ISSN: 2754-4923

Journal of Diagnosis & Case Reports

SCIENTIFIC Research and Community

Research Article

Open Access

Magnitude and Determinants of Uncontrolled Blood Pressure among Adult Hypertensive Patients in Ethiopia: A Systematic Review and Meta-Analysis (2025)

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ABSTRACT

Background: According to the World Health Organization, an estimated 1.28 billion adults worldwide have hypertension, with two-thirds residing in low- and middle-income countries. Despite the serious health consequences of this condition, 46% of adults with hypertension are unaware that they have it, only 42% receive treatment, and only 1 in 5 individuals has adequately controlled blood pressure. So this study aimed to estimate the pooled magnitude and determinants of uncontrolled blood pressure among Hypertensive Patients in Ethiopia.

Methods: We conducted a systematic search of published studies from PubMed, Scopus, web of Science, and manually on Google Scholar. This meta-analysis follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines, The quality of studies was assessed by the JBI assessment tool. Meta-analysis was carried out using a random-effects method using the STATA™ Version 14 software.

Result: The 19 studies included 7013 participants were included in this meta-analysis. The pooled magnitude of uncontrolled blood pressure among hypertensives after correction of Duval and Tweedie's trim and fill analysis with random effect model was 56.6 % (95% CI: 48.6-62.6) Whereas the highest prevalence 67.8%; (95% CI: 28.2- 107.4) seen in Amhara region and the lowest 44.2 %;(95% CI: 32.3, 56.1) seen in Tigray region.

Conclusion: Despite of it had serious health impact; the magnitude of uncontrolled blood pressure in Ethiopia is a significant public health issue. The observed variation across different regions highlights the need for targeted interventions.

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Received: August 20 2025; **Accepted:** August 22, 2025; **Published:** August 30, 2025

Keywords: Uncontrolled Blood Pressure, Ethiopia, Meta-Analysis, Systematic Review

Introduction

Hypertension (HTN), or elevated blood pressure, is a common condition characterized by persistently high arterial blood pressure. According to the American Heart Association/American College of Cardiology (AHA/ACC) Blood Pressure Guideline, hypertension is defined as a blood pressure reading of ≥140/90 to ≥130/80 mmHg, based on an average of at least two readings taken on two separate occasions; If individuals blood pressure (BP) exceeds 140/90 mmHg it known as uncontrolled [1,2].

Hypertension is a serious medical condition that can increase the risk of heart disease, stroke, kidney issues, and other health problems. The impact of hypertension is especially pronounced in low- and middle-income countries, where approximately two-thirds of cases occur, largely due to an increase in risk factors in these populations over recent decades [3, 4]. Common risk factors for hypertension include the presence of comorbid conditions, low fruit consumption, physical inactivity, obesity, smoking, stress, and dyslipidemia [5-7].

According to the World Health Organization, an estimated 1.28 billion adults worldwide have hypertension, with two-thirds residing in low- and middle-income countries. Despite the serious health consequences of this condition, 46% of adults with hypertension are unaware that they have it, only 42% receive treatment, and only 1 in 5 individuals has adequately controlled blood pressure [8].

Evidence shows a significant association between hypertension and both all-cause mortality and cardiovascular disease (CVD)-specific mortality. Reports indicate 771 deaths attributed to heart disease and 256 deaths related to cerebrovascular disease [9]. Hypertension is increasingly recognized as a critical chronic noncommunicable disease, particularly in developing countries, leading to life-threatening complications [10].

Currently, raised blood pressure is a prominent health issue in low- and middle-income countries [11]. Poorly controlled blood pressure can lead to serious complications. Therefore, studying the magnitude and determinants of uncontrolled blood pressure is essential for informing healthcare strategies, improving population health, and reducing the overall burden of cardiovascular diseases.

Methods and Materials

Study Design and Search Strategy

This systematic review and meta-analysis were conducted under the Preferred Reporting Items guidelines for Systematic Reviews and Meta-analyses (PRISMA) statement [12]. We made the searching of articles published in English language published 2020 outwards from PubMed, Scopus, the web of Science, Cochrane data base, Google Scholar, and the reference lists of all relevant citations. The search was performed using key terms such as blood pressure, hypertension, raised blood pressure, hypertensive, magnitude, prevalence, level, proportion, adult, young, and Ethiopia.

