8	427	21
Bikila, 2017 [39]	Retrospective cross-sectional	Addis Ababa	SPMMC	57.5 ± 15.8	43.6	163	24
Birrie, 2015 [51]	Prospective cross-sectional	SNNPR	HURH	53.1 ± 16.9	33.7	163	12
Ermias, 2015 [29]	Retrospective cross-sectional	Amhara	UGH	68	53.1	98	27
Eyob, 2018 [30]	Retrospective cohort	Amhara	UGH	65.17 ± 14.068	57.7	208	76
Firomsa, 2023 [44]	Prospective cross-sectional	Oromia	MKGH, BGH	57.9	37	135	9
Gashaw, 2022 [31]	Prospective cross-sectional	Amhara	UGH, TGSP, FHRH	61 ± 12.85	53.3	554	5
Ginenus, 2019 [45]	Prospective cross sectional	Oromia	JMC	55.1 ± 14.0	37.1	116	19
Hayet, 2018 [46]	Retrospective cross-sectional	Oromia	JMC	Na	32.07	367	45
Henok, 2020 [32]	Retrospective cross-sectional	Amhara	DMRH	60	53.7	162	30
Hussein, 2022 [33]	Retrospective cross-sectional	Amhara	DCSH	59.2 ± 14.6	51.9	312	47
Kibreab, 2023 [48]	Prospective cross-sectional	Tigray	ACSH	Na	57.4	272	22
Menbeu, 2017 [40]	Retrospective cross-sectional	Addis Ababa	TASH	55	57.5	301	43
Samson, 2018 [34]	Retrospective cross-sectional	Amhara	FHRH	Na	37	508	37
Seid, 2019 [35]	Prospective cross-sectional	Amhara	UGH	65	50.3	151	33
Sennay, 2023 [49]	Retrospective cross-sectional	Tigray	ACSH	62.8 ± 15.6	45.8	142	11
Solomon, 2020 [50]	Prospective cross-sectional	Tigray	ACSH	61.2 ± 15.6	58.3	216	21
Wakgari, 2023 [47]	Retrospective cohort	Oromia	JMC	55.43 ± 14.56	37.71	480	146
Yared, 2015 [41]	Prospective cohort	Addis Ababa	TASH, BTH, ZMH	52.7 ± 17.6	39	71	4

ACSH: Ayder Comprehensive Specialized Hospital; AURH: Ambo University Referral Hospital; DCSH: Dessie Comprehensive Specialized Hospital; SPMMC : St. Paul's Millennium Medical College; HURH: Hawassa University Referral Hospital; UGH: University of Gondar Hospital; TGSP: Tibebe Ghion Specialized Hospital; FHRH: Felege Hiwot Referral Hospital; DMRH: Debre Markos Referral Hospital; MKGH: Mettu Karl General Hospital; BGH: Bedele General Hospital; BTH: Bethel Teaching Hospital; ZMH: Zewditu Memorial Hospital; SNNPR: South Nations, Nationalities and Peoples Region

Pooled prevalence estimates of AF

A total of 5451 stroke patients were assessed in the included studies; 696 of them were diagnosed with AF, yielding a pooled prevalence of 13% [95% CI: (10%, 17%)] among stroke patients in Ethiopia (Fig. 2).

Subgroup analysis

We conducted a subgroup analysis of the prevalence of AF among stroke patients based on different variables (i.e., region, year of publication, and study design). The subgroup analysis by region revealed that the highest pooled prevalence of AF was 16% [95% CI: (8 -25%)], which was from the Amhara region, which was followed by Oromia region 15% % [95% CI: (7 -23%)]. Addis Ababa city had pooled prevalence 11% [95% CI: (7 -15%)] of AF among stroke patients, respectively. The pooled prevalence of AF among stroke patients in the Tigray region was 9% [95% CI: (6 -11%)]. However, one study reported the prevalence of AF among stroke patients from South, nations, nationalities, and people's region, which was 7% [95% CI: (3 -11%)] (Fig. 3).

The other subgroup analysis was performed based on the study design, which showed the pooled prevalence of AF among stroke patients 10% [95% CI: (6%, 14%)] and 13% [95% CI: (9%,16%)] for prospective cross-sectional and retrospective cross-sectional studies, respectively. However, three cohort studies (two retrospective and one prospective) reported a pooled prevalence of 33% [95% CI: (27%, 39%)] and 6% [95% CI: (0%,11%)] (Fig. 4). In general, Fig. 5 shows the pooled prevalence of AF 9% [95% CI: (6%, 13%)] from the prospective study and 17% [95% CI: (11%, 22%)] from the retrospective study. Moreover, we have conducted a subgroup analysis based on the year of publication as between 2015 and 2020 and studies published in 2020 and later. The pooled prevalence of AF among stroke patients from studies published in 2020 and later was 11% [95% CI: (5%, 17%)] and from those published between 2015 and 2020 was 15% [95% CI: (10%, 19%)] (Fig. 6).

