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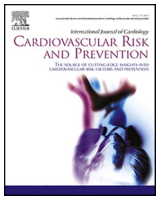

Hypertensive crisis and its predictors in Africa: Systematic review and meta-analysis, 2024

Ousman Adal [a,*], Natnael Kebede [b], Amare Mebrat Delie [c], Eyob Ketema Bogale [d], Tadele Fentabil Anagaw [d], Misganaw Guadie Tiruneh [e], Eneyew Talie Fenta [c], Destaw Endeshaw [f]

[a] Department of Emergency and Critical Care Nursing Medicine, College of Medicine and Health Sciences, Bahir Dar University, Bahir Dar City, Ethiopia
[b] Department of Health Promotion, School of Public Health College of Medicine Health Sciences, Wollo University, Dessie City, MSc, Ethiopia
[c] Department of Public Health, College of Medicine and Health Science, Injibara University, Injibara City, MSc, Ethiopia
[d] Health Promotion and Behavioral Science Department, College of Medicine and Health Sciences, Bahir Dar University, Bahir Dar City, MSc, Ethiopia
[e] Department of Health Systems and Policy, Institute of Public Health, College of Medicine and Health Sciences, University of Gondar, Gondar City, MSc, Ethiopia
[f] Department of Adult Health Nursing, College of Medicine and Health Sciences, Bahir Dar University, Bahir Dar City, MSc, Ethiopia

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ABSTRACT

Introduction: Hypertensive crises are a leading cause of visits to emergency departments, carrying grave health implications. A significant number of patients presenting with these crises have a known history of hypertension.
Objective: The aim of this systematic review and meta-analysis is to examine the combined prevalence of hypertensive crises among individuals with either a history of hypertension or unknown status (newly diagnosed with a hypertensive crisis).
Methods: This review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and was registered with the Prospective Register of Systematic Reviews (PROSPERO). Research databases, including PubMed, Embase, Scopus, Africa Index Medicus, Science Direct, HINARI, and Google Scholar, were systematically searched. Study quality was evaluated using the Newcastle–Ottawa Scale, while publication bias was explored through Egger's regression test, funnel plots, and sensitivity analyses. Data collection adhered to the Joanna Briggs Institute (JBI) format. Meta-analysis was performed using STATA version 17, employing the random-effects DerSimonian–Laird model.
Results: Amongst the 15 studies analyzed, the application of the random-effects DerSimonian-Laird statistical model indicated that the prevalence of hypertensive crisis was determined to be 9.09 %, with a 95 % confidence interval (CI) ranging from 7.41 % to 10.77 %. Factors such as poor medication adherence (POR 5.00; 95 % CI: 3.61, 6.93), patients with comorbidities (POR 4.73; 95 % CI: 3.29, 6.80), patients with a history of hypertension (POR 5.64; 95 % CI: 4.57, 6.94), patients aged >65 (POR 2.77; 95 % CI: 2.16, 6.59), and excessive alcohol intake (POR 5.01; 95 % CI: 3.82, 6.58) were associated with higher odds of hypertensive crisis.
Conclusion: The findings indicate a markedly higher incidence of hypertensive crisis among hospital-presenting patients in Africa. Factors such as medication non-adherence, co-existing comorbidities, historical hypertension, being over 65, and alcohol misuse significantly contribute to this condition. These insights call for a comprehensive healthcare strategy that targets both the management of hypertension and its complications, aiming to improve the overall health outcomes of affected patients.

1. Introduction

Hypertensive crises are severe elevations in blood pressure. Most patients with significantly elevated blood pressure (systolic pressure ≥180 mmHg and/or diastolic pressure ≥120 mmHg) do not suffer acute, end-organ injury. This condition is known as hypertensive urgency [1]. In contrast, significantly elevated blood pressure (systolic pressure ≥180 mmHg and/or diastolic pressure ≥120 mmHg) accompanied by end-organ injury or progressive target-organ dysfunction—such as coronary ischemia (myocardial infarction), disordered cerebral function, acute kidney injury, hemorrhagic stroke, acute pulmonary edema, an exacerbation of chronic pulmonary edema, aortic dissection, hypertensive encephalopathy, and retinopathy—is termed hypertensive

* Corresponding author.
E-mail address: adalousman5@gmail.com (O. Adal).

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Abbreviation

JBI	Joanna Briggs Institute
NOS	The Newcastle–Ottawa Scale
PRISMA	Preferred Reporting Items for Systematic Review and Meta-Analysis
PROSPERO	Prospective Register of Systematic Reviews

emergency [2–4].

