

# Prevalence of Hypertension-Mediated Organ Damage Among Adults in Ethiopia: A Systematic Review and Meta-Analysis 2025

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## ABSTRACT

**Introduction:** evidences demonstrated that subclinical HMOD is strongly associated with adverse cardiovascular outcomes, including left ventricular hypertrophy, reduced kidney function, microalbuminuria, and increased arterial stiffness and mortality. Therefore, this study is aimed to estimate prevalence of hypertension-mediated organ damage in Ethiopian adults.

**Methods and Material:** PubMed, Scopus, web of science, and goggle scholar databases were used for this analysis. We assessed methodological quality using the Joanna Briggs Institute (JBI) critical appraisal checklist. An inverse variance-weighted random-effects model meta-analysis was performed to estimate the pooled prevalence with a 95% confidence interval (CI). The I2 test statistic was used to check between-study heterogeneity, and the Egger's regression statistical test was used to check publication bias. A p-value of less than 0.05 used to declare statistical significance.

**Result:** Ten studies with 3751 participants were included in this analysis. Most of the included studies were cross-sectional studies with prevalence of hypertension-mediated organ damage among adults in Ethiopia were ranged from 14.2% to 92.1%. The pooled Prevalence of hypertension-mediated organ damage among adults in Ethiopia with a random-effects model was 37.2 2% (95% CI: 21.9-52.2).

**Conclusion:** This study showed that more than one-third of adults with hypertension in Ethiopia experience hypertension-mediated organ damage. Therefore, critical need of early diagnosis of hypertension, routine screening for target organ damage, and strengthened blood pressure management strategies is recommended.

**Keyword:** Hypertension, Organ Damage, Ethiopia, Adult, Meta-analysis

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## Introduction

Hypertension remains a significant public health importance affecting over one billion people worldwide and responsible for an estimated 9.4 million deaths annually contributing to the onset of cardiovascular diseases, stroke, disability, and premature death [1,2].

Hypertension-mediated organ damage (HMOD), is a structural and functional changes in arteries or vital organs, is a marker of cardiovascular (CV) disease [3].

Also, evidences demonstrated that subclinical HMOD is strongly associated with adverse cardiovascular outcomes, including left ventricular hypertrophy, reduced kidney function, microalbuminuria, and increased arterial stiffness and mortality [4-6].

In Ethiopia, systematic reviews and meta-analyses indicate a rising burden of uncontrolled hypertension, with pooled prevalence of 51%. which shows the populations are at risk of target organ damage [7].

The significant and large clinical implications of high blood pressure on cardiovascular morbidity and mortality are explained by the effect of hypertension on specific organs, particularly sensitive to the effects of changes in blood pressure, resulting cardiac remodeling, cerebrovascular disease, renal failure, atherosclerotic vascular disease, and retinopathy [8].

Furthermore, the presence of hypertensive mediated organ damage is related to increased vascular risk and mortality and its prevention should be a therapeutic target and a surrogate marker of in/adequate blood pressure control [9]. Unlike hypertension itself, HMOD often remains clinically silent until advanced stages, yet it can be detected through non-invasive tests and routine clinical assessments and is amenable to prevention and mitigation through improved blood pressure control and risk factor management [10].

Despite of easily diagnosis of HMOD due to advancements in imaging techniques [11] and increased evidence on uncontrolled hypertension prevalence and related complication there is no comprehensive pooled estimate of the prevalence of hypertension-mediated organ damage among Ethiopian adults. Most available studies focus on hypertension prevalence or isolated comorbid conditions without synthesizing evidence on the broader spectrum of organ damage attributable to elevated blood pressure. Therefore, a systematic review and meta-analysis to determine the pooled prevalence of HMOD among Ethiopian adults is critical for informing targeted interventions, strengthening clinical screening programs, and reducing the burden of cardiovascular and renal complications associated with hypertension in Ethiopia.

## Objectives of the Review

- To determine prevalence of hypertension-mediated organ damage in Ethiopian adults

## Methods and Materials

Study Design and Reporting Framework

This systematic review and meta-analysis were conducted in

accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [12].