Publication bias

Funnel plots (visual inspection) and Egger and Begg rank statistical tests at the 5% significance level were used to assess the presence of publication bias. Although, the funnel plot showed asymmetry (Fig. 7) for pooled estimates of AF, and the Egger and Begg rank test didn't

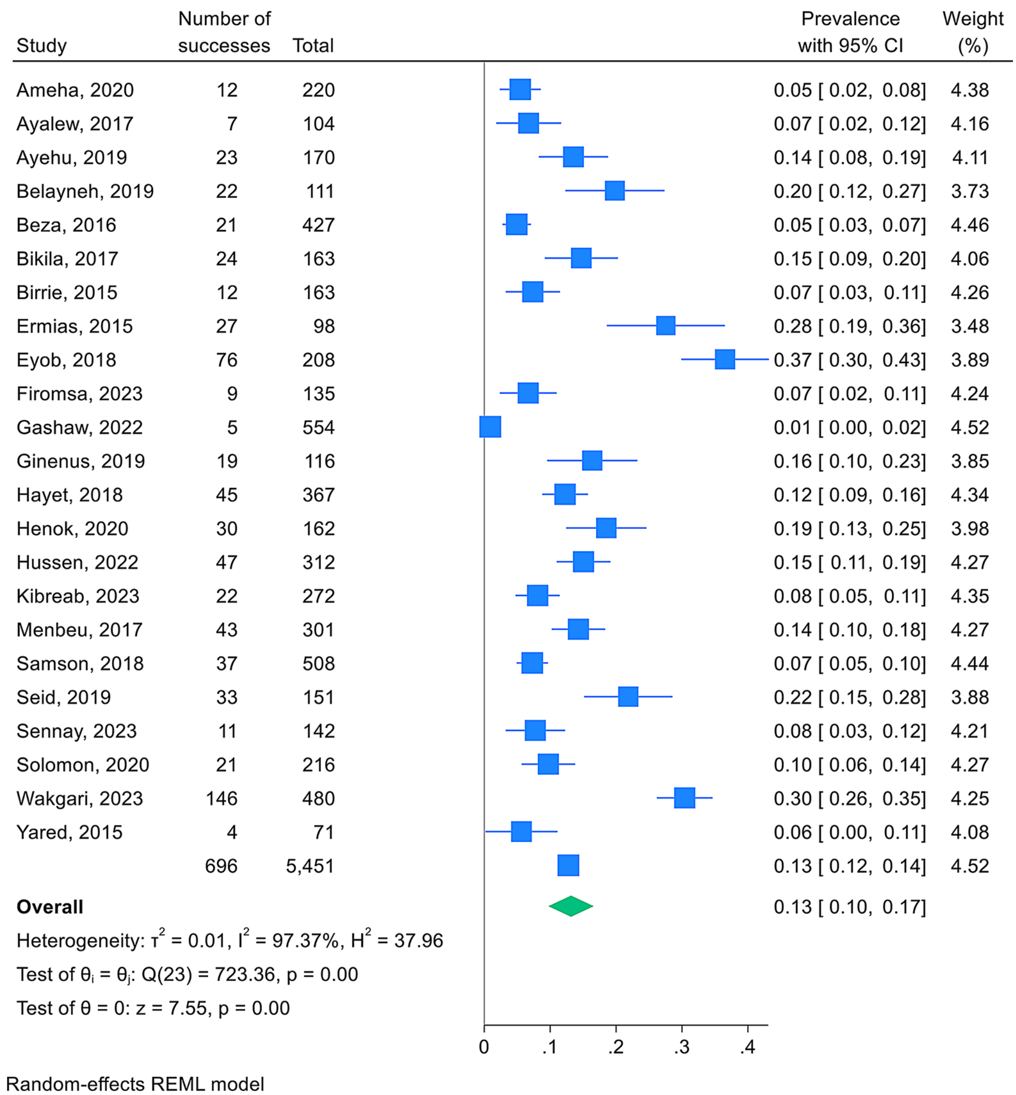

Fig. 2 Forest plot depicting the overall pooled prevalence estimate of AF among stroke patients in Ethiopia

showed evidence of statistically significant publication bias (p=0.132 and P- value=0.273) respectively.

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 AF among stroke patients in Ethiopia. According to our findings, no single study had a significant impact on the pooled prevalence of AF among stroke patients in Ethiopia (Fig. 8).