According to a previous study, approximately 1–2% of patients with chronic hypertension experience acute elevations of blood pressure (BP) accompanied by acute organ dysfunction. Conversely, a more recent study shows that over half of the patients with hypertension who presented in the emergency department experienced acute exacerbations accompanied by sudden organ dysfunction [5]. Additionally, current literature suggests that the burden of hypertensive crises is significantly higher in low-income countries than in high-income countries [6]. For instance, hypertensive crises affect fewer than 1 % of hypertensive adults in the United States Conversely, in Africa, hypertensive crises occur in both outpatient and emergency department settings at rates ranging from 2.5 % to 5 % [7]. Among all cases of hypertensive crisis, hypertensive urgency accounts for 33 %–65 %, and hypertensive emergency comprises about 68 % of cases [8].

Hypertensive crises are among the most prevalent reasons for emergency department visits and are associated with significant health consequences. At the time of presentation, most study subjects had previously been diagnosed with hypertension. Diabetes mellitus was found to be a comorbid condition in one-quarter of these patients, and the mortality rate remains high [9]. Although original studies are available to identify the predisposing factors of hypertensive crises, pooled studies are not yet available. Based on the available original studies, unemployment, comorbidities (such as diabetes mellitus, heart failure, and renal failure), undiagnosed hypertension, poor adherence to antihypertensive medication, other cardiac diseases, increasing age, the use of illegal or illicit drugs, and infrequent medical checkups have been identified as the most common predisposing factors for hypertensive crises [10–12].

The researcher identified a gap in prior research, particularly the lack of studies specifically addressing the combined prevalence of hypertensive crises among individuals with either a history of hypertension or unknown status (those newly diagnosed with a hypertensive crisis), despite the existence of individual (primary) studies and their clinical importance for patient treatment outcomes. The amalgamation of data from multiple studies through systematic reviews and meta-analyses provides a more comprehensive and reliable understanding of overall patterns and outcomes. Despite this potential, there has been limited exploration of the combined prevalence of hypertensive crises in Africa. Consequently, the objective of this systematic review and meta-analysis is to examine the combined prevalence of hypertensive crises among individuals with either a history of hypertension or unknown status (newly diagnosed with a hypertensive crisis).

2. Methods and materials

2.1. Research questions

What is the combined prevalence of hypertensive crisis among patients who are both newly diagnosed and previously diagnosed with hypertension presenting in hospitals?

What are the potential factors combined influencing the prevalence of hypertensive crisis?

3. Methods

3.1. Protocol and registration

The results of this review comply with the standards outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist [13] (Fig. 1). The methodology for this review was pre-registered with the International Prospective Register of Systematic Reviews (PROSPERO) and can be identified by its registration number CRD42024511931.

3.2. Search strategy and studies identification

To locate pertinent studies, searches were executed across several databases, including PubMed, Scopus, Embase, Africa Index Medicus, Science Direct, HINARI, and Google Scholar. These searches, conducted from January 05 to February 07, 2024, employed specific keywords such as "Hypertensive" AND "emergency OR "Hypertension, AND "urgency OR "hypertensive crisis" AND "prevalence OR (determinants). Upon discovering potentially relevant articles, the studies were downloaded and organized using EndNote X9. The search process was independently carried out by three authors to ensure thoroughness and accuracy.

3.3. Inclusion and exclusion criteria

This systematic review and meta-analysis included all research conducted in Africa and published in English that documented hypertensive crises among patients presenting at hospitals with either pre-existing hypertension or an unknown blood pressure status. Articles without abstracts or full texts, unpublished reports, editorials, and studies that did not clearly report outcomes were excluded.

3.4. Quality assessment and data abstraction procedures

All identified studies from the database search were imported into the citation management software, EndNote version X9, to remove duplicates and facilitate further analysis. The titles and abstracts of these studies were then independently screened and assessed by four authors (OA, AT, EB, and TA). Any arising disagreements were resolved through discussion, particularly with the fourth author, in line with predetermined criteria (excluding articles without abstracts or full texts, unpublished reports, editorials, and studies that did not clearly report outcomes) for selecting articles. The quality of each included study was evaluated using the Newcastle–Ottawa Scale, which was modified to meet the quality assessment needs of this systematic review [14]. Each study was individually appraised by each author, and in instances of differing opinions, a consensus was achieved by calculating the average of the scores assigned by all four authors. The scoring was done on a scale from 0 to 10 for cross-sectional studies, and from 0 to 9 for cohort and case-control studies, with scores above 6 categorized as 'good' and therefore eligible for inclusion in the review [15]. The assessment of publication bias involved Egger's regression test, funnel plot analysis, and sensitivity analysis. The reliability of these methods was notably consistent across the varied studies, as indicated by Cronbach's alpha values ranging between 8.5 and 9.3. Additionally, a rigorous validation process by two experts included a detailed evaluation of every study considered for this review.

