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REVIEW ARTICLE

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Prevalence and determinants of medication adherence among patients taking antihypertensive medications in Africa: A systematic review and meta-analysis 2010–2021

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Abstract

Aim: This study synthesized the prevalence and determinants of hypertension medication adherence.

Design: Systematic review and meta-analysis through systematic search in PUBMED, EMBASE, CINAHL, Cochrane library and Google Scholar, from 2010 to 2021.

Methods: Screening was conducted and reported according to PRISMA criteria, and ten studies identified according to predetermined criteria. The studies were evaluated using the Mixed Method Appraisal Tool. Analysis was done using the narrative synthesis method. Prevalence data were examined using random effects meta-analysis in Comprehensive Meta-Analysis version 3.

Results: The overall prevalence of medication adherence was 34.1%, and determinants of medication adherence were the ability to attain hypertension control; hypertension knowledge; and treatment-related factors including belief of the drug efficacy, having commodities, sociocultural and financial-related factors. It is imperative to develop, test and use a comprehensive hypertension medication adherence tool that is culturally congruent to Africa.

KEYWORDS
blood pressure, hypertension, medication adherence, meta-analysis, risk factors, systematic review

1 | INTRODUCTION

Medication nonadherence in hypertensive patients is a complex problem that results in enormous health and economic burdens. In Africa, medication nonadherence is reported as high at 62.5%, while the global rate remains at 45.3% (Abegaz et al., 2017; Weldegebreal et al., 2019). Several reasons are attributed to the inability of patients diagnosed with long-term diseases to continue to take their medications regularly. Medication nonadherence is a multifactorial phenomenon that is influenced by socioeconomic, health systems, disease states, pharmacological treatments and patient beliefs (Sabaté, 2003). These factors interact in a complex way to support patients' medication nonadherence.

Several factors that are regarded as the determinants of antihypertension medication adherence have been studied in Africa. These studies have largely been cross-sectional in design. To the best of our knowledge, no synthesis of the determinants of antihypertension medication adherence has been conducted in Africa.

Medication nonadherence has been linked to uncoordinated policies and practices among healthcare professionals to ensure that hypertension patients adhere to medications. Supporting long-term medication adherence is an essential component of patient management and requires effective interventions to help achieve sustained medication intake. Therefore, the identification of the prevalence and determinants of medication adherence is needed to develop interventions that can help achieve sustained medication intake among hypertension patients.

2 | BACKGROUND

The burden that is associated with hypertension is widespread as it is estimated that globally over nine million out of one billion adults suffer from the disease (Lim et al., 2012; WHO, 2017) and younger people are increasingly affected. The drain associated with hypertension is worsened by poor knowledge, increasing engagement in risk factors, poor medication adherence, lack of prevention resources, and poor healthcare infrastructure for treatment with its impact felt in regions where general literacy including health literacy is noted to be low (Adeloye, 2014). Hypertension is also noted to be associated with increasing prevalence of cardiovascular diseases, ischaemic heart diseases, stroke, congestive heart failure, acute myocardial infarction, peripheral vascular disease and renal failure (Adeoye et al., 2017; Akpa et al., 2020; Amugsi et al., 2018; Anto et al., 2020; Appiah et al., 2017; Benneh-Akwasi Kuma et al., 2018; Dassah et al., 2019; Kodaman, Aldrich, Sobota, Asselbergs, Brown, et al., 2016; Kodaman, Aldrich, Sobota, Asselbergs, Poku, et al., 2016; Obirikorang et al., 2016). Hypertension is also associated with worsening socioeconomic status, increasing healthcare cost to both patients and governments (Abegaz et al., 2017; Weldegebreal et al., 2019). Cultural and social antecedents are noted to have an influence in people's tendency to adopt hypertension prevention measures (Abegaz et al., 2017; Weldegebreal et al., 2019).