Discussion

The current systematic review and meta-analysis conducted in Ethiopia found a pooled prevalence of atrial fibrillation (AF) among stroke patients to be 13% (95% CI: 10%, 17%). A study by Wolf et al. [56] also found that AF is a significant risk factor for stroke, with a prevalence of about 15% among stroke patients. This aligns closely with the current overall pooled prevalence. Similar studies have been conducted in other geographic regions to investigate the prevalence of AF among stroke patients. For instance, a systematic review by Wang et al. [57] estimated the overall prevalence of AF in patients with acute ischemic stroke to be 17.7%. This figure is slightly higher than the Ethiopian findings, potentially due to differences in sample size, study settings, and detection capabilities. A meta-analysis by Kamel et al. [58] found that a prevalence of AF 16.1%. This figure was slightly higher than the prevalence observed in our study. The discrepancy might be attributed to the larger number of studies included in Kamel et al.'s meta-analysis.

Moreover, the prevalence of AF exhibited significant regional disparities, ranging from 7 to 16%. The findings highlight the notable burden of AF in this population, particularly in the Amhara (16%) and Oromia (15%) regions. A single study from the Southern nations,

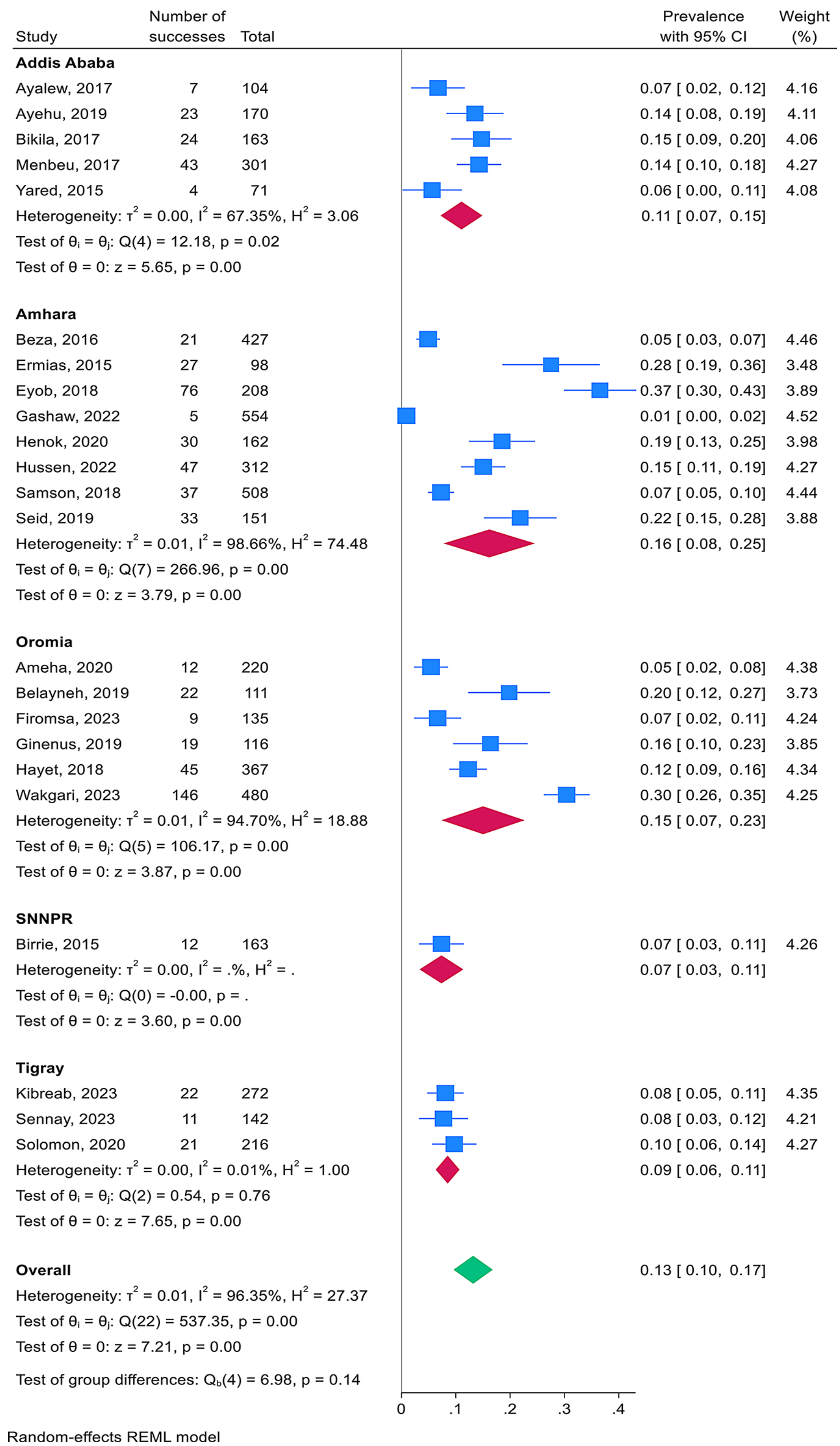

Fig. 3 Forest plot depicting the subgroup analysis of pooled prevalence estimate of AF among stroke patients based on region in Ethiopia