Study Selection and Eligibility Criteria

- Population- the population included in this study was all adults.
- Condition – articles dealing about uncontrolled blood pressure included in this study.
- Context – articles conducted in Ethiopia were included in this study.
- Outcome- articles which deal about magnitude of uncontrolled blood pressure among hypertensives patients.
- Both published and unpublished studies conducted in Ethiopia were included.

Study Extraction and Quality Appraisal

The retrieved articles were exported to the reference manager software, EndNote x8, and removed duplicate studies. All reviewers independently screened the title and abstract based on established article selection criteria. The details of studies that met the inclusion criteria were imported into the Joanna Briggs Institute's System for the Unified Management, Assessment and Review of Information (JBI SUMARI, The Joanna Briggs Institute critical appraisal tools was used to evaluate the quality of all studies [13]. All reviewers independently appraised the quality of the studies by criteria adapted for reporting prevalence data and cross-sectional studies. Studies were considered low risk if a score of 7 and above of the quality assessment indicators. Any disagreements that arose between the reviewers were resolved through discussion with other reviewers. Data were extracted by all reviewers using a standardized data extraction format that was developed according to the 2014 Joanna Briggs Institute Reviewers' Manual. The tool used to extract includes authors' name, study year, region, study area, and study design, sample size, magnitude of uncontrolled blood pressure, and determinants with odds ratio in Ethiopia. Any discrepancy was solved through discussion.

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 [14].

Outcome Measure

The primary outcome of this review was the magnitude of uncontrolled blood pressure. The second outcome of is the determinants of uncontrolled blood pressure with odds ratio.

Data Synthesis and Analysis

The pooled magnitude of uncontrolled blood pressure was carried out using a random-effects (Der Simonian and Laird) method. The Heterogeneity among the included studies was checked with forest plot, I2 test, and the p-values. Heterogeneity among the included studies was investigated with subgroup analysis. Publication bias was checked with a funnel plot and egger test. Subgroup analysis was done by region of the study conducted. The results were presented in the form of text, tables, and figures. Additionally, a univariate meta-regression model was applied by taking sample size and publication year of the primary study to investigate the sources of heterogeneity. Finally, a forest plot figure was used to present the point proportions with their 95% CI of the primary studies. Meta-regression and sensitivity analysis was also conducted. STATA™ Version 14 software were used to conduct the analysis.

Results

Study Selection

Initially, a total of 7,525 studies were retrieved from the databases and manual searching. From this, 3,321 duplicates were found and removed. After title and abstract screening, 3548 irrelevant studies were removed. 656 articles were assessed for eligibility, and 637 of them were excluded due to not reporting the outcome of interest. Finally, a total of 19 studies was fulfilled the inclusion criteria and enrolled in the study. The detailed retrieval process is shown in figure 1.

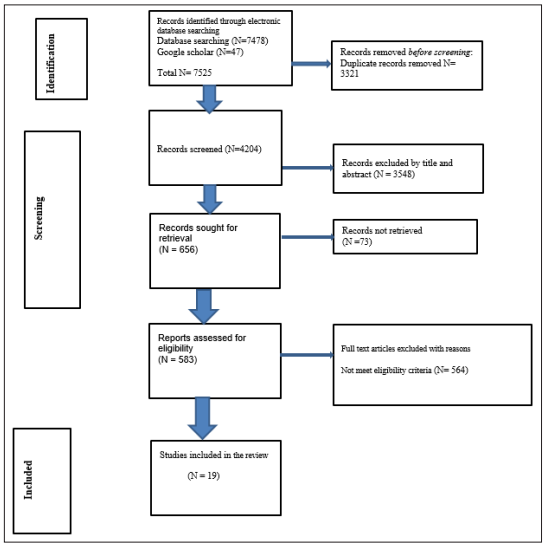

Figure 1: Prisma Flow Diagram of Study Selection

Study Characteristics

The 19 studies included 7013 participants. All studies are cross-sectional studies [15-33]. The sample size ranged from 186 [17] to 616 [28]. Most the studies were conducted in the Addis Ababa region. Among the included studies, the magnitude of uncontrolled blood pressure ranges from 31.4 [31] to 88 [30] (Table 1).