In sub-Saharan Africa, there have been a steady increase in the hypertension prevalence from 9.7% (1990) to over 30.8% (2010) as current prevalence is estimated to range from 15% to 70% (Adeloye, 2014; Ataklte et al., 2015; Mills et al., 2016). One of the surest ways for the control of hypertension is the use of medications for a lifetime (Abegaz et al., 2017; Agbor et al., 2018; Weldegebreal et al., 2019). Adherences refer to an extent an individual's behaviour including the taking of medication, implementing dietary or lifestyle recommendations is in consonance to the recommendations made by a healthcare professional (Agbor et al., 2018). Poor and inadequate treatment of hypertension can lead to complications (Ferdinand et al., 2017; Weldegebreal et al., 2019). The domains related to poor medication adherence include health literacy levels, medication cost, availability of health insurance, cultural belief systems related to the treatment and illness, provider–patient relationship, nature of communication between provider and service recipient, community care support services and waiting time (Ferdinand et al., 2017). In hypertension treatment, other factors noted included absence of symptoms, presence of other comorbidities like depression or psychotic disorders, frequency of medication change, nature and severity of side effects, dosage of the medication, and taking multiple medication could also be of influence (Agbor et al., 2018; Ferdinand et al., 2017).

Studies that assess medication adherence among patients diagnosed with hypertension in Africa are geographically, and methodologically sporadic, lacking a unified and coordinated systematic review that synchronizes and synthesizes the prevalence and determinants. To develop effective strategic interventions to promote antihypertension medication adherence in Africa, it is necessary to determine factors related to medication adherence. This study identified the prevalence and determinants of medication adherence in Africa. Synthesizing the prevalence and determinants of antihypertensive medication adherence could guide policymakers to adjust effective strategies to improve blood pressure control.

3 | THE REVIEW

3.1 | Aim

This study synthesized the prevalence and determinants of medication adherence among hypertension patients in Africa.

3.2 | Design

A systematic review of the determinants of medication adherence was conducted after an evaluation of the selected studies using the Mixed Method Appraisal tool (MMAT; Hong et al., 2018). The PRISMA statement (Liberati et al., 2009; Moher et al., 2011; Shamseer et al., 2015) was used to guide reporting of the review.

3.3 | Search methods

There was a detailed search using the 'advanced search' option of five electronic databases (Pubmed central, Cumulative Index to Nursing and Allied Health Literature—CINAHL, EMBASE, Cochrane library and Google Scholar) and identified articles published between January 2010 and April 2021. The population, intervention, comparison and outcome (PICO) criteria guided the articles' search, screening and selection. The population were people taking antihypertensive medications, the interventions were the determinants of medication adherence, no comparisons were identified, and the outcome was medication adherence. Also, the PICO was integrated into the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework that served as the basis for the identification, screening and selection of scholarly works for this review (Liberati et al., 2009; Moher et al., 2011; Shamseer et al., 2015). In searching for the literature, medically indexed words were used as Medical Subject Headings (MeSH) terms, while nonmedical terms

were searched as free text words and using related synonyms combined with the appropriate Boolean operators. The search terms included epidemiologic factors (MeSH) OR 'Social determinants of health (MeSH)' AND 'Medication adherence (MeSH) AND hypertension (MeSH)' and filtered for only Africa-based articles from January 2010 to April 2021. The search trail of each individual database is found in Appendix S1.

3.4 | Search outcomes

In using the key words of the search in four electronic databases (Pubmed central, CINAHL, EMBASE and Cochrane library), 17,878 articles were identified (Tables S1–S4) and through a manual search of the first 150 titles making first three pages of google scholar, the results were then exported to endnote version 9 for duplicates removal. The first three pages of google scholar were used because of the ability of the site to prioritize search results based on the relevance of the search keywords. In line with this, the authors believe that all relevant studies based on this review would have been included in the first 150 titles, and further search did not show any relevant article based on the inclusion criteria. After the removal of duplicates, 16,687 titles were screened and those specifically for the African continent and published from 2010 to 2021 were 112 titles. All the 112 titles were individually screened for appropriateness, and 56 abstracts that assessed the factors that are related to medication adherence among people on antihypertension medications were selected. Upon full-text screen, ten (10) studies met the basic criteria for inclusion in this study as they assessed the determinants of medication adherence among hypertension patients in Africa.