3.5. Outcome measurement

The main objective is to ascertain the prevalence of hypertensive crisis, defined as the proportion of patients experiencing a hypertensive crisis among those with a history of hypertension or those newly diagnosed. This proportion was calculated by dividing the total count of patients experiencing a hypertensive crisis, as reported across all studies under review, by the aggregate number of patients diagnosed with

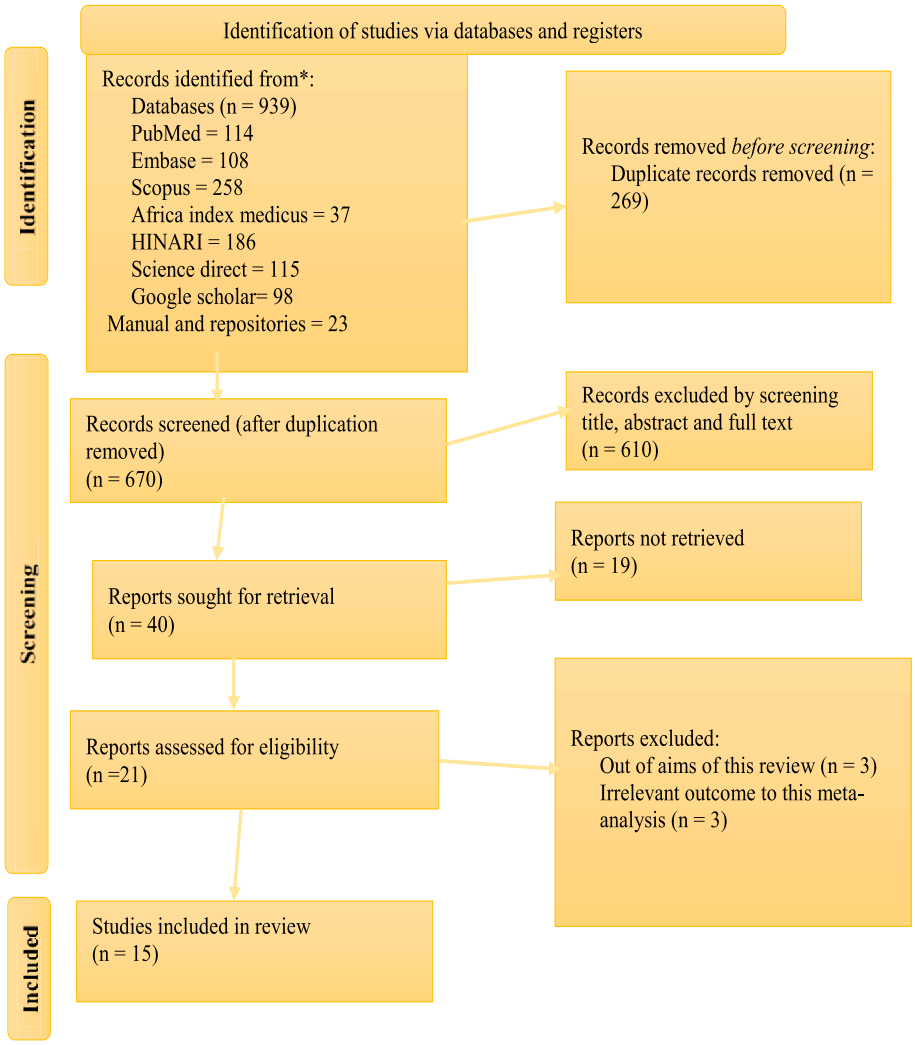

Fig. 1. A flowchart showing the sequence of study selection using PRISMA.

hypertension (both previously diagnosed and newly identified), and then multiplying by 100.

The majority of patients presenting with significantly high blood pressure (systolic pressure ≥180 mmHg and/or diastolic pressure ≥120 mmHg) do not suffer from acute, end-organ damage, a condition referred to as severe asymptomatic hypertension, or hypertensive urgency. On the other hand, a state of hypertension that results in end-organ damage or dysfunction is classified as hypertensive emergency. Together, hypertensive urgency and hypertensive emergency constitute the conditions under the umbrella of hypertensive crisis [2–4,16].

3.6. Data extraction and analysis

Data collection was conducted using the Joanna Briggs Institute (JBI) data extraction template, ensuring a uniform methodology [17]. Each of the five researchers independently extracted pertinent information using this template, which included the lead author's name, the country of the study, year of publication, study design, sample size, sampling method, the prevalence of hypertensive crisis along with a 95 % confidence interval (CI), the logarithm of the proportion, and factors associated with hypertensive crisis with a 95 % CI. The meta-analysis was performed using STATA version 17, utilizing the random-effects DerSimonian-Laird method for pooled analysis [18]. Heterogeneity among the included studies was evaluated using the I-squared statistic. To address publication bias and heterogeneity and sensitivity analysis were applied. The presentation of the gathered data followed the guidelines set out in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist [13] (Fig. 1).