nationalities, and people's region reported a prevalence of 7%. Such regional (geographical) variation has been reported in other studies too [59–61]. Geographic differences in AF prevalence can often be linked to varying risk factors, such as hypertension and diabetes, which are known to be more prevalent in certain areas [62]. For example, the prevalence of risk factors for AF such as hypertension, diabetes, and obesity may vary between

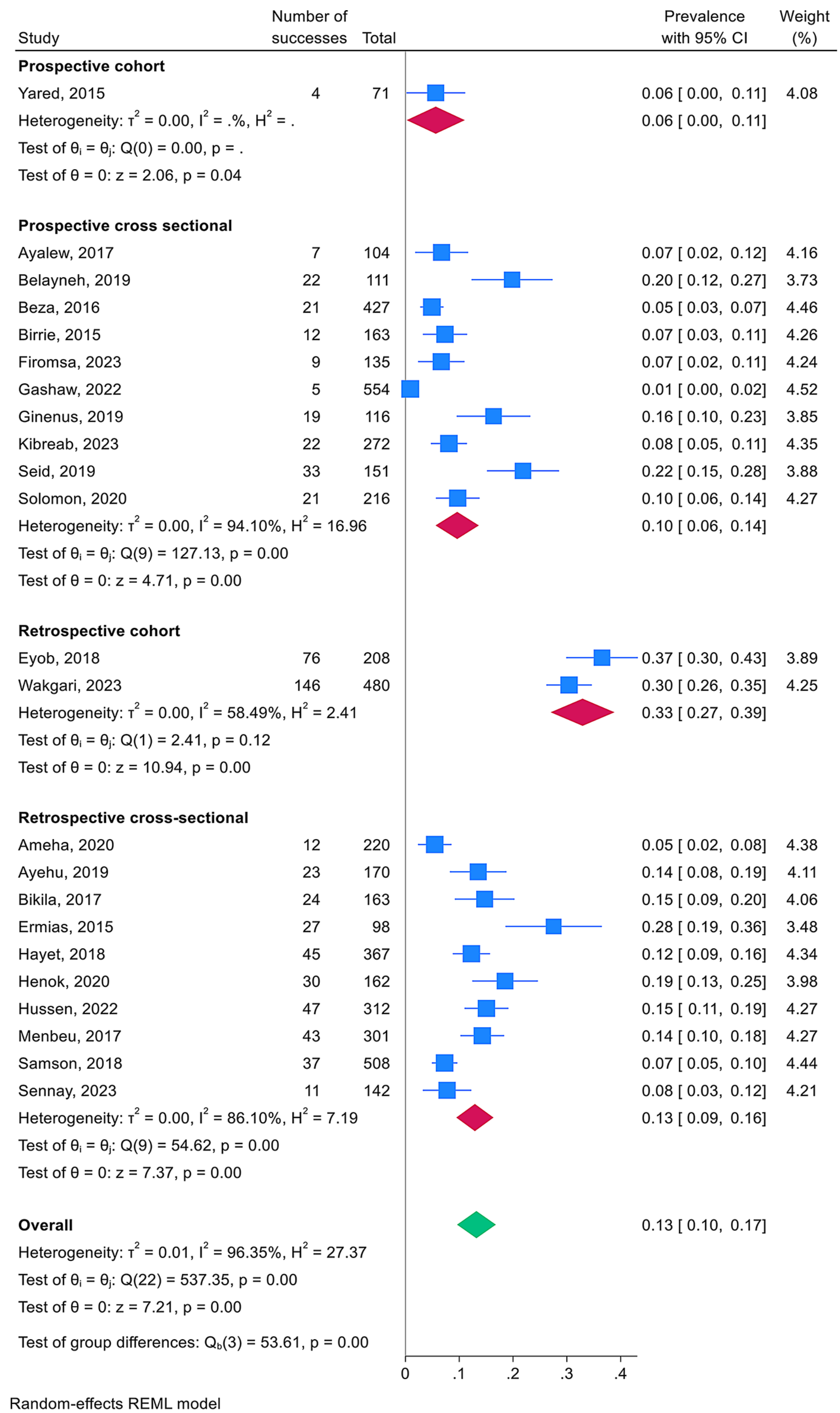

Fig. 4 Forest plot depicting the subgroup analysis of pooled prevalence estimate of AF among stroke patients based on study design in Ethiopia

regions, which could contribute to differences in AF prevalence among stroke patients [62]. Additionally, access to healthcare and diagnostic resources may also differ between regions, potentially impacting the detection and reporting of AF cases [6, 63]. The observed variations in AF prevalence across regions highlight the importance of considering geographic factors when studying stroke epidemiology and risk stratification. Further research