3.5 | Eligibility criteria

The inclusion criteria for this study are to assess the prevalence and/or determinants of medication adherence among hypertension patients. This study included articles written in English language and were published in Africa between 2010 and April 2021. The study exclusion criteria included studies that described blood pressure control than medication adherence, determined the determinants of poor hypertension control, identified factors associated with hypertension control and showed challenges associated with poor hypertension control.

3.6 | Quality appraisal

The two researchers used the Mixed Method Appraisal tool (MMAT) version 2018 to independently assess each study for quality (Hong et al., 2018). The assessed data were compared between the two researchers for similarities. Where discrepancies were found between the two researchers, it was discussed until a consensus was arrived (Table S5). The MMAT tool is a quality assessment tool that appraises the methodological quality of qualitative, quantitative and mixed methods studies. The quantitative section that was appropriate for appraising the articles selected for this review assessed the aim of the study, study design, methodology, recruitment of study participants and data collection methods, including analysis, presentation of results and discussion, and the conclusions. Based on the assessment made, the studies can be rated to have high, moderate and low quality. However, the subsequent views of Hong et al., 2018 emphasized that the researcher does not need to assess the overall quality of studies. They strongly recommended the detailed presentation of the appraised findings.

The components of the screening questions and as shown from the MMAT tool include (A) the presence of clear research questions and (B) collected data addressing the research question. Based on the consensus gained during the appraisal, all the articles received an affirmative response to the two statements above. The appraisal sections that were relevant for this study were (1) relevance of sampling strategy; (2) representativeness of sample to the target population; (3) appropriateness of measurements; (4) risk of nonresponse bias; and (5) appropriateness of statistical analysis.

The appraisal of each manuscript showed that they all adhered to these five principles of appraisal outlined for quantitative studies in the MMAT guidelines. It was realized that all the studies met the criteria of the appropriateness of the sampling strategy to answer the research question and the representativeness of the sample to the study population; having lower risk of bias; and used the appropriate statistical analysis method to answer the research questions. Two studies were evaluated not to have appropriate measurement (Adeoye et al., 2019; Teshome et al., 2017).

3.7 | Data extraction and synthesis

A matrix was first developed, discussed and agreed among the two researchers and adopted as the template for the data extraction. The template included the population, design, factors associated with medication adherence, tools used to assess the outcome variables (i.e. medication adherence) and key findings. The two researchers independently extracted data from the selected studies and the results of the extractions compared and discussed as discrepancies resolved through consensus. Statistical analysis is performed using software from Comprehensive Meta-Analysis (CMA) version 3 (https://www.meta-analysis.com/index.php) according to the recommendations of the Cochrane Handbook.

In conducting a meta-analysis, Cochran's *Q*-statistic and *I* square (I^2) statistic was reported.

The I^2 statistic, heterogeneity was shown if $I^2 \geq 50\%$ and *p-value* < 0.10, and hence, the synthesis will use the random effects model for meta-analysis. The medication adherence prevalence and sample size were extracted from each of the studies. Medication adherence prevalence at 95% confidence interval (CI) was then computed for each study. In furtherance to this, the Hedges *Q*-statistic and the I^2 statistic were computed between studies for

heterogeneity. A *p-value* < 0.1 indicated statistically significant heterogeneity with I^2 values higher than 75% showing higher heterogeneity (Higgins, 2003). An application of a random effects model was then applied to estimate the pooled effects of high degree heterogeneity between the data (Higgins, 2003). Also, a funnel plot (Figure S1) and Egger's test was implicated to evaluate publication bias. In doing this, a *p-value* < 0.05 indicating a publication bias (Egger et al., 1997). Meta-analysis of determinants of medication adherence and hypertension patients was not done due to heterogeneity of the variables and results.