4. Results

4.1. Search results

The research team identified 939 original articles using databases such as PubMed, Scopus, Embase, Africa Index Medicus, Science Direct, HINARI, along with additional resources including Google Scholar and manual searches. After removing 269 duplicates, 670 distinct articles remained. The screening of titles, abstracts, and full texts led to the exclusion of 610 studies because they did not meet the study's objectives. Of the 40 studies that remained, 19 could not be accessed, leaving 21 studies that met the inclusion criteria (articles with full texts, published reports, and studies that clearly reported outcomes). Subsequently, six studies were excluded; three because they were outside the scope of this review [5,19,20], and three because their outcomes did not align with the objectives of this meta-analysis [1,6,21]. Certainly, this systematic review and meta-analysis included 15 studies [8–12,22–31] (Fig. 1).

4.2. Characteristic of the reviewed studies

The meta-analysis included 15 pertinent studies spanning from 2019 to 2023, with most conducted in the timeframe of 2020–2023 [8–12,22–24,27,28,30,31], and a minority, three studies, carried out before 2020 [25,26,29]. Of these studies, eight primarily utilized a cross-sectional approach [8,9,23,24,26–28,30], four were based on a case-control study design [10,11,25,29]. And the remaining three adopted a cohort study design [12,22,31]. The number of participants in each study ranged significantly, from 140 to 7,600, with the combined sample size across all studies reaching 32,538 patients. The majority of the studies in this meta-analysis were conducted in Ethiopia, where the highest rate of hypertensive crisis was observed at 25.8 % [22]. The most frequently reported complication associated with hypertensive crises was brain dysfunction, specifically stroke, as noted in (Table 1).

4.3. Risk bias assessment

Each study analyzed in this systematic review and meta-analysis was assessed to have minimal risk bias based on the evaluation criteria of the Newcastle-Ottawa Scale. Consequently, all studies met the criteria for inclusion in the analysis of this review.

4.4. Publication bias

Egger's test revealed a significant publication bias ($p < 0.001$). An asymmetric distribution observed in the funnel plot suggests the presence of publication bias (Fig. 2). However, Begg's test did not show statistically significant publication bias ($p = 0.13$) in the estimation of hypertensive crisis.

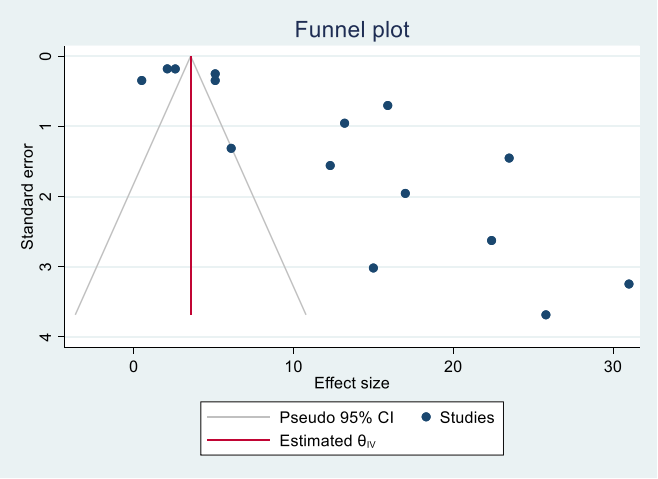

Fig. 2. Funnel plot showing the asymmetric distribution of 15 articles on hypertensive crisis in Africa, 2024.

4.5. Sensitivity analysis

A random effect model result showed that no single study has influenced the overall pooled prevalence of hypertensive crisis in Africa, 2024 (Fig. 3).

4.6. Proportion of hypertensive crisis in africa, 2024

In the random-effects model analysis, the overall proportion of hypertensive crisis was found to be 9.09 % (95 % CI: 7.41, 10.77) with a heterogeneity index ($I^2 = 98.09$ %, p-value <0.001), indicating substantial heterogeneity among the studies. In this analysis, the occurrence

Table 1
Types of organ dysfunction in each reviewed studies among patients with hypertensive crisis, 2024.