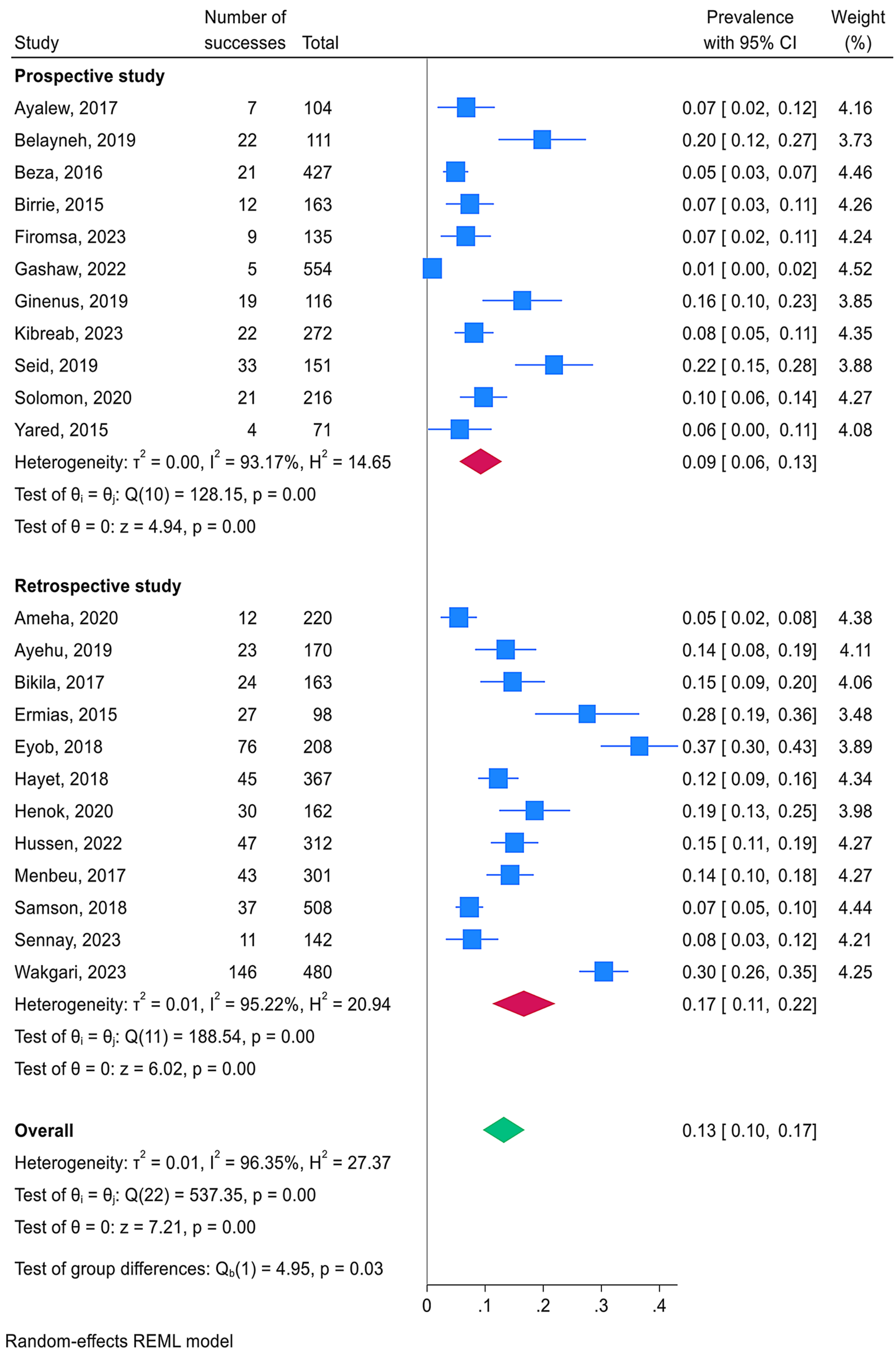

Fig. 5 Forest plot depicting the subgroup analysis of pooled prevalence estimate of AF among stroke patients based on study design in Ethiopia

