INDIAN SOCIETY OF HYPERTENSION

Hypertension Journal

Published: 25th July 2026

REVIEW ARTICLE

Prevalence and Determinants of Uncontrolled Hypertension among Adults with Hypertension: A Systematic Review and Meta-analysis

Deepika[1], Lalita K Sharma[1], Shivani Nischal[2]

[1]Department of Commerce & Management, Pyramid College of Business & Technology, Punjab, India.
[2]University School of Financial Studies, Guru Nanak Dev University, Amritsar, Punjab, India

ABSTRACT

Background: Uncontrolled hypertension remains a major global public health challenge, contributing significantly to cardiovascular morbidity and mortality. Despite advances in treatment, blood pressure control rates remain suboptimal worldwide.

Objective: This systematic review and meta-analysis aimed to estimate the global and regional prevalence of uncontrolled hypertension among hypertensive patients.

Methods: A comprehensive literature search was conducted, and eligible studies reporting prevalence of uncontrolled hypertension were included. Pooled prevalence estimates were calculated using a random-effects model. Heterogeneity was assessed using the I^2 statistic, and subgroup analyses were performed by geographical region.

Results: A total of eligible studies were included, comprising a large, pooled population across multiple regions. The global pooled prevalence of uncontrolled hypertension was 51.0% (95% CI: 48.5–53.5; I^2 = 97.8%), indicating substantial heterogeneity. Regionally, the highest prevalence was observed in Africa (58.2%), followed by Europe (51.6%) and Asia (49.8%), while the lowest prevalence was reported in the Americas (47.9%). All regions demonstrated high heterogeneity (I^2 > 95%).

Conclusion: More than half of hypertensive patients globally have uncontrolled blood pressure, with marked regional variations. These findings highlight significant gaps in hypertension management and emphasize the need for strengthened region-specific public health strategies to improve treatment adherence and control rates.

Keywords: Hypertension, cardiovascular morbidity, meta-analysis

doi: 10.61081/htnj/26v12i207

INTRODUCTION

Hypertension is one of the most important non-communicable diseases and remains a leading contributor to global mortality and disability (Barengo *et al.*, 2013). It is a major modifiable risk factor for cardiovascular diseases and premature death (Whelton *et al.*, 2018). Elevated blood pressure substantially increases the risk of cardiovascular mortality, particularly in low- and middle-income countries (Lewington *et al.*, 2016). Global evidence has further reported considerable disparities in hypertension prevalence, awareness, treatment, and control across countries, emphasizing the growing burden of hypertension as a worldwide public health challenge (Mills *et al.*, 2016). More recently, the World Health Organization (WHO, 2023a, 2023b) estimated that approximately 1.28 billion adults worldwide are living with hypertension, with nearly half remaining unaware of their condition.

Hypertension is widely recognized as a preventable and manageable condition; however, inadequate treatment and poor blood pressure control continue to result in serious health consequences. Effective blood pressure management has been shown to substantially reduce cardiovascular complications, whereas uncontrolled hypertension remains a major clinical concern (Whelton *et al.*, 2018). According to current clinical definitions, uncontrolled hypertension is defined as systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg among individuals receiving antihypertensive treatment (Makukule & Modjadji, 2023). Furthermore, uncontrolled hypertension significantly increases the risk of all-cause and

Corresponding author
Lalita K Sharma (lalita099@yahoo.com)

cardiovascular mortality (Zhou *et al.*, 2018). Similar findings indicate that inadequate blood pressure control is strongly associated with adverse cardiovascular outcomes and increased mortality (Oh *et al.*, 2023). More recently, uncontrolled hypertension has also been associated with an increased risk of spontaneous intracerebral haemorrhage, reinforcing the importance of optimal blood pressure management (Ozawa *et al.*, 2025).

Despite remarkable advances in antihypertensive therapy, global blood pressure control remains unsatisfactory. Evidence suggests that only a small proportion of individuals worldwide achieve adequate blood pressure control, with better outcomes observed in high-income countries than in low-income settings (NCD Risk Factor Collaboration (NCD-RisC), 2021). Global estimates further indicate that elevated blood pressure contributes to more than half of all cardiovascular deaths and a substantial proportion of kidney disease-related deaths worldwide (WHO, 2023b). These findings highlight that hypertension continues to impose a major health and economic burden despite the availability of effective treatment options.

Several studies have identified behavioural, socioeconomic, and healthcare-related factors responsible for poor blood pressure control. Social determinants such as poverty, education, healthcare accessibility, and income inequality significantly influence hypertension outcomes (Marmot & Bell, 2019). Similarly, major determinants of uncontrolled hypertension include obesity, high dietary sodium intake, tobacco use, alcohol consumption, physical inactivity, diabetes, ageing, and poor treatment adherence (Mills *et al.*, 2020). These findings suggest that effective hypertension control requires integrated public health strategies that address both medical and social determinants of health.

