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Magnitude of Cardiovascular Disease Admissions and Their Outcomes in Ethiopia: A Systematic Review and Meta-Analysis (2025)

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ABSTRACT

Introduction: CVDs pose a significant burden, particularly in developing countries, affecting individuals, families, healthcare systems, and economies. Cardiovascular diseases are the leading cause of death worldwide, with a disproportionate burden observed in low- and middle-income countries where access to preventive and acute care is limited. So this review is aimed to estimate pooled magnitude of cardiovascular disease admissions and its outcome in Ethiopia.

Methods and materials: A systematic search of published studies from PubMed, Scopus, web of science, google scholar, and reference lists of identified studies were conducted. This meta-analysis follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. The quality of studies was assessed by the modified Newcastle-Ottawa Scale (NOS). Meta-analysis was carried out using a random-effects method using the STATA™ Version 14 software.

Result: Ten studies involving 38,440 participants were included in this meta-analysis. The magnitude of cardiovascular admission were ranged from 17.5 - 53.9 %; with pooled magnitude of cardiovascular admission with a random-effects model in Ethiopia was 36.3% (95% CI: 27.6- 45.0). Whereas the magnitude of cardiovascular admission in Addis Ababa region was 40.19 %; 95% CI: (28.3- 51.9) and 45.2%; 95% CI :(28.1- 62.2) in Tigray region. The magnitude of cardiovascular disease admission outcome ranges from 13.2- 24.3%.

Conclusion: According to this study, there is a significant burden of cardiovascular disease admissions in the region. Notably, the Addis Ababa region reports an admission rate of 40.19%, while the Tigray region has an even higher rate of 45.2%. Therefore, urgent targeted interventions and healthcare strategies are needed.

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Introduction

Cardiovascular diseases (CVDs), commonly referred to as heart disease, encompass a range of disorders affecting the heart and blood vessels. These include coronary heart disease, cerebrovascular disease, peripheral arterial disease, rheumatic heart disease, congenital heart disease, deep vein thrombosis, and pulmonary embolism [1,2]. CVDs are the leading cause of global mortality and represent one of the most serious health issues worldwide [3].

The primary risk factors for cardiovascular disease include unhealthy nutrition, physical inactivity, dyslipidemia, hyperglycemia, high blood pressure, obesity, smoking, thrombosis, kidney dysfunction, and genetics/familial hypercholesterolemia [4, 5].

CVDs pose a significant burden, particularly in developing countries, affecting individuals, families, healthcare systems, and economies [6]. A systematic review and meta-analysis conducted in Ethiopia reveal that the prevalence of CVDs ranges from 1% to 20%, with an overall pooled prevalence of 5% [7]. Among various cardiovascular diseases, hypertension is the most frequent, followed by heart failure

(HF), with hypertensive heart disease identified as the leading cause of cardiac issues [8]. Moreover, the age-standardized prevalence and mortality rates for cardiovascular diseases in Ethiopia are 5534 and 182.63 per 100,000 population, respectively [9]. Despite the high prevalence of cardiovascular diseases, inadequate healthcare systems, poor infrastructure, a shortage of cardiac professionals, and high treatment costs are significant barriers to prevention in Sub-Saharan Africa [10].

Furthermore, globally, cardiac disease admissions present a pressing public health concern, particularly in developing countries. According to the World Health Organization, cardiovascular diseases are the leading cause of death worldwide, with a disproportionate burden observed in low- and middle-income countries where access to preventive and acute care is limited [11,12].

CVD can lead to serious health outcomes such as heart attacks, strokes, heart failure, and even death [13]. Moreover the outcomes associated with cardiac disease admissions can vary significantly depending on the healthcare resources available. Studies show that in many developing regions, the lack of specialized care and advanced medical technology contributes to higher mortality rates and poorer prognoses for patients with cardiac conditions [11,14].

Understanding cardiovascular disease admissions is essential not only for immediate patient care but also for the development of long-term health strategies and improvements in healthcare systems. So this study aims to assess the pooled burden of cardiovascular admissions in Ethiopia.

Methods and Materials
Study Design and Search Strategy
This systematic review and meta-analysis was conducted under the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) statement [15].