First author	Country	Sample size	Study design	Prevalence of hypertensive crisis	Hypertensive urgency	Hypertensive Emergency				
							Types of organ dysfunction			
				%	%	%	Renal %	Heart %	Pulmonary %	Brain (Stroke %)
Abebe et al., 2023	Ethiopia	444	cross-sectional	12.3	63.5	36.5	33.8	16.6	7.1	42.5
Destan et al., 2020	Ethiopia	141	cohort	25.8	70.2	29.8	7.1	11.1	9.3	72.5
Gebresillassie et al., 2020	Ethiopia	852	cross-sectional	23.5	70.9	29.1	3	7	10.3	79.7
Gezie et al., 2023	Ethiopia	252	case-control	22.4	58	42	29.7	30.0	15.7	24.6
Kilindimo eet.al 2023	Tanzania	2700	cross-sectional	6.3	43.2	56.8	21.5	25.8	29.3	23.4
Mandi et al., 2019	Burkina Faso	1254	case-control	22.5	31.9	68.1	28	18	26.5	27.5
Masenga et al., 2020	Zambia	7600	cross-sectional	5.1	35	65	12.7	26.9	23.7	36.7
Mohamud et al., 2023	Somalia	6239	case-control	2.1	45.3	54.7	16	8.3	15.2	60.5
Nakalema et al., 2019	Uganda	4000	cross-sectional	5.1	32.5	67.5	29	6	10	55
Nkoke et al., 2020	Cameroon	332	cross-sectional	6.2	51.6	49.4	7.8	43.6	9.6	39
Reis et al., 2020	Tanzania	7600	cohort	2.6	33.4	66.6	13.7	22.3	24.3	39.7
Samuel et al., 2022	Ethiopia	369	cross-sectional	17	37	63	31.6	14.9	18.7	34.8
Talle et al., 2023	South Africa	412	cross-sectional	0.5	32	68	12.2	27.6	24.8	35.4
Yizengaw et al., 2022	Ethiopia	167	cohort	15	48	52	27	15	12.3	45.7
Shao et al., 2018	Tanzania	203	case-control	2.5	32	68	18.7	22.3	25.3	33.7

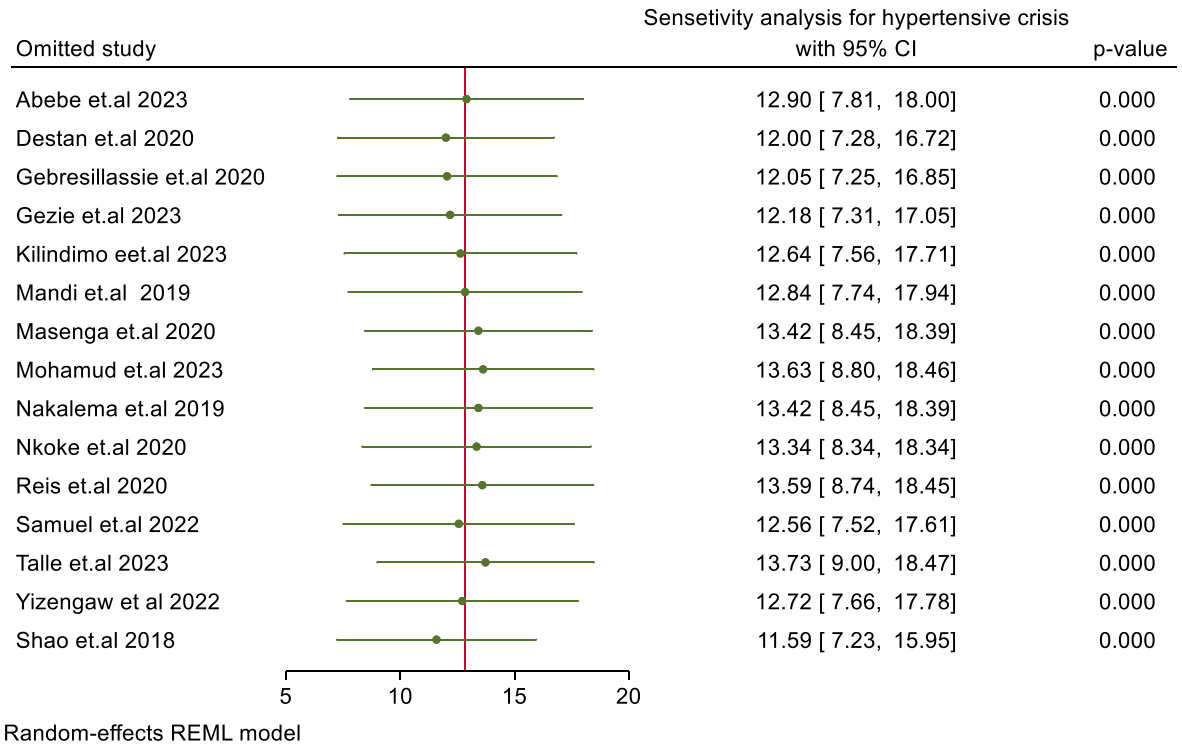

Fig. 3. Sensitivity analysis for hypertensive crisis in Africa, 2024.

of hypertensive crisis among patients ranged from 2.1 %, as cited in Ref. [11], to 25.8 %, as found in Ref. [22]. The forest plot showed a distribution of weights across studies with a relatively wide range, extending from 4.04 % to 7.89 % (Fig. 4).