Table 1: Characteristics of the Study

Authors Name	Publication Year	Study area	Study design	Sample size	Magnitude 95% CI
Fekadu G,	2020	Nekemte	Cross-sectional	297	36.4(30.9-41.8)
Solomon M,	2023	Bishoftu	Cross-sectional	398	58.8(53.9-63.6)
Dedefo MG,	2020	Nekemte	Cross-sectional	186	44.1(36.9-51.2)
Worku AD,	2024	Addis Ababa	Cross-sectional	408	66.2(61.6-70.7)
Abdisa L,	2022	Dire Dawa	Cross-sectional	415	48(43.1-52.8)
Aberhe W,	2020	Mekele	Cross-sectional	396	48.6(43.6-53.5)
Gebremichael GB,	2019	Mekele	Cross-sectional	320	52.5(47.0-57.9)
Sheleme T,	2022	Bedele	Cross-sectional	219	56.2(49.6-62.7)
Sisay Y,	2022	Addis Ababa	Cross-sectional	474	52.1(47.6-56.5)
Teka AM,	2025	Addis Ababa	Cross-sectional	621	48(44.0-51.9)
Lemessa F	2021	Bale	Cross-sectional	323	56.7(51.2-62.1)
Barega B,	2023	Addis Ababa	Cross-sectional	369	60.2(55.2-65.1)
Kebede B,	2021	Jimma	Cohort	416	57.2(52.4-61.9)
Amare F,	2020	Addis Ababa	Cross-sectional	616	69(65.3-72.6)
Anota A,	2022	Shashemene	Cross-sectional	320	48.7(43.2-54.1)
Bogale K,	2021	Dessie	Cross-sectional	203	88(83.5-92.4)
Kinfe DG,	2020	Mekele	Cross-sectional	223	31.4(25.3-37.4)
Sorato MM	2022	South	Cross-sectional	406	86.2(82.8-89.5)
Wagaye M,	2024	Amhara	Cross-sectional	403	47.8(42.9-52.6)

Magnitude of Uncontrolled Blood Pressure

The pooled magnitude of uncontrolled blood pressure among hypertensives with random effect model was 56.6 % (95% CI: 48.6-62.6) with a heterogeneity index (I2) of 97.5% (p≤=0.001) (Figure 2).

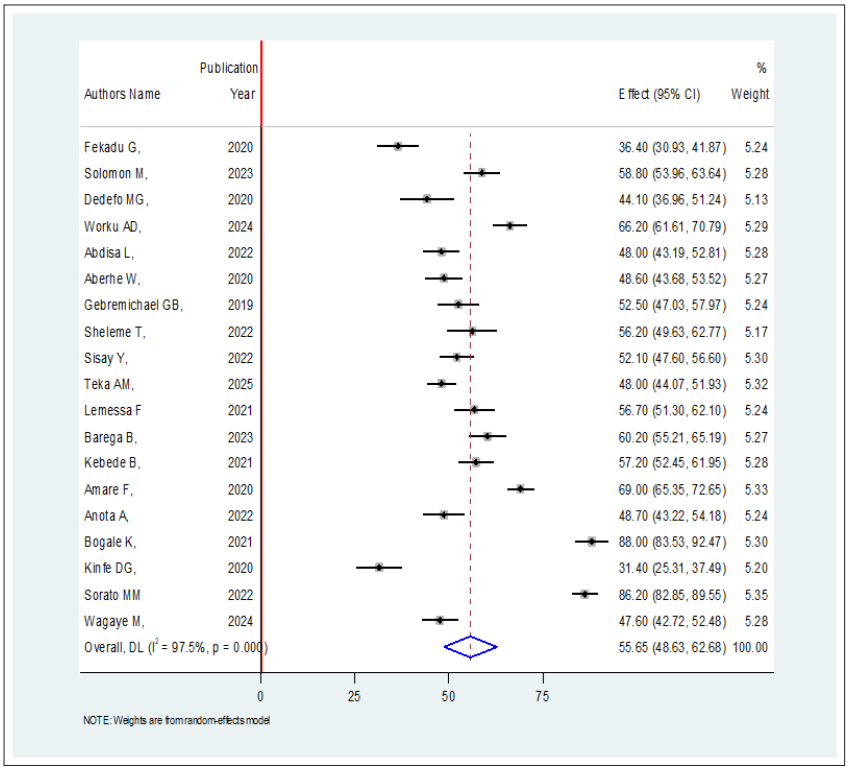

Figure 2: Forest Plot Showing Pooled Magnitude of Uncontrolled Blood Pressure Among Hypertensive Patient in Ethiopia

Subgroup Analysis

Subgroup analyses revealed variation across the regions, with highest prevalence 67.8%; (95% CI: 28.2- 107.4), I2 = 99.3%) seen in Amhara region and the lowest 44.2 %;(95% CI: 32.3, 56.1), I2 = 93.0%) seen in Tigray region (Figure 3).