An initial limited search of PubMed was undertaken followed by analysis of the text words contained in the title and abstract, and of the index terms used to describe article. Also, the Scopus, web of science, google scholar and reference lists of all identified articles were searched for additional studies. The search was performed using key terms such as cardiovascular disease, heart disease, cardiac case, cardiac disease, admission, and outcome.

Study Selection and Eligibility Criteria
- Population- the population included in this study was all adults.
- Condition - articles dealing about cardiovascular disease included in this study.
- Context - articles conducted in Ethiopia were included in this study.
- Outcome- articles which deal about burden admission and outcome among patients with cardiovascular disease.
- Both published and unpublished studies conducted in Ethiopia were included.

Study Extraction and Quality Appraisal
The data were extracted by all reviewers independently using a data extraction format prepared in a Microsoft Excel spreadsheet. The extracted data were: the first author's name, publication year, country, design, sample size, prevalence of admission, and outcome of admission. The quality of each study was assessed using the modified Newcastle-Ottawa Scale (NOS) for cross-sectional studies [16]. Studies were included with a score of 5 and more on the NOS [17]. The quality of each study was evaluated independently by all reviewers and any disagreements were resolved by discussion and consensus.

Publication Bias and Heterogeneity
To assess the existence of publication bias, funnel plots were used and Egger's test was computed. 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 [18].

Outcome Measure
The primary outcome of this review was the magnitude of cardiovascular admission. The second outcome of is the outcome of cardiovascular admission.

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 admission and outcome of cardiovascular disease was carried out using a random-effects (Der Simonian 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 5,094 studies were retrieved from the databases and manual searching. From this, 1988 duplicate were found and removed. The remaining 3106 articles were screened by their title and abstract and 2791 irrelevant studies were removed. 315 full-text articles were assessed for eligibility and 305 of them were excluded due not reporting the outcome of interest. Finally, a total of 10 studies was fulfilled the inclusion criteria and enrolled in the study.
The detailed retrieval process is shown in figure 1.
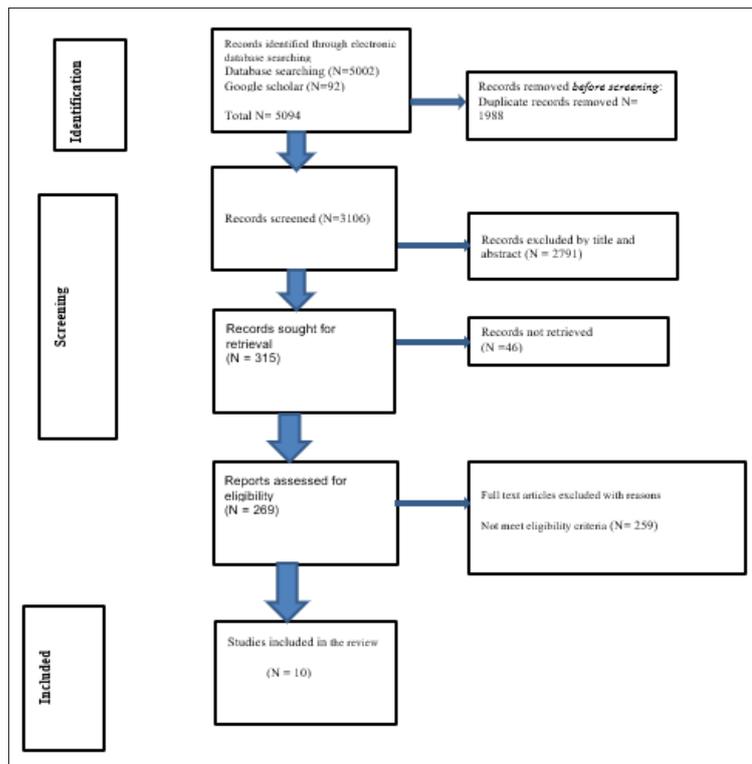
Study Characteristics

The 10 studies included 38,440 participants [19-28]. Most of the included studies were utilized retrospective cross-sectional studies and the sample size ranged from 500[20] to 22,320[28]. Most studies were conducted in Addis Ababa. Among the included studies, magnitude of cardiovascular admission were ranged from 17.5 [21] to 53.9 [24] (Table 1).