4.7. Subgroup analysis of hypertensive crisis in africa, 2024

The subgroup analysis, segmented by country, study design, and sampling methods through a meta-regression model, revealed significant heterogeneity in most categories, except for the census method.

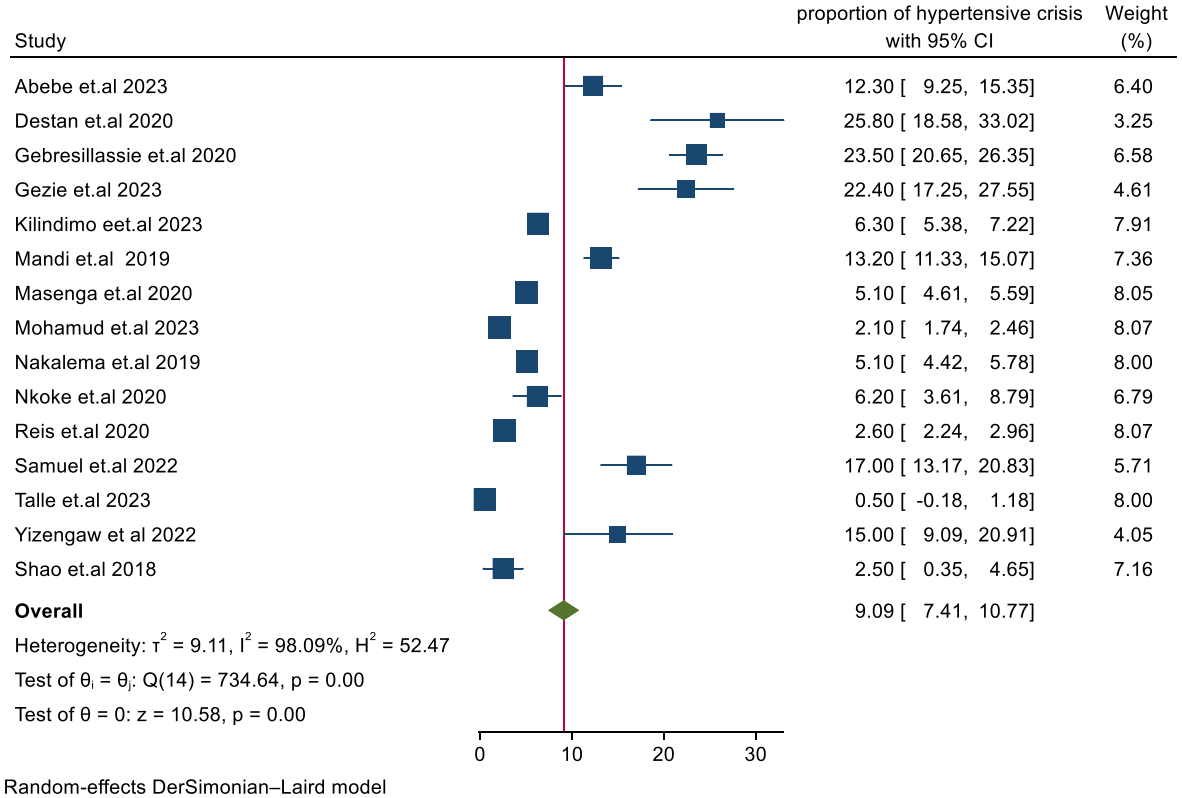

Fig. 4. A forest plot of hypertensive crisis in Africa, 2024 (n = 15).

Specifically, Ethiopia exhibited a relatively higher prevalence of hypertensive crisis at 19.11 % (95 % CI: 14.52–23.70), while South Africa had a lower rate of hypertensive crisis at 0.5 % (95 % CI: 0.18–1.18) (Table 2).