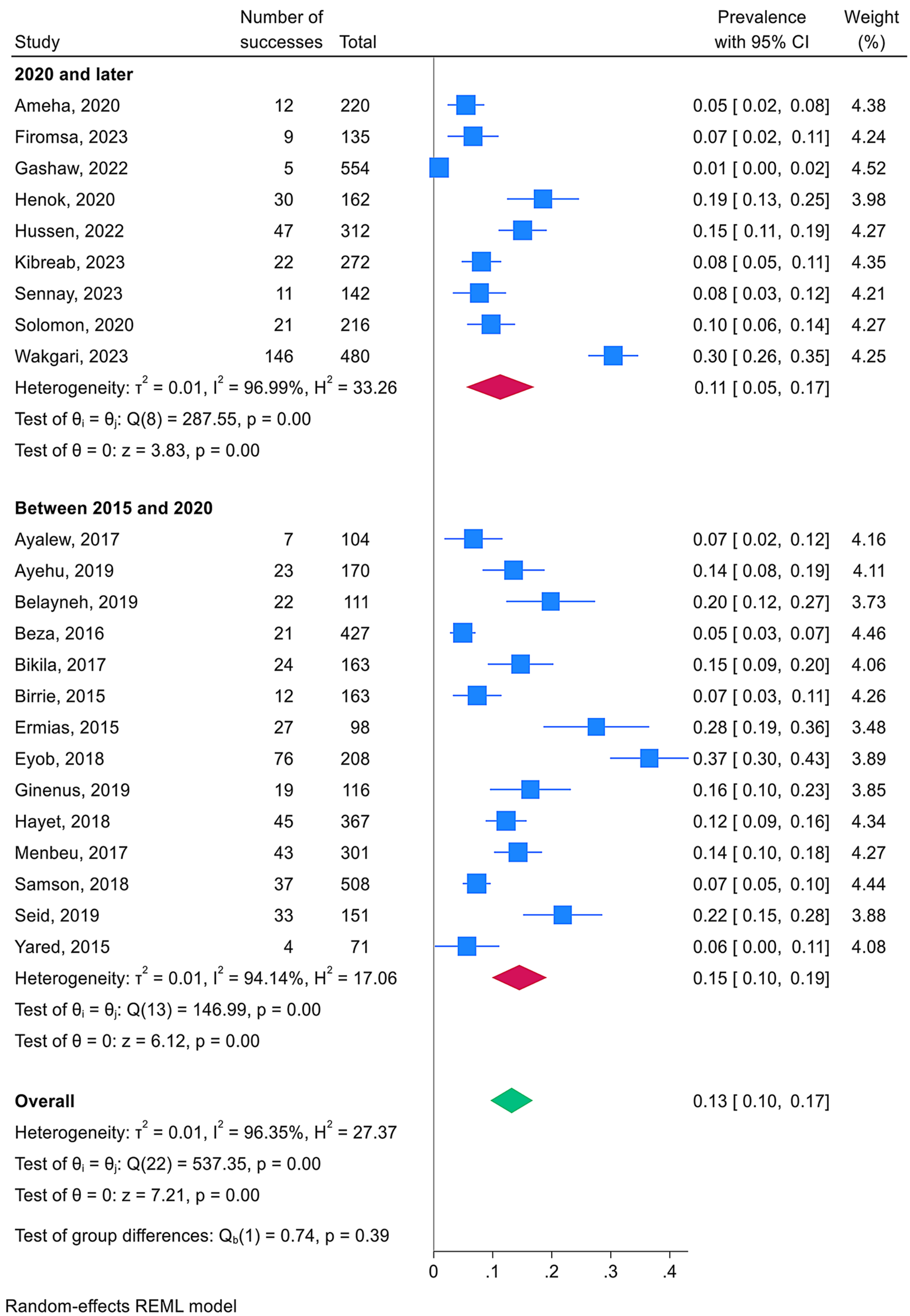

Fig. 6 Forest plot depicting the subgroup analysis of pooled prevalence estimate of AF among stroke patients based on year of publication in Ethiopia

is needed to elucidate the underlying causes of these regional differences and to develop targeted prevention strategies.