Table 1: Characteristics of Included Study

	Publication year	Study area	Years	Study design	Sample size	Prevalence of admission 95%CI	Prevalence of death
Mengistu MD,	2022	Addis Ababa	1 years	Retrospective	1165	30.3(27.6-32.9)	24.3
Giday A,	2015	Addis Ababa	30 years	Retrospective	500	42.6(38.2-46.9)	
Beyene F	2016	Asella	10	Retrospective	5541	17.5(16.4-18.5)	
Bane A,	2016	Addis Ababa	1	Retrospective	840	48.8(45.4-52.1)	
Hailu A,	2023	Mekele	1	Retrospective	2084	53.9(51.7-56.0)	13.2
Mengistu MD.	2023	Addis Ababa	1	Retrospective	1165	26(23.4-28.5)	23.8
Tessema HG,	2019	Gonder	5	Retrospective	504	36.1(31.9-40.2)	
Hailu A,	2023	Mekelle	1	Prospective	2084	36.5(34.4-38.5)	13.2
Belayneh A,	2024	Addis Ababa	1	Prospective	2237	53.3(51.2-55.3)	
Endriyas M,	2018	South	1	retrospective	22320	18.8(18.2-19.3)	

Systematic Review and Meta-Analysis

The pooled magnitude of cardiovascular disease admissions in Ethiopia with a random-effects model was 36.3% (95% CI: 27.6- 45.0), with heterogeneity index (I2) of 99.6% (p ≤ 0.001) (Figure 2).
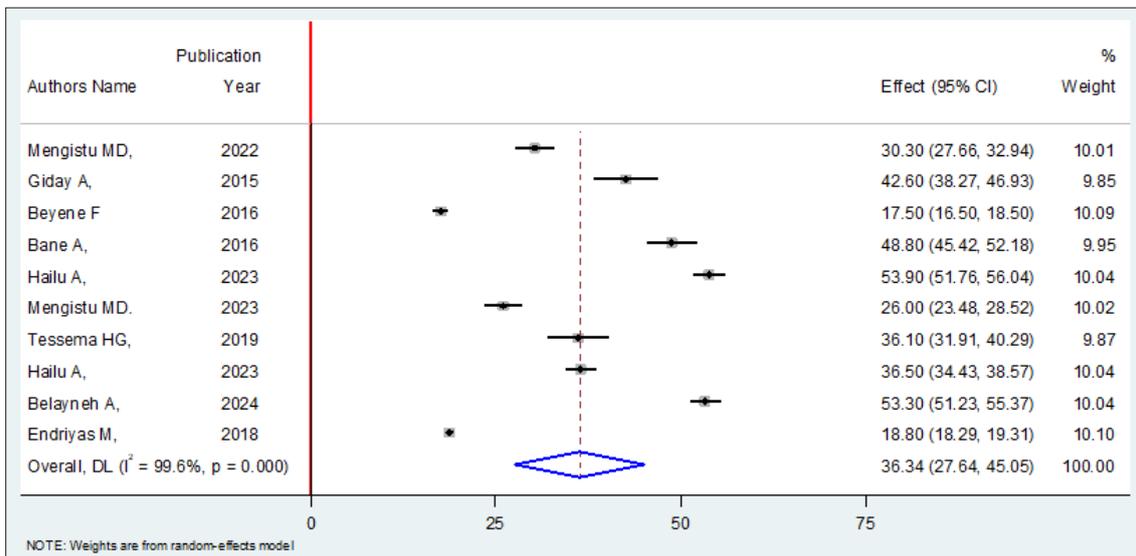
Figure 2: Forest Plot Showing Pooled Magnitude of Cardiovascular Disease Admissions and its outcome in Ethiopia