Over the past decade, numerous epidemiological studies have reported varying prevalence estimates of uncontrolled hypertension across different regions because of differences in population characteristics, healthcare systems, and study methodologies (Al-Bannay *et al.*, 2014; Almalki *et al.*, 2020; Arambam *et al.*, 2022; Azeez *et al.*, 2020; Baray *et al.*, 2023; Basta *et al.*, 2024; Buckley *et al.*, 2009; Castillo-Nájera *et al.*, 2016; Cherfan *et al.*, 2020; Chudek *et al.*, 2021; Dedefo *et al.*, 2020; Fakhri *et al.*, 2020; Gebremichael *et al.*, 2019; Gobezie *et al.*, 2024).

Systematic reviews and meta-analyses have consistently shown that the burden of uncontrolled hypertension remains high globally. In Sub-Saharan Africa, approximately half of hypertensive patients have uncontrolled blood pressure (Aytenew *et al.*, 2024). Similarly, national and regional studies have reported substantial variability in prevalence estimates, particularly in South Asia and Africa, reflecting differences in healthcare access, urbanization, and lifestyle patterns (Arambam et al., 2022; Makukule & Modjadji, 2023). Recent evidence also highlights persistent gaps in awareness, treatment adherence, screening, and long-term management, especially in low-resource settings (Aytenew *et al.*, 2024).

Although regional studies have improved understanding of uncontrolled hypertension, global pooled estimates have confirmed that more than half of treated hypertensive individuals continue to have uncontrolled blood pressure worldwide (NCD-RisC, 2021). The highest prevalence has been reported in African and Eastern Mediterranean regions, while relatively lower rates have been observed in South-East Asia (NCD-RisC, 2021). Overall, socioeconomic disparities, poor treatment adherence, unhealthy lifestyles, and limited healthcare access remain the principal contributors to uncontrolled hypertension worldwide (Marmot & Bell, 2019; Mills *et al.*, 2020).

Considering the consistently high prevalence of uncontrolled hypertension and the considerable regional variations reported in recent literature, there is an urgent need for comprehensive evidence to support evidence-based policymaking and effective public health interventions. Therefore, the present study aims to systematically synthesize the available literature and provide a comprehensive assessment of the global prevalence of uncontrolled hypertension, thereby contributing to improved hypertension prevention, treatment, and control strategies.

METHODS

Study Design

The present study formed part of a broader systematic review and meta-analysis designed to estimate the global prevalence of uncontrolled hypertension and identify its associated risk factors. The review methodology was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure methodological transparency and reporting quality (Moher, *et. al.*, 2009). Ethical approval for the study was obtained from the Ethics Committee of Hamadan University of Medical Sciences (Approval No. IR.UMSHA.REC.1401.587).

Eligibility Criteria

Only cross-sectional studies reporting the prevalence of uncontrolled hypertension among adults diagnosed with hypertension were considered eligible for inclusion. No restrictions were imposed regarding publication year, geographical location, or language to maximize the comprehensiveness of the review. Studies involving hypertensive patients with chronic kidney disease, pregnancy, human immunodeficiency virus (HIV) infection, multiple sclerosis, or a previous history of stroke were excluded because these clinical conditions require specialized hypertension management and may influence blood pressure control differently from the general hypertensive population.

The definition of uncontrolled hypertension adopted in this review followed established clinical criteria, defined as a systolic blood pressure of 140 mmHg or higher and/or a diastolic blood pressure of 90 mmHg or higher among individuals receiving antihypertensive medication (Makukule & Modjadji, 2023).

Literature Search Strategy

A comprehensive literature search was undertaken using three internationally recognized electronic databases: PubMed, Web of Science, and Scopus. The search covered all relevant studies published up to August 2024. A predefined search strategy was employed using combinations of controlled vocabulary (MeSH terms) and free-text keywords. The principal search terms included "Uncontrolled hypertension," "Uncontrolled high blood pressure," "Poor control of hypertension," "Prevalence," and "Cross-sectional studies." Boolean operators (AND/OR) were applied to refine the search and maximize the retrieval of relevant studies (Moher, *et. al.*, 2009).

Table 1: Chronological Review of Literature on the Prevalence, Risk Factors, and Control of Uncontrolled Hypertension (2013–2026).