The prevalence of AF among stroke patients higher in retrospective studies (17%) compared to prospective studies (9%). The findings align with previous literature that indicates variability in AF prevalence based on study design. For example, a meta-analysis by Lip et al. [8] reported similar trends, emphasizing how study methodologies can influence observed outcomes. Furthermore, a study by Desteghe et al. [64, 65] highlighted the importance of study design in prevalence estimation,

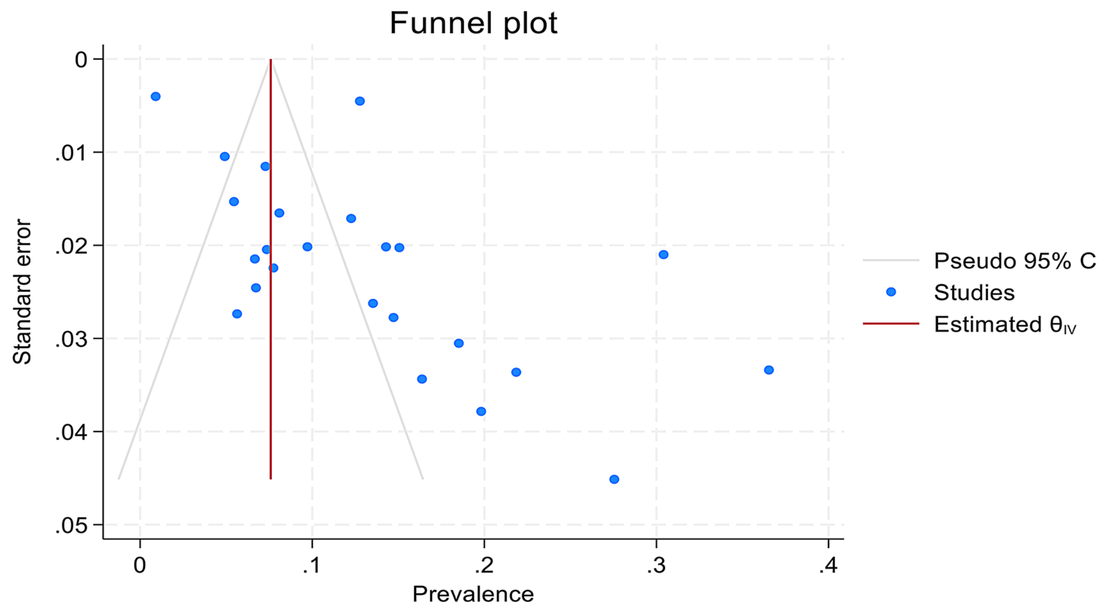

Fig. 7 The funnel plot shows publication bias

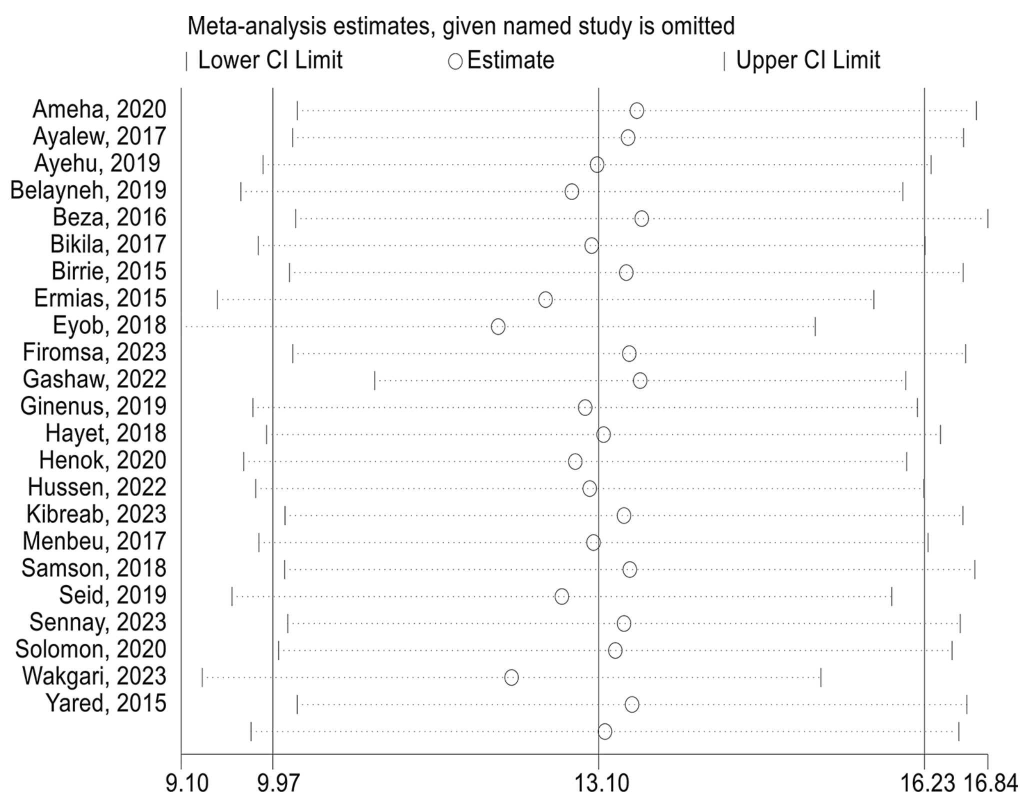

Fig. 8 Sensitivity analysis for single study effect of estimated pooled prevalence of AF among stroke patients

suggesting that prospective studies may provide more reliable estimates due to their structured data collection methods. The higher prevalence rates observed in retrospective studies might be influenced by biases inherent in retrospective data collection, such as selective reporting or incomplete data.