To adjust and minimize the reported heterogeneity of this study (I2=99.6%); subgroup analysis was conducted based on regions of the study conducted. In this analysis only regions with two or more articles conducted considered on this study; so studies conducted in Oromia, south, and Amhara regions were invalid. The subgroup analysis result revealed that the magnitude of cardiovascular admission in Addis Ababa region was 40.19 %; 95% CI: 28.3, 51.9), I2 = 98.9%) and 45.2%; 95% CI: 28.1, 62.2) in Tigray region (Figure 3).
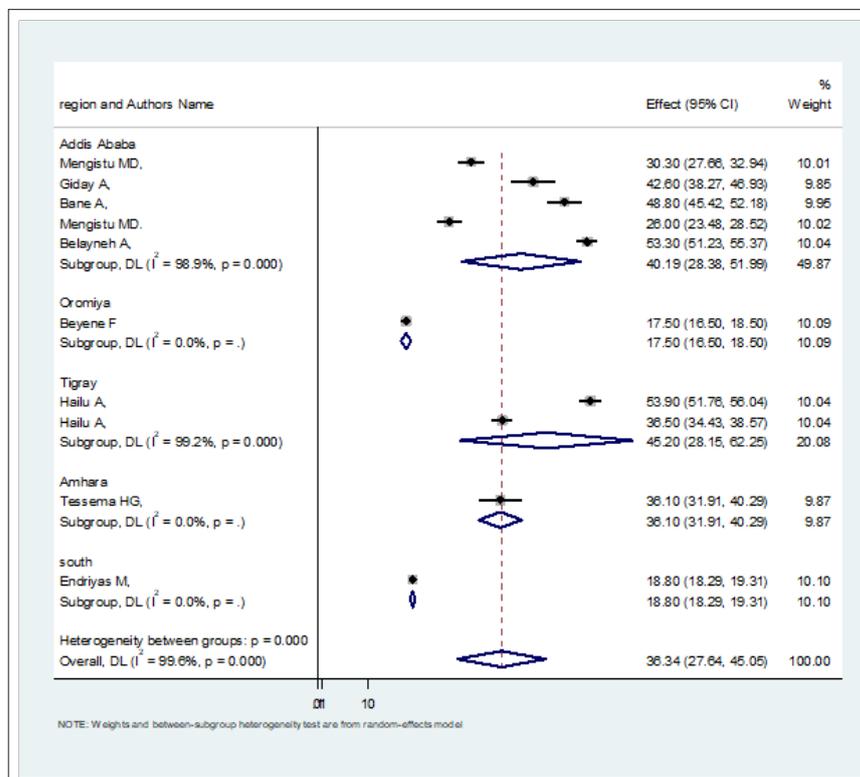

**Figure 3:** Subgroup Analysis of Magnitude of Cardiovascular Disease Admissions and its Outcome in Ethiopia

The presence of publication bias was checked using the Egger's test, and graphical by Funnel plot, the result egger's test was found significant (p=0.005), as a result to estimating the number of missing studies that might exist in a meta-analysis we conducted Duval and Tweedie's trim and fill analysis, but is not significant. Also visual inspection of the funnel plot indicated asymmetrical distribution (Figure 4), showing publication bias.
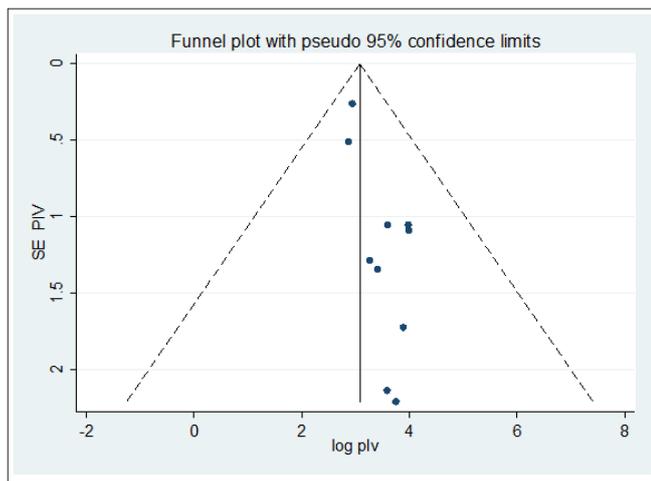
Figure 4: Funnel Plot to Test the Publication Bias in 10 Studies With 95% Confidence Limits