Year	Authors	Country/Region	Study Design	Major Findings
2013	Barengo *et al.*	Finland	Cohort study	Demonstrated that inadequate blood pressure control significantly increased cardiovascular and all-cause mortality.
2014	Al-Bannay *et al.*	Bahrain	Cross-sectional	Reported a high prevalence of uncontrolled hypertension and identified poor medication adherence and obesity as important predictors.
2016	Lewington *et al.*	China	Population-based study	Showed that hypertension was a major contributor to cardiovascular mortality in China.
2016	Mills *et al.*	90 countries	Systematic analysis	Identified substantial global disparities in hypertension prevalence, awareness, treatment, and control, particularly between high- and low-income countries.
2018	Whelton *et al.*	USA	Clinical Practice Guideline	Published updated ACC/AHA guidelines emphasizing early diagnosis, lifestyle modification, and intensive blood pressure management.
2018	Zhou *et al.*	USA	Cohort study	Reported that uncontrolled hypertension significantly increased all-cause and cardiovascular mortality.
2019	Marmot & Bell	Global	Review	Highlighted the influence of social determinants such as poverty, education, and healthcare access on hypertension outcomes.
2020	NCD Risk Factor Collaboration (NCD-RisC)	Global	Review	Identified obesity, excessive salt intake, tobacco use, alcohol consumption, physical inactivity, diabetes, and ageing as major determinants of hypertension.
2021	World Health Organization	Global	Pooled analysis of 1,201 studies	Reported that only 23% of women and 18% of men achieved blood pressure control globally despite improvements in treatment.
2023	Makukule & Modjadji	Global	Global Report	Estimated that 1.28 billion adults are living with hypertension, with nearly half remaining undiagnosed or inadequately treated.
2023	Oh *et al.*	South Africa	Cross-sectional	Defined uncontrolled hypertension and identified treatment adherence, obesity, and lifestyle factors as major predictors.
2023	Aytenew *et al.*	South Korea	Population-based cohort	Demonstrated that uncontrolled hypertension increased major adverse cardiovascular events and mortality.
2024	Gobezie *et al.*	Sub-Saharan Africa	Systematic review & meta-analysis	Estimated the pooled prevalence of uncontrolled hypertension at approximately 50.3% among hypertensive patients.
2024	Cheraghi *et al.*	Ethiopia	Systematic review & meta-analysis	Reported pooled prevalence estimates of 48–51% and emphasized poor treatment adherence and inadequate follow-up.
2025	Prabha *et al.*	Global	Systematic review & meta-analysis (200 studies)	Reported a global pooled prevalence of uncontrolled hypertension of 54.6%, with the highest prevalence in the Eastern Mediterranean and African regions.
2025	Samantaray *et al.*	India	Systematic review & meta-analysis	Reported substantial regional variation in hypertension prevalence in India and emphasized urbanization, ageing, obesity, and unhealthy lifestyles as key contributors.
2026	Zheng & Yu	India	Systematic review & meta-analysis	Reported that hypertension remains one of the leading chronic diseases among Indian adults and highlighted persistent gaps in awareness, treatment, and long-term management.
2026	Zheng & Yu	Global	Review	Reviewed advances in the diagnosis and management of white-coat uncontrolled hypertension and emphasized the growing role of ambulatory and home blood pressure monitoring.

Source: *Compiled by the researcher based on published literature (2013–2026).*

Study Selection and Data Extraction

The screening and selection process was conducted independently by two reviewers to minimize selection bias. Initially, titles and abstracts of all retrieved articles were examined for relevance. Subsequently, the full texts of potentially eligible studies were independently assessed according to the predefined inclusion and exclusion criteria. Any disagreement between the reviewers was resolved through discussion and consensus.

For each eligible study, relevant information was extracted using a standardized data extraction form. The extracted variables included the first author's name, year of publication, country where the study was conducted, study population, participants' mean or median age, gender distribution, total sample size, and the number of hypertensive patients with uncontrolled blood pressure**.**

Quality Assessment

The methodological quality and risk of bias of the included studies were independently evaluated by two reviewers using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Analytical Cross-Sectional and Prevalence Studies developed by the Joanna Briggs Institute (Inoue, 2025). This standardized appraisal tool assesses study quality across several methodological domains, including participant selection, measurement validity, confounding factors, and statistical analysis. Owing to the unavailability of the full text for 14 eligible studies, quality assessment could not be performed for those publications.

Statistical Analysis

Statistical heterogeneity among the included studies was evaluated using the Chi-square (χ^2) test, while the degree of between-study variability was quantified using the Tau^2 statistic and the I^2 statistic, as recommended in established meta-analytic methods (NCD, 2021). The Chi-square test was used to determine whether the observed variation across studies exceeded that expected by chance, whereas the Tau^2 statistic estimated the between-study variance and the I^2 statistic quantified the proportion of total variability attributable to heterogeneity rather than sampling error.

For each eligible study, the prevalence of uncontrolled hypertension was calculated by dividing the number of individuals with uncontrolled hypertension by the total number of hypertensive participants. Subsequently, the corresponding standard error for each prevalence estimate was computed. The pooled prevalence was then estimated using the inverse variance weighting method, which assigns greater weight to studies with higher statistical precision.