A convergent synthesis design was adopted in describing the factors that are associated with hypertension medication adherence. This analysis method allowed for the translation of studies' findings into qualitative descriptions, coalescence through the integration of the determinants (Pluye & Hong, 2014). In translating the findings into qualitative thematic descriptive analysis, themes were identified after collating and integrating generated codes into subthemes and subsequently themes. Descriptive themes were assessed to generate meaning beyond the original data leading to the development of new, interpretive and analytic themes.

4 | RESULT

4.1 | Study characteristics

The search of articles that assessed medication adherence in Africa retrieved ten articles that met the inclusion criteria as shown in Figure 1 (PRISMA flowchart). All the studies that were used in this review were cross-sectional studies that used questionnaires. The settings of the studies showed that they were conducted in Southwestern (Adeoye et al., 2019; Okunrinboye et al., 2019) and Northwestern—Sokoto (Adisa et al., 2018) Nigeria; Buea Health District in Cameroon (Adidja et al., 2018), Northwest (Ambaw et al., 2012) and specifically at the Debre Tabor General Hospital (Teshome et al., 2017) Ethiopia; rural South Africa (Rampamba et al., 2018); Lusaka in Zambia (Mweene et al., 2010); Southern and northern Ghana (Kretchy et al., 2014, 2020), respectively. Table 1 shows the key findings related to medication adherence among hypertension patients.

4.2 | Measurement tools for medication adherence

The tools used for assessing medication adherence (the outcome variable) were the 8-item Morisky Medication Adherence Scale—MMAS-8 (Adeoye et al., 2019; Kretchy et al., 2014); the Modified Morisky Medication Adherence Scale—MMAS (Adidja et al., 2018; Ambaw et al., 2012; Kretchy et al., 2014; Okunrinboye et al., 2019); the 9-item Modified Morisky Adherence Predictor Scale—MMAPS (Adisa et al., 2018); the 4-item Morisky–Green–Levine Scale—MGLS (Teshome et al., 2017); the 9-item Beliefs about Medicine Questionnaire—BMQ (Adisa et al., 2018); the modified Hill–Bone adherence scale (Mweene et al., 2010); and the Medication Adherence Questionnaire—MAQ (Kretchy et al., 2020). Some other important variables were assessed using the Hamilton Rating Scale for Depression—HAM-D (Okunrinboye et al., 2019); Mini International Neuropsychiatric Interview—MINI (Okunrinboye et al., 2019); and the 18-item Hypertensive Medication Side Effect Experience Scale—HMSEES (Kretchy et al., 2014); the practice of self-monitoring of blood pressure—SMBP (Adisa et al., 2018); Brief Illness Perception Questionnaire—BIPQ (Adisa et al., 2018); the 10-item Kessler Psychological Distress Scale (Kretchy et al., 2020); and the insomnia scale which assesses eight factors (Kretchy et al., 2020).

4.3 | Prevalence of medication adherence

The prevalence of medication adherence was widely varied across the various studies assessed as divergent tools were used in various population groupings. This was shown to be high (4.1%), moderate (68.9%) and low (27%; Adeoye et al., 2019; Adidja et al., 2018), while nonadherence was noted to be 66.7% (Adidja et al., 2018) and 75.1% (Teshome et al., 2017). Urban residents, taking less than two drugs per day (Teshome et al., 2017), were important influencers as shown in Table 2. The MMAPS showed that 8.9% of participants had total scores <1 indicating optimal adherence to antihypertensive medications, while 91.1% had scores ≥1 suggesting nonadherence (Adisa et al., 2018). Others showed that 64.6% (Ambaw et al., 2012) and 54.6% (Rampamba et al., 2018) of patients with hypertension were said to be medication adherent while 96.8%, 2.8% and 0.4% had high, moderate, and low adherence, respectively (Okunrinboye et al., 2019). The prevalence of adherence was 83% by self-report and 70% using modified Hill–Bone scale (Mweene et al., 2010). Table 2 reports the prevalence and key determinants of medication adherence. In some of the studies instead of adherence, nonadherence was reported.