4.8. Factors associated with prevalence of hypertensive crisis

In this extensive meta-analysis, we identified five factors that positively influence the prevalence of hypertensive crisis. The combined impact of eleven studies [8–12,22–24,26,28,29] revealed that individuals with poor medication adherence had five times higher odds (POR 5.00; 95 % CI: 3.61–6.93) of experiencing a hypertensive crisis compared to those with good medication adherence. Similarly, the collective findings from eight studies [8–12,23,26,29] showed that patients with comorbid conditions, including diabetes mellitus, heart failure, morbid obesity, renal failure, and chronic liver disease, had approximately a fivefold increased likelihood of experiencing a hypertensive crisis (POR 4.73; 95 % CI: 3.29–6.80) compared to those without such comorbidities. Additionally, the combined results of nine studies [9–12,22–24,26,29] demonstrated that a history of hypertension was associated with 5.6 times higher odds of hypertensive crisis (POR 5.64; 95 % CI: 4.57, 6.94) compared to patients newly diagnosed with hypertension. Furthermore, the combined effect of five studies [8–10,24,28] showed that patients aged over 65 had approximately 2.8 times higher odds of hypertensive crisis (POR 2.77; 95 % CI: 2.16–6.59) compared to their younger counterparts. The combined effect of six studies [9,10,24,28,30,31] indicated that excessive alcohol intake was associated with five times higher odds of hypertensive crisis (POR 5.01; 95 % CI: 3.82–6.58) compared to those who consume alcohol moderately or not at all (Table 3).

5. Discussion

This systematic review and meta-analysis was conducted to determine the overall prevalence of hypertensive crisis among individuals known to have hypertension and those being newly diagnosed (with previously unknown status). According to the findings derived from the random-effects DerSimonian-Laird model, the overall prevalence of hypertensive crisis is 9.09 %, with a 95 % confidence interval ranging from 7.41 % to 10.77 %. This means that, on average, approximately nine out of every 100 patients encountered in healthcare settings, whether they have a prior diagnosis of hypertension or are newly diagnosed, are experiencing a hypertensive crisis. Such a finding is concerning, as it points to a significant health issue that can lead to severe complications such as organ damage, an increase in disability, and a higher rate of mortality. The findings from the meta-analysis highlight a significant concern regarding the burden of hypertensive crisis, suggesting a noteworthy correlation between lower-income countries and the heightened incidence or aggravation of hypertensive complications [32]. This relationship underscores the multifaceted challenges faced by individuals in economically disadvantaged regions, where limited access to healthcare, inadequate medical resources, and lack of awareness or education about hypertension management can contribute to the severe manifestations of the condition Such a scenario not only exacerbates the direct health impacts on the population but also reflects broader socio-economic disparities that influence public health outcomes [33].

In the USA, the prevalence of hypertensive emergency is 2.5 % [2], while in Italy, it stands at 0.3 % for hypertensive emergency and 0.9 % for hypertensive urgency [34], figures that are much lower than the pooled prevalence of hypertensive crisis identified in this systematic review and meta-analysis. This variation could be attributed to differences in the population's education and understanding, the availability of hospital services, and the country's income level [[32]. For instance, in many African countries, such as Ethiopia, a significant portion of the population, especially those in rural areas, is either illiterate or has received only primary education [35]. Moreover, compared to higher-income countries like the USA and Italy, the level of income and accessibility to hospitals for the early diagnosis and treatment of hypertension in low-income countries are considerably lower [36].

This comprehensive meta-analysis sheds light on various factors contributing to the onset of hypertensive crises. Key among these are non-adherence to prescribed medication regimens, the presence of comorbid conditions, a history of hypertension, being over the age of 65, and alcohol abuse, all of which play significant roles in the occurrence of hypertensive crises. Effective control of hypertension largely hinges on strict adherence to medication and consistent medical follow-ups, with lapses in these areas significantly heightening the risk of complications such as hypertensive crises [37].

Additionally, comorbid conditions such as diabetes mellitus, heart

Table: 2
Subgroup analysis of hypertensive crisis in Africa, 2024.

SN	Variables	Response	number of studies	Pooled prevalence with 95 % CI	I2 (p-value)
1	Continent	Ethiopia	6	19.11 % (95 % CI: 14.52 −23.70)	86 % (<0.001)
2		Tanzania	3	16.04 % (95 % CI: 4.41− 27.66)	99.51 % (<0.001)
3		Burkina Faso	1	13.2 % (95 % CI:11.33 − 15.07)	(<0.001)
4		Zambia	1	5.1 % (95 % CI: 4.61 −6.0)	(<0.001)
5		Somalia	1	2.1 % (95 % CI: 1.74 −2.46)	(<0.001)
6		Uganda	1	5.1 % (95 % CI: 4.42 − 5.78)	(<0.001)
7		Cameroon	1	6.1 % (95 % CI: 3.53 −8.67)	(<0.001)
8		South Africa	1	0.5 % (95 % CI: 0.18 −1.18)	(0.15)
9	Study design	Cross-sectional	8	10.46 % (95 % CI:6.93 −14.0)	(<0.001)
10		Case-control	4	16.76 %(95 % CI: 6.68− 26.84)	(<0.001)
11		Cohort	3	14.13 % (95%CI: 0.001−28.25)	(<0.001)
12	Sampling method	Simple random	5	18.0 % (95 % CI:13.42 −22.57)	78.88 % (<0.001)
13		Census	10	9.3 % (95 % CI: 7.04 −11.54)	99 % (0.05)

Table 3
Factors associated with the prevalence of hypertensive crisis in Africa, 2024.