## Eligibility Criteria

- Population: Adults (>18 years) with hypertension in Ethiopia
- Outcome: Prevalence of hypertension-mediated organ damage (HMOD), including but not limited to cardiac, renal, cerebrovascular, retinal, or vascular damage
- Study design: Observational studies (cross-sectional, cohort, or baseline data from longitudinal studies)
- Setting: Community-based or facility-based studies conducted in Ethiopia
- Language: Studies published in English
- Publication status: Published and unpublished studies.
- Case reports, case series, editorials, reviews, conference abstracts, and studies conducted outside Ethiopia or among children/adolescents are excluded from this study.

## Information Sources and Search Strategy

A comprehensive literature search was conducted using electronic databases of PubMed/MEDLINE, Scopus, Web of Science, and google scholar. Additional studies were identified by screening reference lists of included articles and relevant reviews. The search strategy combined Medical Subject Headings (MeSH) and text words. Searches were conducted from database inception to December 2025.

## Study Selection

All identified studies were imported into endnote software and duplicates were removed. Two reviewers independently screened titles and abstracts for relevance. Full texts of potentially eligible studies were then assessed independently against the inclusion criteria. Discrepancies were resolved through discussion or by consulting a third reviewer. The study selection process was documented using a PRISMA flow diagram.

## Data Extraction

Data were extracted independently by two reviewers using a standardized data extraction form. Extracted information included: first author name, year of publication, Study area, Study design, sample size, Prevalence estimates of HMOD. Any disagreements were resolved by consensus.

## Quality Assessment

The methodological quality of included studies was assessed independently by two reviewers using the Joanna Briggs Institute (JBI) critical appraisal checklist for prevalence studies. Studies were categorized as low, moderate, or high risk of bias based on assessment scores [13].

## Effect Measures

Proportions were used to measure the effect for the prevalence, while Odds ratio (OR) was used to measure the effect for the risk factors.

## Data Synthesis and Analysis

A narrative synthesis was first conducted to summarize study characteristics and findings. Meta-analysis was performed to estimate the pooled prevalence of hypertension-mediated organ damage using a random-effects model. Statistical heterogeneity

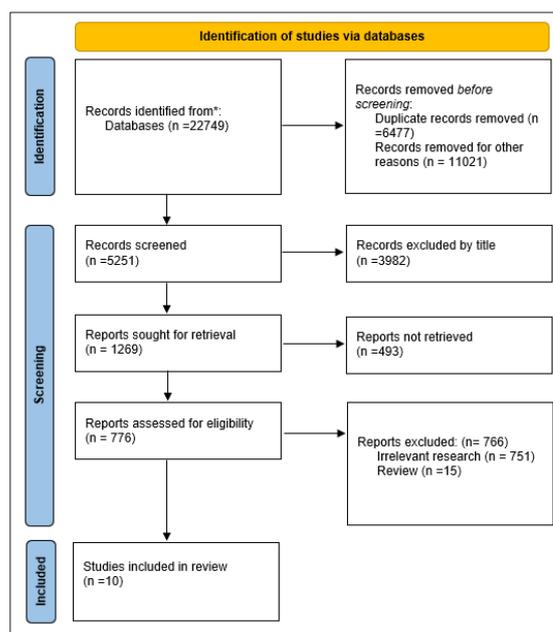
was assessed using the  $I^2$  statistic. An  $I^2$  test statistics of  $<50$  was declared as low heterogeneity,  $50-75\%$  was moderate, and  $>75\%$  was high heterogeneity [14]. The funnel plot and Egger's test were utilized to check for publication bias; while sensitivity analyses were performed to assess robustness of the synthesized results. A subgroup analysis was done based on the region of the study conducted.

**Results**

**Study Selection and Study Characteristics**

Our literature search retrieved 22749 studies, from which we collected 776 potentially eligible studies after screening the titles and abstracts. Finally, we selected 10 studies after a review of the full article [1]. The reasons for exclusion are due to article don't report the value of outcome of interest, and due to exclusion criteria (Figure.1).

The 10 studies [15-24] included 3751 participants. Most of the included studies were cross-sectional studies and the sample size ranged from 140 [23] to 694 [15]. Most studies were conducted in Amhara region. Among the included studies, Prevalence of hypertension-mediated organ damage among adults in Ethiopia were ranged from 14.2 [17] to 92.1 [23] (Table 1).