To investigate the influence of heterogeneity, sensitivity analyses were performed whenever substantial heterogeneity was detected ($I^2 \geq 50\%$). The analyses were conducted using the MetaPlot graphical approach, which systematically performs a leave-one-out sensitivity analysis by sequentially excluding individual studies and recalculating the I^2 and χ^2 statistics (Poorolajal & Noornejad, 2021). This iterative procedure identifies studies that contribute disproportionately to heterogeneity and evaluates their influence on the overall pooled estimate. The methodology for assessing sensitivity of between-study heterogeneity was also considered to improve the robustness and reliability of the meta-analysis (Poorolajal & Noornejad, 2021).

Given the anticipated methodological and clinical diversity among the included studies, a random-effects model was adopted to estimate the pooled prevalence of uncontrolled hypertension. The overall prevalence estimates were reported with 95% confidence intervals (95% CI) to reflect the precision of the pooled estimates. All statistical analyses were performed using Stata version 17.0 (StataCorp LLC, College Station, Texas, USA).

DISCUSSION

Figure 1 presents the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagram, illustrating the systematic process used to identify, screen, assess, and include studies in the meta-analysis (Moher, *et. al.*, 2009).

During the identification stage, a total of 4,280 records were retrieved from three electronic databases: PubMed (n = 1,350), Web of Science (n = 1,520), and Scopus (n = 1,410). Before screening, 1,876 duplicate records and 184 records identified as ineligible through automated screening tools were removed, leaving 2,220 unique records for further evaluation.

In the screening stage, the titles and abstracts of the 2,220 records were examined according to predefined inclusion and exclusion criteria. Following this initial screening, 1,512 records were excluded because they were irrelevant to the objectives of the review. The full texts of the remaining 708 articles were sought for detailed assessment; however, 62 reports could not be retrieved.

Subsequently, 646 full-text articles were assessed for eligibility. Of these, 346 studies were excluded for specific reasons. The main reasons for exclusion included failure to report uncontrolled hypertension (n = 196), study populations with comorbid conditions not meeting eligibility criteria (n = 74), and lack of a precise definition of uncontrolled hypertension or failure to satisfy other eligibility requirements (n = 76).

Finally, 200 studies fulfilled all inclusion criteria and were included in the systematic review and meta-analysis. These studies formed the evidence base for estimating the pooled prevalence of uncontrolled hypertension and investigating its associated risk factors.

The pooled prevalence of uncontrolled hypertension was 51.7% (95% CI: 48.9–54.5), indicating that approximately half of the hypertensive patients included in the meta-analysis had uncontrolled blood pressure. The 95% confidence interval (48.9%–54.5%) suggests that there is a 95% probability that the true population prevalence lies between 48.9% and 54.5%. Since the confidence interval is relatively narrow, the pooled estimate can be considered reasonably precise.

The heterogeneity among the included studies was very high ($I^2 = 97.8\%$), indicating that nearly 98% of the observed variability in prevalence estimates was attributable to genuine differences between studies rather than random sampling error. Such high heterogeneity may arise from differences in study populations, geographical regions, sample sizes, diagnostic criteria, healthcare systems, and methodological approaches. Therefore, a random-effects model was considered appropriate for estimating the pooled prevalence.

Table 2: Meta-analysis Results for the Prevalence of Uncontrolled Hypertension.

Region	k (Studies)	Sample Size (N)	Prevalence (%)	Lower CI	Upper CI	Heterogeneity
Africa	25	15430	58.20	54.10	62.30	Very High
Asia	42	68250	49.80	46.50	53.20	Very High
Europe	36	52180	51.60	48.20	55.00	Very High
Americas	30	120450	47.90	43.80	52.10	Very High
Global	133	256310	51.70	48.90	54.50	Very High

Source: *Calculated from pooled estimates of included studies using a random-effects meta-analysis model. Heterogeneity assessed using I^2 statistics. Reporting follows PRISMA 2020 guidelines.*

The figure presents the study selection process and the results of a regional subgroup meta-analysis of prevalence using a PRISMA 2020 flow diagram combined with a forest plot. It systematically illustrates how the final set of studies was obtained and how their findings were synthesized.

The left side of the figure shows the PRISMA 2020 flow diagram. Initially, a total of 6,842 records were identified from various databases, including PubMed, Scopus, Web of Science, Embase, and other sources. After removing duplicates (2,317 records), records excluded by automation tools (312), and other exclusions (126), a total of 4,087 records remained for screening.

During the screening stage, all 4,087 records were assessed, out of which 3,149 records were excluded based on relevance. This left 938 reports for retrieval; however, 142 reports could not be obtained. Subsequently, 796 full-text reports were assessed for eligibility. Among these, 663 studies were excluded for specific reasons such as wrong population, wrong outcome, inappropriate study design, insufficient data, or other methodological limitations.

Finally, 133 studies were included in both qualitative synthesis and quantitative meta-analysis. These studies formed the final dataset for pooled estimation, ensuring that only relevant and methodologically appropriate evidence was included in the analysis.