The subgroup analysis reveals a notable difference in the pooled prevalence of AF among stroke patients based on the publication year. Studies published in 2020 and later reported a lower prevalence (11%) compared to those published between 2015 and 2020 (15%). Some studies published after 2020 [23, 66] have reported similar declines in AF prevalence, attributing these changes to better awareness and treatment of risk factors. Enhanced stroke prevention strategies and the management of cardiovascular risk factors (e.g., hypertension, diabetes) in recent years might have contributed to a lower rate of AF in stroke patients. However, not all studies agree. Some have reported stable or even increasing rates of AF [67, 68], particularly in older populations, highlighting the variability based on geographic and demographic factors.

These findings highlight the critical need for healthcare interventions focused on the management of AF among stroke patients in Ethiopia. Addressing this issue through targeted public health initiatives and increasing awareness among healthcare providers can significantly improve patient outcomes and reduce the burden of stroke in this population. Future research should focus on understanding the underlying factors contributing to the observed regional variations and developing tailored strategies to enhance AF management in Ethiopia.

Strength and limitations

This systematic review and meta-analysis have several strengths. It was the first review that dealt with the pooled prevalence of AF among high-risk patients (i.e., stroke) for poor prognosis. Unlike the previous study [69], the current review included 23 research articles, which provides a comprehensive overview of the prevalence of AF among stroke patients in Ethiopia. The subgroup analysis by region provides a more nuanced understanding of the regional disparities in atrial fibrillation (AF) prevalence among stroke patients. This information can inform targeted interventions and healthcare resource allocation. It is anticipated to contribute significantly to a comprehensive understanding of AF prevalence in this patient population. Future research should focus on addressing the remaining gaps in the literature to enhance clinical management and public health interventions for stroke patients with AF.

However, it is important to acknowledge the limitations of this analysis. The findings may be specific to the Ethiopian context and may not be generalizable to other populations or settings. Moreover, the retrospective nature of the included studies introduces inherent biases. Patients in retrospective studies may not represent the general population, potentially leading to skewed results. Additionally, data collected retrospectively may rely on patient recall or incomplete medical records, affecting accuracy.

Despite the valuable insights provided by these systematic reviews and meta-analyses, there are still inconsistencies and gaps in the literature that require further investigation. For example, the underlying factors contributing to regional variations in AF prevalence among stroke patients remain unclear and necessitate additional research. Furthermore, more studies are needed to explore the impact of specific risk factors or comorbidities on AF prevalence in this population.

Conclusion

In conclusion, the prevalence of AF among stroke patients in Ethiopia was found to be 13%, with regional variations ranging from 7 to 16%. These findings highlight the importance of considering demographic and healthcare differences between regions when assessing the prevalence of AF among stroke patients. The high prevalence of AF underscores the need for effective strategies to identify and manage this condition to prevent recurrent strokes. Targeted interventions, such as anticoagulation therapy, may be warranted for stroke patients with AF to reduce their risk of future cardiovascular events.

Abbreviations

AF	atrial fibrillation
CI	Confidence Interval
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
MOOSE	Meta-analysis of Observational Studies in Epidemiology guideline
ACSH	Ayder Comprehensive Specialized Hospital
AURH	Ambo University Referral Hospital
DCSH	Dessie Comprehensive Specialized Hospital
SPMMC	St. Paul's Millennium Medical College
HURH	Hawassa University Referral Hospital
UGH	University of Gondar hospital
TGSP	Tibebe Ghion Specialized Hospital
FHRH	Felege Hiwot Referral Hospital
DMRH	Debre Markos Referral Hospital
MKGH	Mettu Karl General Hospital
BGH	Bedele General Hospital
BTH	Bethel Teaching Hospital
ZMH	Zewditu Memorial Hospital
SNNPR	South Nations, Nationalities and Peoples Region

Supplementary Information

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Supplementary Material 1

Supplementary Material 2

Supplementary Material 3

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Author contributions

MM, YS, and TM conducted database search, screening, and quality assessment. MM, YS and TM made substantial contributions to the conception and design, analysis, and interpretation of data; took part in drafting the article, revising it critically; agreed to submit to the current journal; gave final approval of the version to be published; and agreed to be accountable for all aspects of the work. All the authors have read and agreed on the final manuscript.

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Data availability
No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate
Not applicable.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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