**Figure 1:** PRISMA flow diagram of study selection for Prevalence of hypertension-mediated organ damage among adults in Ethiopia

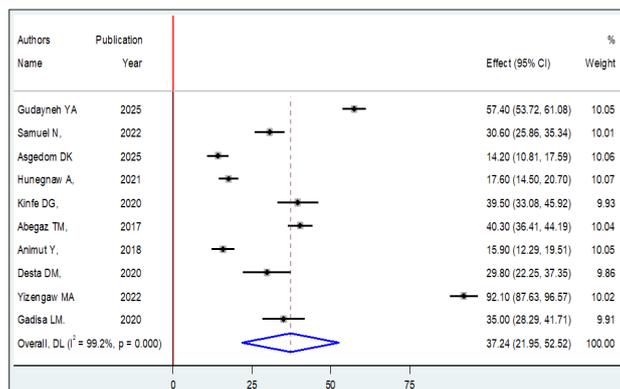
**Table 1: Characteristics of the Included Studies in the Systematic Review and Meta-Analysis**

Authors Name	Publication Year	Study Area	Study Design	Sample	Prevalence with 95%CI
Gudayneh YA	2025	Gonder	Cross-sectional	694	57.4(53.7-61.0)
Samuel N,	2022	Harar	Cross-sectional	363	30.6(25.8-35.3)
Asgedom DK	2025	Gonder	Cohort	408	14.2(10.8-17.5)
Hunegnaw A,	2021	Amhara	Cross-sectional	581	17.6(14.5-20.6)
Kinfe DG,	2020	Amhara	Cohort	223	39.5(33.0-45.9)
Abegaz TM,	2017	Gonder	Cohort	612	40.3(36.4-44.1)
Animut Y,	2018	Gonder	Cross-sectional	395	15.9(12.2-19.5)
Desta DM,	2020	Mekele	Cross-sectional	141	29.8(22.2-37.3)
Yizengaw MA	2022	Jimma	Cross-sectional	140	92.1(87.6-96.5)
Gadisa LM.	2020	Assosa	Cross-sectional	194	35(28.2-41.7)

**Systematic Review and Meta-Analysis**

**Prevalence of Hypertension-Mediated Organ Damage**

A Der Simonian and Laird random-effects model was fitted to determine the pooled effect size. Accordingly, the pooled Prevalence of hypertension-mediated organ damage among adults in Ethiopia with a random-effects model was 37.2 2% (95% CI: 21.9-52.2) with heterogeneity index ( $I^2$ ) of 99.2% ( $p = 0.000$ ) (Figure. 2).



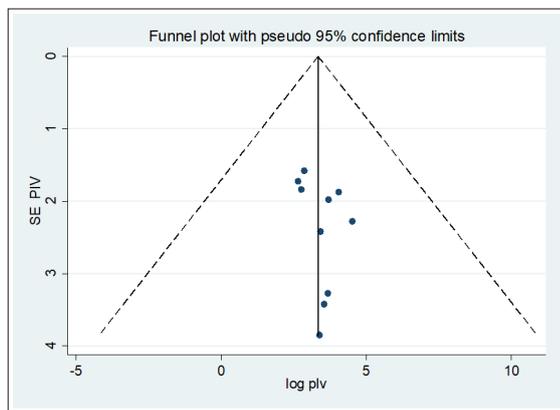
Note: Weights are from randow-effects model

**Figure 2:** Forest plot showing the pooled Prevalence of hypertension-mediated organ damage among adults in Ethiopia

### Heterogeneity and Publication Bias

To identify the source reported heterogeneity of this study ( $I^2=99.2\%$ ); meta-regression was conducted using sample size and year of publication 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 0.750 and 0.821 respectively.