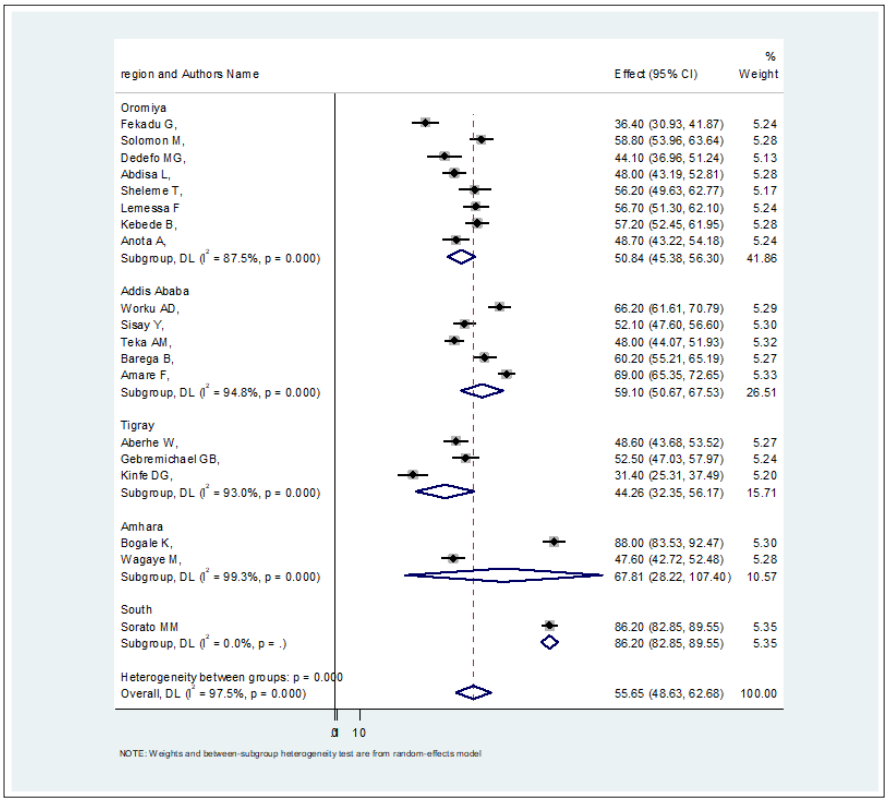

Figure 3: Subgroup Analysis of Magnitude of Uncontrolled Blood Pressure Among Hypertensive Patient in Ethiopia

Meta-Regression

Due to high heterogeneity in subgroup analysis, we have conducted meta-regression to investigate the extent to which statistical heterogeneity between results of multiple studies can be related to one or more characteristics of the studies by using sample size and publication year as a covariate. The meta-regressions showed the absence of effect of sample size and publication year on heterogeneity between studies (Table 2).

Heterogeneity source	Coefficients	Std. Err.	P-value
Sample size	0.0284798	.0.1233148	0.820
Year of publication	1.311042	8.74078	0.883

Publication Bias

The visual inspection of the funnel plot indicated asymmetrical distribution (Figure 4). Additionally, Egger's linear regression test had used to identify publication bias. The result showed that Egger's linear regression test was statistically significant (P = 0.007) and the presence of publication bias. 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, so the pooled prevalence was 55.6% CI (48.6- 62.6). As a result, it was adjusting for the publication bias by rim and fill analysis; then the funnel plot appeared symmetrical (Figure 5).

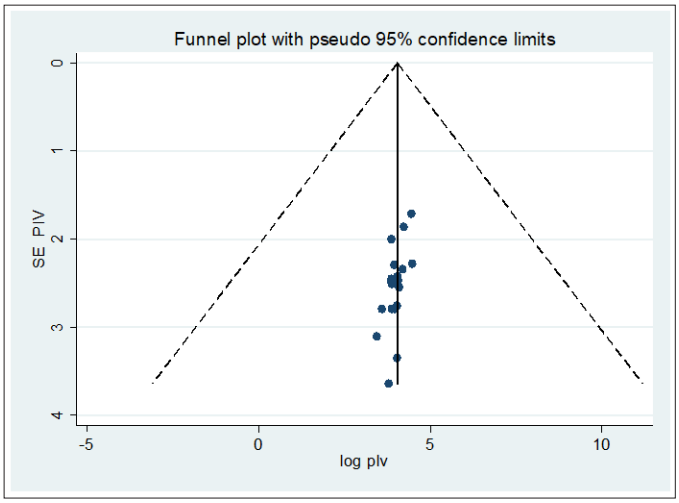

Figure 4: Funnel Plot to Test the Publication Bias in 19 Studies With 95% Confidence Limits