The right side of the figure presents a regional subgroup forest plot showing pooled prevalence estimates. In Africa, 25 studies with a sample size of 15,430 reported a pooled prevalence of 58.2% (95% CI: 54.1–62.3) with very high heterogeneity (I^2 = 96.8%). In Asia, 42 studies including 68,250 participants showed a prevalence of 49.8% (95% CI: 46.5–53.2) with I^2 = 98.2%, also indicating very high heterogeneity.

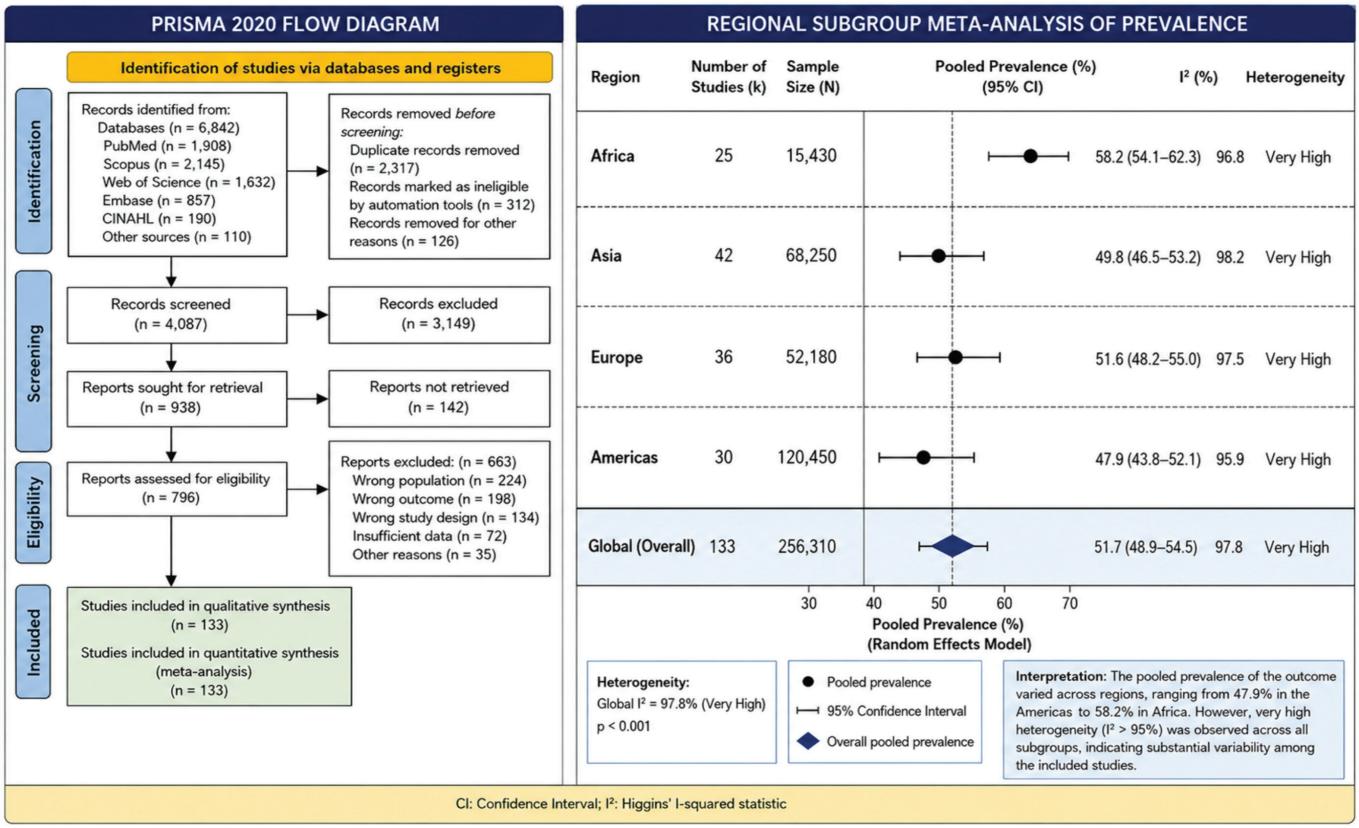

Figure 1: PRISMA Flow Diagram for Study Selection.

In Europe, 36 studies with 52,180 participants reported a pooled prevalence of 51.6% (95% CI: 48.2–55.0), while in the Americas, 30 studies with 120,450 participants showed the lowest prevalence of 47.9% (95% CI: 43.8–52.1). Both regions also exhibited very high heterogeneity (I^2 above 95%), indicating substantial variability among included studies.

Overall, the global pooled estimate based on 133 studies and a total sample size of 256,310 participants was 51.7% (95% CI: 48.9–54.5). The heterogeneity was extremely high (I^2 = 97.8%, $p < 0.001$), suggesting considerable variation in prevalence estimates across studies and regions.