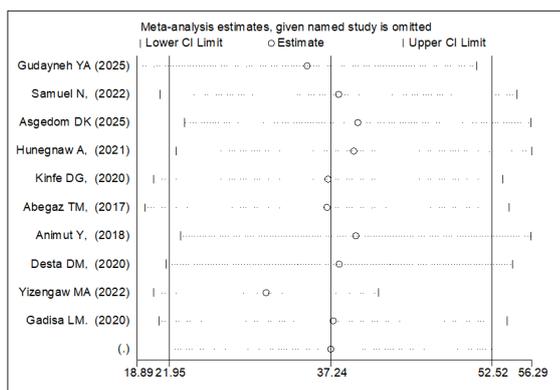
The presence of publication bias was tested by Egger’s test, (0.278) and visual inspection of the funnel plot showed a relatively symmetrical distribution of studies around the pooled prevalence estimate, suggesting no substantial evidence of publication bias (Figure 3).



**Figure 3:** Funnel plot to test publication bias in 10 studies with 95% confidence limits

### Sensitivity Analysis

Sensitivity analysis was conducted by removing studies step by step to evaluate the effect of a single study on the overall effect estimate. The analysis showed that omission of any individual study did not substantially alter the pooled prevalence estimate, indicating that the results were robust (Figure 4).



**Figure 4:** Sensitivity analysis of pooled Prevalence of hypertension-mediated organ damage among adults in Ethiopia for each study being removed one at a time

### Discussion

In low- and middle-income countries, the prevalence of hypertension has increased substantially, and hypertension-mediated organ damage (HMOD) is common among adults with hypertension, largely due to late diagnosis and suboptimal blood pressure control. Ethiopia reflects this broader trend, where hypertension is frequently undiagnosed or poorly controlled because of limited access to healthcare, delayed health-seeking behavior, and low public awareness. Consequently, the risk of

developing HMOD is high, and evidence from both hospital- and community-based studies indicates a growing burden of hypertension-related complications, consistent with the country’s ongoing epidemiological transition [25-29].

According to this systematic review and meta-analysis, the pooled prevalence of hypertension-mediated organ damage (HMOD) among adults in Ethiopia was 37.2% (95% CI: 21.9–52.2). This finding is comparable with reports from other parts of the world. Global systematic review showed that approximately 35.6% of hypertensive patient’s exhibit left ventricular hypertrophy which closely aligns with the pooled prevalence observed in the present study [30].

However, evidence from Cameroon reported a very high burden of hypertension-related organ damage 87.4% [31]. These variation may be explained by difference in characteristics of study populations, diagnostic criteria for organ damage, the inclusion of hospital-based patients with more advanced disease, and limited access to healthcare services, Evidence from multiple studies indicates that the development of hypertension-mediated target organ damage is strongly influenced by the level of systolic blood pressure, as well as socioeconomic and demographic factors, the presence of comorbid cardiovascular risk factors, and the adequacy of treatment to achieve target blood pressure levels. However, hypertension-mediated organ damage cannot be explained solely by elevated blood pressure values; the pathogenesis of target organ damage is complex and involves the interaction of multiple mechanisms beyond blood pressure itself [32, 33].

On this study the funnel plot demonstrated a relatively symmetrical distribution of studies around the pooled prevalence estimate. The absence of marked asymmetry shows minimal small-study effects, supporting the robustness and credibility of the pooled prevalence of hypertension-mediated organ damage.

### Conclusion

This study showed that more than one-third of adults with hypertension in Ethiopia experience hypertension-mediated organ damage. The finding reflects persistent challenges in hypertension detection, treatment, and long-term blood pressure control in the country. Therefore, critical need of early diagnosis of hypertension, routine screening for target organ damage, and strengthened blood pressure management strategies, improving access to essential diagnostic services, and promoting adherence to evidence-based treatment guidelines is recommended to mitigate the growing burden of hypertension-mediated organ damage in Ethiopia.

### Limitation of the Study

This systematic review and meta-analysis provided new insight on burden of hypertension mediated organ damage. However, there are certain limitations to be considered. First due to significant heterogeneity of studies, result should be interpreted with caution. Secondly, we encountered difficulties when comparing our findings due to the absence of systematic reviews and meta-analyses on similar population groups.

### Declaration

Ethics approval and consent to participant  
Not applicable

**Consent for Publication**

Not applicable

**Availability of Data and Materials**

all the data analyzed during the current systematic review and meta-analysis is available with reasonable request from corresponding author.

**Competing Interests**

all the authors declare that they have no competing interests

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Not applicable.

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