Sensitivity Analysis

Sensitivity analysis was done 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 magnitude (Figure 5).
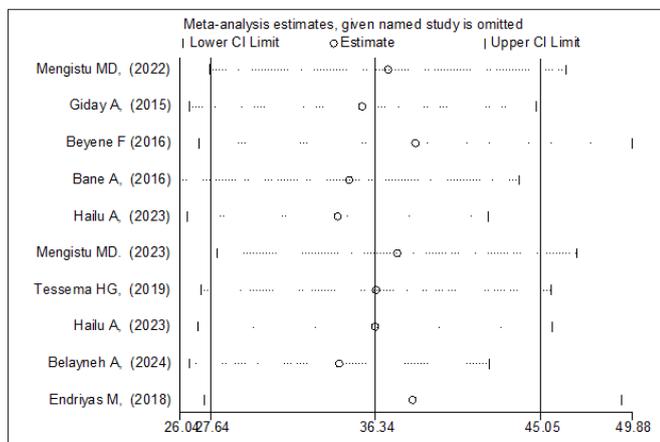
Figure 5: Sensitivity Analysis of Pooled Magnitude of Cardiovascular Disease Admissions and its outcome in Ethiopia for Each Study Being Removed one at a Time

Magnitude of outcome

The magnitude of cardiovascular disease admission outcome / death ranges from 13.2- 24.3%.

Discussion

Cardiovascular diseases emerged as the leading cause of morbidity and mortality worldwide, posing significant public health challenges. The prevalence of CVDs is particularly alarming in low- and low-middle-income countries (LMICs), where healthcare resources may be limited and risk factors are on the rise. In sub-Saharan Africa (SSA), the situation is critical; the region is experiencing a rapid increase in CVD cases [29-32].

In this systematic review and meta-analysis, the pooled magnitude of cardiovascular disease admissions in Ethiopia at 36.3% (95% CI: 27.6-45.0). In recent years, several studies have focused on the increasing burden of non-communicable diseases in low- and middle-income countries, including Ethiopia. The findings suggest that urbanization, lifestyle changes, and demographic shifts might be contributing factors to the rise in cardiovascular conditions. A study by highlights the association between lifestyle factors such as diet, physical inactivity, and the increased prevalence of hypertension and other cardiovascular diseases [33-35].

According the subgroup analysis the magnitude of cardiovascular admission in Addis Ababa region was 40.19 %; 95% CI: 28.3, 51.9), and 45.2%; 95% CI: 28.1, 62.2) in Tigray region. The variations might also stem from differences in healthcare access, infrastructure, and quality of care available in the two regions. The studies conducted in Tigray region was more recent, this might be enables the clients to receive more specialized cardiovascular care, this could lead to a higher rate of admissions as more cases are being detected and treated. Also, the variation in demographics, differences in public health initiatives like health promotion campaigns or preventive measures in place, may lead to variation in admission rate.

Furthermore, the magnitude of death or adverse outcomes due to cardiovascular disease during hospital admissions can vary significantly, ranging from 13.2% to 24.3%. This variation can be influenced by multiple factors, including the severity of the disease at the time of admission, patient demographics, the quality of care provided, and the healthcare systems. This underscores the need for continuous improvement in healthcare strategies, patient education, and research findings on reducing these outcomes.

Conclusion

The prevalence of cardiovascular admissions in Ethiopia exhibits significant variability, with a pooled estimate of 36.3%. This indicates a considerable burden of cardiovascular disease in the region. Notably, the Addis Ababa region reports a higher admission rate of 40.19%, while the Tigray region shows an even higher rate of 45.2%. So urgent targeted interventions and healthcare strategies to address cardiovascular diseases in these regions, as well as the importance of ongoing surveillance and research to better understand the factors contributing to these admissions is needed.

Limitations of the study

This systematic review and meta-analysis presented the magnitude of cardiovascular disease admission and outcome in Ethiopia; it might have faced the following limitations. First, the lack of studies from many regions may affect the generalizability of the findings. Secondly, due to the presence of significant heterogeneity and presence of publication bias, the result should be interpreted cautiously. Finally, we have faced difficulties due to a lack of regional and worldwide systematic reviews and meta-analyses.

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