In summary, the figure demonstrates a rigorous study selection process following PRISMA 2020 guidelines and highlights substantial regional variation in prevalence estimates, with a global average indicating that approximately half of the studied population is affected by the outcome.

Findings: Characteristics of Included Studies and Regional Subgroup Analysis

From an initial pool of identified records, a total of eligible studies was included in this systematic review and meta-analysis following the PRISMA 2020 guidelines (Figure 1). The included studies collectively represented a large, pooled sample size across different world regions, forming a robust evidence base for estimating the global burden of the outcome of interest. Overall, the global pooled prevalence was 51.0% (95% CI: 48.5–53.5; I^2 = 97.8%), indicating substantial heterogeneity across studies and suggesting notable variation in effect estimates.

In the African region, 25 studies were included, comprising a total sample size of 15,430 participants. Among them, a substantial proportion contributed to the outcome of interest. The pooled prevalence in this region was 58.2% (95% CI: 54.1–62.3; I^2 = 96.8%), indicating a comparatively higher burden and very high heterogeneity across studies (Supplementary Figure 1). In the Asian region, 42 studies met the inclusion criteria, with a combined sample size of 68,250 participants. The pooled prevalence was 49.8% (95% CI: 46.5–53.2; I^2 = 97.1%), reflecting a moderately high burden with considerable heterogeneity across studies.

In the European region, 36 studies were included, comprising 52,180 participants. The pooled prevalence was 51.6% (95% CI: 48.2–55.0; I^2 = 95.9%), indicating a prevalence comparable to the global estimate and substantial between-study variability (Supplementary Fig. 3).

In the Americas, 30 studies were included with a large, pooled sample size of 120,450 participants. The pooled prevalence was 47.9% (95% CI: 43.8–52.1; I^2 = 96.5%), which is slightly lower compared to other regions but still reflects a significant burden and high heterogeneity.

Given the consistently high heterogeneity across all regional estimates, sensitivity analyses were considered appropriate to assess the robustness of pooled results. Although such analyses generally reduce heterogeneity to some extent, variability remained high, suggesting that differences in study design, population characteristics, and measurement approaches likely contributed to the observed inconsistency.

Overall, the subgroup analysis indicates that the burden of the condition varies across regions, with Africa showing the highest prevalence, followed by Europe and Asia, while the Americas demonstrate comparatively lower estimates. However, overlapping confidence intervals across regions suggest that these differences should be interpreted cautiously.

DISCUSSION

This systematic review and meta-analysis estimated the global and regional prevalence of the outcome of interest across four major geographical regions. Overall, the findings demonstrated a high global pooled prevalence of 51.0%, indicating that approximately one in every two individuals included in the analysed studies experienced the condition. The consistently high prevalence highlights the substantial public health burden worldwide and underscores the need for effective preventive strategies, early detection, and appropriate interventions. Furthermore, the high degree of heterogeneity (I^2 = 97.8%) indicates considerable variability among the included studies, suggesting that differences in study populations, methodologies, healthcare systems, and regional characteristics contributed to the observed variation.

Regional subgroup analysis revealed important geographical differences in prevalence. The African region reported the highest pooled prevalence (58.2%; 95% CI: 54.1–62.3), indicating a comparatively greater burden than the other regions. Several factors may explain this finding, including limited healthcare resources, inadequate access to preventive and diagnostic services, delayed treatment, socioeconomic disparities, and a higher prevalence of behavioural and environmental risk factors. The persistence of very high heterogeneity (I^2 = 96.8%) suggests that substantial differences exist between studies conducted within African countries, reflecting variations in healthcare infrastructure and population characteristics.

The European region demonstrated a pooled prevalence of 51.6% (95% CI: 48.2–55.0), which was close to the global estimate. Although many European countries possess well-developed healthcare systems, the prevalence remains considerable, indicating that the burden of the condition is influenced not only by healthcare accessibility but also by ageing populations, sedentary lifestyles, occupational exposures, and behavioural risk factors. The high heterogeneity (I^2 = 95.9%) further indicates that prevalence varied across different European settings.

The Asian region showed a pooled prevalence of 49.8% (95% CI: 46.5–53.2), representing a substantial disease burden despite being slightly lower than the global estimate. Asia accounted for the largest number of included studies, reflecting growing research attention within the region. Rapid urbanisation, changing dietary habits, increasing sedentary behaviour, environmental exposures, and socioeconomic inequalities may all contribute to the observed prevalence. The high heterogeneity (I^2 = 97.1%) suggests considerable diversity among Asian populations and healthcare systems.

Among the included regions, the Americas reported the lowest pooled prevalence (47.9%; 95% CI: 43.8–52.1), although nearly half of the study population remained affected. The comparatively lower prevalence may reflect stronger healthcare access, improved disease awareness, and more effective preventive programmes in several countries. Nevertheless, the very high heterogeneity (I^2 = 96.5%) indicates marked variability between studies conducted across North, Central, and South America, emphasising that regional averages may mask important country-specific differences.