	Factor	No of included studies	Pooled AOR (95 % CI)	I^2 (p-value)	Reference category
1	Poor adherence	11	5.00 (3.61, 6.93)	63.75 % (<0.001)	No
2	Comorbidities (diabetes, heart failure, chronic liver disease and obesity	8	4.73 (3.29, 6.80)	54.77 % (0.03)	yes
3	History of hypertension	9	5.64 (4.57, 6.94)	8.09 % (<0.001)	No
4	Age >65	5	2.77 (2.16, 6.59)	61.94 % (<0.02)	yes
5	Alcohol abuse	6	5.01 (3.82, 6.58)	0.00 % (<0.001)	Yes

Note: Note: POR = Pooled Odds Ratios, Comorbidities include; diabetes mellitus, heart failure, morbid obesity, renal failure, and chronic liver disease, P-value significant at < 0.05.

failure, renal failure, obesity, and chronic liver disease have been identified as increasing the likelihood of a hypertensive crisis. Diabetes mellitus can cause vascular damage due to its hyperglycemic effects [11]. Both heart failure and renal failure can lead to fluid retention, increased blood volume, and activation of the renin-angiotensin-aldosterone system (a counteractive effect) [26]. A mechanism also observed in chronic liver disease. Obesity can contribute to both vascular overload and fluid retention [9]. The combined effect of these conditions may exacerbate a hypertensive crisis. This situation holds true for both low-income and high-income countries, though the burden is heavier in low-income countries [22,24]. A pre-existing history of hypertension contributes to the risk, as prolonged high blood pressure can lead to ischemia and an increased cardiac workload, ultimately culminating in a crisis [38]. Furthermore, individuals older than 65 years are at a heightened risk due to age-associated declines in cellular function and increased peripheral vascular resistance, both of which can exacerbate the incidence of hypertensive crises [39].

Furthermore, individuals older than 65 years are at heightened risk due to age-associated declines in cellular function and increased peripheral vascular resistance, both of which can exacerbate the incidence of hypertensive crises [40].

5.1. Limitation of the study

This systematic review and meta-analysis included studies available in the English language; studies written in other languages were excluded. Additionally, due to accessibility issues, studies available only in hard copy were not incorporated.

6. Conclusion

The meta-analysis conducted highlights the notably increased incidence of hypertensive crises among hospital patients in Africa. Various factors contribute to this heightened occurrence, including lack of medication adherence, the presence of comorbidities, a history of hypertension, age over 65, and alcohol abuse, all of which are significant contributors to the incidence of hypertensive crises. Each of these elements emerges as a key predictor, underscoring their strong correlation with the heightened risk of experiencing a hypertensive crisis.

6.1. Implication of the study

The findings from the meta-analysis underscore a significant concern regarding the burden of hypertensive crises, suggesting a noteworthy correlation between lower-income countries and the heightened incidence or aggravation of hypertensive complications. This relationship highlights the multifaceted challenges faced by individuals in economically disadvantaged regions, where limited access to healthcare, inadequate medical resources, and a lack of awareness or education about hypertension management can contribute to severe manifestations of the condition. Such a scenario not only exacerbates the direct health impacts on the population but also reflects broader socioeconomic disparities that influence public health outcomes. Addressing these issues requires a concerted effort to improve healthcare accessibility, enhance the quality of medical care, and increase education on hypertension prevention and management in these vulnerable communities.

7. Declaration

Ethical approval and consent to participate.

Not relevant, as systematic reviews exclusively rely on secondary data.

8. Consent for publication

Not applicable.

Competing interests

The author(s) declare no competing interests.

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9. Data availability

All data generated or analyzed during this study are included in the manuscript or supplementary information.

CRediT authorship contribution statement

Ousman Adal: Conceptualization. **Natnael Kebede:** Funding acquisition. **Amare Mebrat Delie:** Methodology. **Eyob Ketema Bogale:** Data curation. **Tadele Fentabil Anagaw:** Formal analysis. **Misganaw Guadie Tiruneh:** Conceptualization. **Eneyew Talie Fenta:** Supervision. **Destaw Endeshaw:** Conceptualization.

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