4.4 | Risk of bias

The risk of bias summary shown in Appendix S2 indicates that ten studies had a low risk of bias. Publication bias was not detected by funnel plot broadly symmetry (Appendix S3) and Egger regression coefficient (1-tailed $p = 0.025$).

4.5 | Meta-analysis

Data regarding medication adherence were very heterogeneous. Regarding the most frequent tool to measure medication adherence, 7 studies (Adeoye et al., 2019; Adidja et al., 2018; Adisa et al., 2018; Ambaw et al., 2012; Kretchy et al., 2014; Okunrinboye et al., 2019; Teshome et al., 2017) were measured with a Morisky-related tool, and medication adherence prevalence was measured

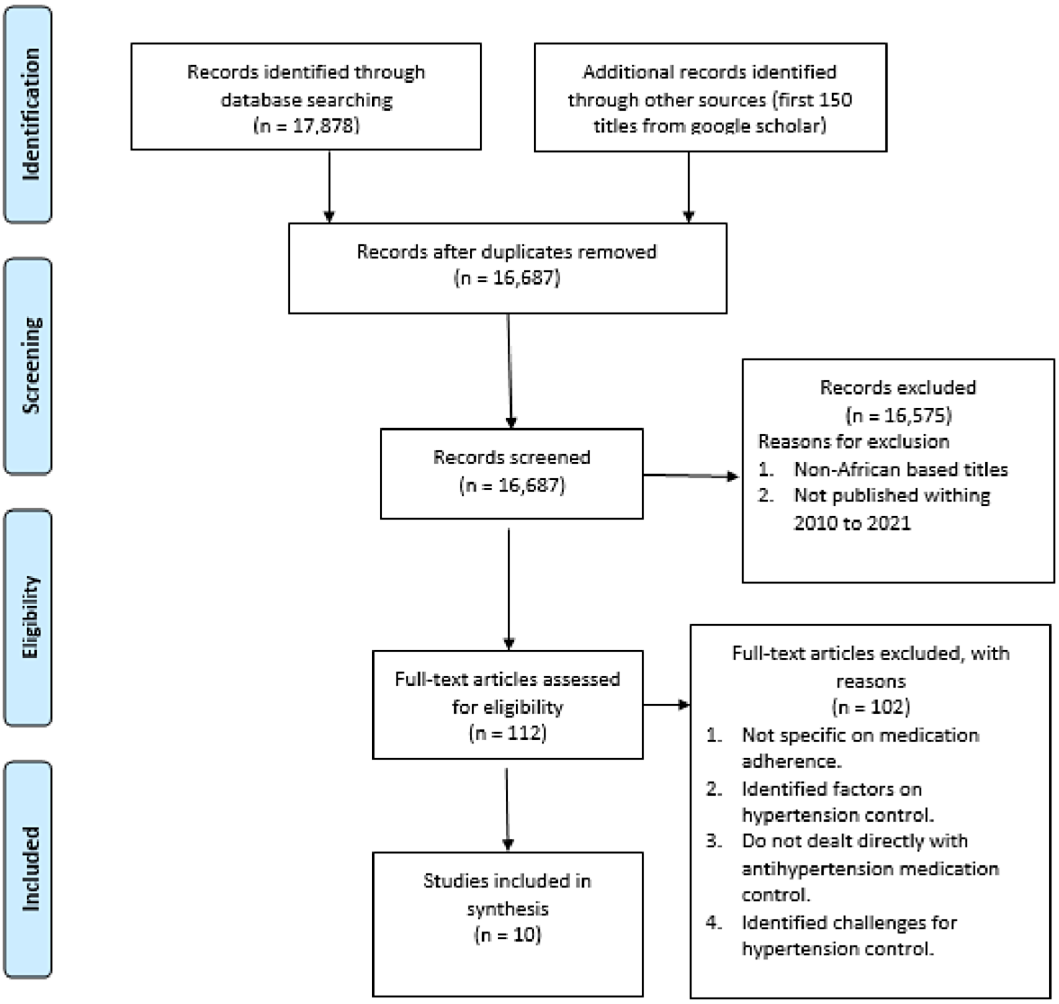

FIGURE 1 PRISMA flowchart

as rate. Three studies used different tools to measure adherence, and by synthesizing the results of these tools, the overall drug adherence meta-analysis model is counterintuitive. Therefore, we decided to include 7 studies in the meta-analysis (Adeoye et al., 2019; Adidja et al., 2018; Adisa et al., 2018; Ambaw et al., 2012; Kretchy et al., 2014; Okunrinboye et al., 2019; Teshome et al., 2017). Table 2 shows descriptive statistics on medication adherence according to the measurement tools used in the study included in this systematic review and meta-analysis.

The overall prevalence of medication adherence with hypertension patients was 58.0% (95% CI: 0.55%–0.61%; Figure 2). The prevalence of medication adherence ranged from 8.9% to 96.8% with a very high heterogeneity between results ($I^2 = 99.1\%$, p-value for the Hedges Q-statistic < 0.001).

4.6 | Findings of thematic synthesis

The main themes that were identified and assessed include the prevalence of medication adherence and the main determinants of medication adherence. The themes identified as the determinants of medication adherence were the ability to attain hypertension control, knowledge on hypertension medications, drug-related factors, sociocultural and financial-related factors.

4.6.1 | Ability to attain hypertension control