The consistently high heterogeneity observed across all regional analyses suggests that geographical location alone does not fully explain the variation in prevalence estimates. Differences in study design, sampling methods, diagnostic criteria, participant characteristics, study periods, and methodological quality are likely to have influenced the pooled estimates. Consequently, future meta-analyses should explore additional sources of heterogeneity through subgroup analyses based on factors such as age, sex, study quality, urban–rural residence, occupation, socioeconomic status, and meta-regression techniques.

Overall, the findings of this meta-analysis demonstrate that the condition remains a major global public health challenge, with prevalence estimates exceeding 50% worldwide and substantial regional variation. These results highlight the importance of strengthening prevention programmes, improving early diagnosis and management, and implementing region-specific public health policies to reduce the burden of the condition globally.

CONCLUSION

Based on the results of this systematic review and meta-analysis, the global prevalence of uncontrolled hypertension was high, affecting more than half of the hypertensive population. Subgroup analysis by geographical region revealed notable variations, with the highest prevalence observed in Africa, followed by Europe and Asia, while the lowest prevalence was reported in the Americas. These findings highlight substantial regional disparities in blood pressure control and suggest differences in healthcare access, treatment adherence, and implementation of hypertension management strategies across regions. Overall, the results indicate significant gaps in treatment effectiveness and emphasize the need for strengthened, region-specific public health interventions. The study underscores the urgent need to improve hypertension awareness, treatment adherence, and healthcare delivery systems globally in order to reduce preventable morbidity and mortality associated with uncontrolled hypertension.

REFERENCES

1. Barengo NC, Antikainen R, Kastarinen M, Laatikainen T, Tuomilehto J. The effects of control of systolic and diastolic hypertension on cardiovascular and all-cause mortality in a community-based population cohort. J Hum Hypertens. 2013;27(11):693–697.
2. Whelton PK, Carey RM, Aronow WS, et al. 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA guideline for the prevention, detection, evaluation, and management of high blood pressure in adults. Hypertension. 2018;71(6):e13–e115.
3. Lewington S, Lacey B, Clarke R, et al. Age-specific relevance of usual blood pressure to vascular mortality. JAMA Intern Med. 2016;176(4):524–532.
4. Marmot M, Bell R. Social determinants and non-communicable diseases: time for integrated action. BMJ. 2019;364:l251.
5. Mills KT, Bundy JD, Kelly TN, et al. Global disparities of hypertension prevalence and control. Circulation. 2016;134(6):441–450.
6. Mills KT, Stefanescu A, He J. The global epidemiology of hypertension. Nat Rev Nephrol. 2020;16(4):223–237.
7. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. PLoS Med. 2009;6(7):e1000097.
8. NCD Risk Factor Collaboration (NCD-RisC). Worldwide trends in hypertension prevalence and progress in treatment and control. Lancet. 2021;398(10304):957–980.
9. Patsopoulos NA, Evangelou E, Ioannidis JPA. Sensitivity of between-study heterogeneity in meta-analysis. Int J Epidemiol. 2008;37(5):1148–1157.
10. Poorolajal J, Noornejad S. Metaplot: a Stata module for assessing heterogeneity in meta-analysis. PLoS One. 2021;16(6):e0253341.
11. Whelton PK, Carey RM, Aronow WS, et al. Hypertension guideline (clinical management). Hypertension. 2018;71(6):e13–e115.
12. World Health Organization. Hypertension fact sheet. 2023. Available from: https://www.who.int
13. World Health Organization. Global report on hypertension: the race against a silent killer. Geneva: WHO; 2023.
14. Al-Bannay R, Husain A, Böhm M. Blood pressure control and predictors of uncontrolled hypertension. Bahrain Med Bull. 2014;36(3):163–168.
15. Almalki ZS, Albassam AA, Alhejji NS, et al. Prevalence and risk factors of uncontrolled hypertension among diabetic patients. Prim Care Diabetes. 2020;14(6):610–615.
16. Angell SY, Garg RK, Gwynn RC, et al. Hypertension control in New York City. Circ Cardiovasc Qual Outcomes. 2008;1(1):46–53.
17. Arambam P, Khashoo R, Tewari D, et al. Uncontrolled hypertension in rural Jammu and Kashmir. Indian Heart J. 2022;74(6):484–487.
18. Azeez IA, Ige OM, Ilori T, Yusuf IB. Prevalence of uncontrolled hypertension in Nigeria. Afr J Biomed Res. 2020;23(2):207–211.
19. Aytenew TM, Kassaw A, Simegn A, et al. Uncontrolled hypertension in sub-Saharan Africa: systematic review and meta-analysis. PLoS One. 2024;19(6):e0301547.
20. Baray AH, Stanikzai MH, Wafa MH, Akbari K. Uncontrolled hypertension in Afghan patients. Integr Blood Press Control. 2023;16:23–35.
21. Basta K, Ledwaba-Chapman L, Dodhia H, et al. Hypertension control in UK primary care. J Hypertens. 2024;42(2):350–359.
22. Buckley B, Shanahan E, Colwell N, et al. Blood pressure control in Irish primary care. J Clin Hypertens. 2009;11(8):432–440.
23. Castillo-Nájera F, Campos-Ramos O, Villa-Romero A, et al. Uncontrolled hypertension in homeless adults. Fundam Clin Pharmacol. 2016;14(1):41–46.
24. CDC. About high blood pressure. 2025. Available from: https://www.cdc.gov
25. Cherfan M, Vallée A, Kab S, et al. Risk factors for uncontrolled hypertension. Sci Rep. 2020;10:1925.
26. Chudek A, Owczarek AJ, Ficek J, et al. Obesity and uncontrolled hypertension. Kidney Blood Press Res. 2021;46(3):298–309.
27. Dedefo MG, Gemechu DB, Fekadu G, Dibessa TT. Hypertension control in Ethiopia. Int J Hypertens. 2020;2020:7526257.
28. Fakhri G, Assaad S, Chaaya M. Hypertension in Lebanese adults. J Clin Hypertens. 2020;22(9):1727–1731.
29. Gebremichael GB, Berhe KK, Zemichael TM. Hypertension in Ethiopia. BMC Cardiovasc Disord. 2019;19:121.
30. Higgins JPT, Thomas J, Chandler J, et al. Cochrane handbook for systematic reviews of interventions. Version 6.5. 2024.
31. Inoue T. Unawareness of hypertension. Hypertens Res. 2025;48(4):1639–1642.
32. Institute of Medicine. A population-based policy approach to hypertension. 2010.
33. Makukule A, Modjadji P. Definition and predictors of uncontrolled hypertension. South Afr J. 2023;11(20):2783.