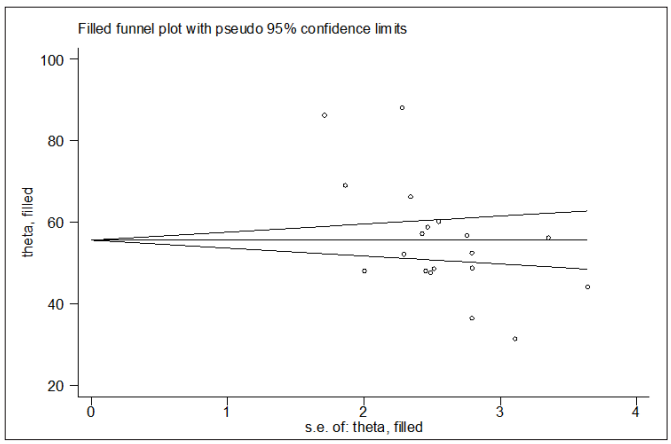

Figure 5: Filled Funnel Plot after Adjusting for Publication Bias With 95% Confidence Limits

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 that the removal of a single study did not have a significant influence on pooled magnitude (Figure 6).

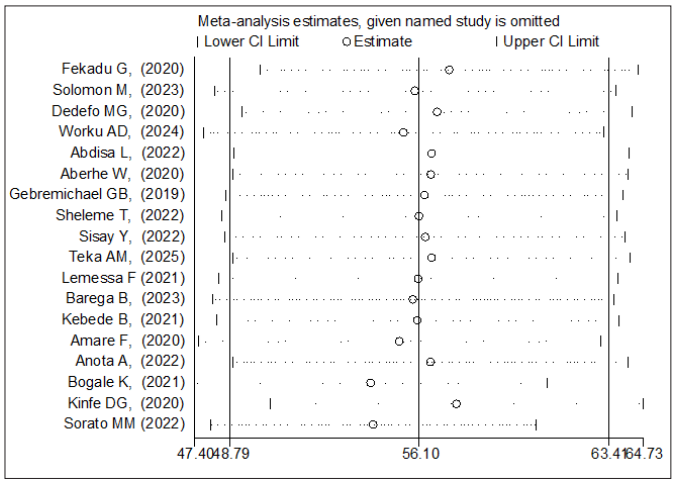

Figure 6: Sensitivity Analysis of Magnitude of Uncontrolled Blood Pressure Among Hypertensive Patient in Ethiopia for Each Study Being Removed one at a Time

Discussion

The prevalence of uncontrolled blood pressure in developing countries, predominantly in Sub-Saharan Africa and countries like Ethiopia, is a pressing public health concern. Despite advancements in medical technology and awareness, many countries still struggle to manage hypertension effectively. In Ethiopia, where healthcare resources are often constrained, many individuals may not receive regular check-ups or necessary medications.

The pooled magnitude of uncontrolled blood pressure after conducting Duval and Tweedie's trim and fill analysis was found to be 55.6% with a confidence interval of 48.6% to 62.6%. This finding indicates a significant prevalence of uncontrolled blood pressure within the studied population. This finding is higher than systematic review and meta-analysis conducted in Ethiopia 48% five years back and Sub-Saharan Africa 50.2%. The discrepancy can be attributed to several factors like worsening trend in hypertension management, possibly due to factors such as aging populations, increasing incidence of lifestyle-related diseases/ more sedentary life, and changes in the population's health behaviors.

Subgroup analyses revealed variation across the regions, with highest prevalence 67.8%; (95% CI: 28.2- 107.4) seen in Amhara region and the lowest 44.2 %;(95% CI: 32.3, 56.1) seen in Tigray region, the differences in magnitude of the regions might be differences in health care accessibility, demographic characteristics, socioeconomic conditions, availability and quality of medical services.

Conclusion

Despite of it had serious health impact; the magnitude of uncontrolled blood pressure in Ethiopia is a significant public health issue. The observed variation across different regions highlights the need for targeted interventions, particularly in the Amhara region, which demonstrated the highest prevalence of 67.8%. In contrast, the Tigray region exhibited a lower prevalence of 44.2%. These findings underscore the importance of regional assessments in addressing hypertension and developing tailored strategies to mitigate the risks associated with uncontrolled blood pressure effectively. Future efforts should focus on implementing effective monitoring and intervention programs.

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