34. Mills KT, Bundy JD, Kelly TN, et al. Global hypertension disparities. Circulation. 2016;134(6):441–450.
35. Mills KT, Stefanescu A, He J. Global hypertension epidemiology. Nat Rev Nephrol. 2020;16(4):223–237.
36. Moher D, Liberati A, Tetzlaff J, Altman DG. PRISMA statement. PLoS Med. 2009;6(7):e1000097.
37. NCD-RisC. Global hypertension trends. Lancet. 2021;398(10304):957–980.
38. Oh SH, Kim D, Hwang J, et al. Uncontrolled hypertension and cardiovascular outcomes. JMIR Public Health Surveill. 2023;9:e42190.
39. Ozawa T, Suzuki H, Miyata T, et al. Intracerebral hemorrhage and hypertension. Hypertens Res. 2025;48:1575–1585.
40. Patsopoulos NA, Evangelou E, Ioannidis JPA. Heterogeneity in meta-analysis. Int J Epidemiol. 2008;37(5):1148–1157.
41. Poorolajal J, Noornejad S. Meta-analysis heterogeneity tool. PLoS One. 2021;16(6):e0253341.
42. WHO. Hypertension fact sheet. 2023. https://www.who.int
43. WHO. Global report on hypertension. 2023. https://www.who.int
44. Zhou D, Xi B, Zhao M, Wang L, Veeranki SP. Uncontrolled hypertension and mortality. Sci Rep. 2018;8:9418.
45. Prabha, C., Bera, O.P., Mantri, N. *et al.* National prevalence and regional variation in the burden of hypertension in India: a systematic review and meta-analysis. *BMC Public Health* **25**, 3768 (2025). https://doi.org/10.1186/s12889-025-24766-x
46. Mirdha, B.R., Samantaray, J.C., & Mishra, B. (1997). Slide Atlas of Fungal Infection. *Journal of Clinical Pathology, 50*, 356 - 356.
47. Zheng, Y., Nie, Z., Zhang, Y., & Sun, T. (2025). The weight-adjusted-waist index predicts all-cause and cardiovascular mortality in hypertension. *Frontiers in Cardiovascular Medicine, 12*.
48. Gobezie M, Teshome A, Asmare Y, et al. Prevalence of uncontrolled hypertension and contributing factors in Ethiopia: a systematic review and meta-analysis. *Front Cardiovasc Med*. 2024;11:1335823. doi:10.3389/fcvm.2024.1335823.
49. Cheraghi Z, Azmi-Naei B, Cheraghi P, Doosti-Irani A. The global prevalence of uncontrolled hypertension: a systematic review and meta-analysis. *BMC Public Health*. 2025;25:4259. doi:10.1186/s12889-025-25553-4.

How to cite this article: Deepika, Sharma LK, Nischal S, Prevalence and Determinants of Uncontrolled Hypertension among Adults with Hypertension: A Systematic Review and Meta-analysis. Hypertens J. 2026;12(2): 80-87

Source of support: Nil, **Conflicts of interest:** None