The ability of a person or the belief that an individual can control BP and the locus of control by a particular patient were noted to have positive correlation to higher medication adherence (Kretchy et al., 2014; Rampamba et al., 2018). The duration of being diagnosed for hypertension (Adeoye et al., 2019; Kretchy et al., 2020), duration of taking antihypertensive medication or being on antihypertension medication treatment (Adidja et al., 2018; Kretchy et al., 2020) and beliefs associated with the efficacy of the medication taken were said to have a positive association with higher medication adherence. The absence of hypotensive symptoms was associated with poor adherence (Adidja et al., 2018; Adisa et al., 2018).

TABLE 1 Distribution of key findings

SN	Author & year	Country	Population	Variables		Key findings
				Determinants	Tool	
1	Adeoye et al. (2019)	Southwestern Nigeria	30 new hypertension patients. Age 61.6 ± 13.3	• Gender, obesity, age, smoking, alcohol use • Family history of hypertension, duration of hypertension and number of antihypertensive drugs	MMAS-8	• Patients had high (4.1%), moderate (68.9%) and low (27%) medication adherence. Knowledge of long-term benefits of hypertension medication was independent determinant of medication adherence. • Medication adherence was associated with motivation ($p = 0.0001$), knowledge ($p = 0.002$) and obesity ($p = 0.036$)
2	Adidja et al. (2018)	Buea Health District, Cameroon.	183 hypertension patients Age 55.9 ± 12.3	• Sociodemographic factors, occupational status • Dose frequency, number of drugs, duration of treatment • Forgetfulness, poverty, busy schedule, belief • Side effects, herbal use, and taste and smell of drug	MMAS-8	• The factors associated with medication nonadherence were multiple antihypertensive medications, use of herbs, cost of treatment, absence of symptoms and busy schedule. • Predictors of medication nonadherence were forgetfulness (adjusted odds ratio (aOR) = 7.9; 95% (CI): 3–20.8, $p < 0.001$), lack of finances (aOR = 2.8; CI: 1.1–6.9, $p = 0.024$), multiple daily doses (aOR =2.5; 1.2–5.6, $p = 0.02$) and drug side effects (aOR = 7.0 CI: 1.7–33.6, $p = 0.007$)
3	Adisa et al. (2018)	Sokoto, North western Nigeria	624 hypertension patients Age 54.5 ± 11.4	• Sociodemographic factors • Blood pressure • Lifestyle, • Illness perception, beliefs about medicine • Number of drugs	MMAPS-9, SMBP, BIPQ, BMQ	• Morisky Adherence Predictor Scale showed that 8.9% had total scores <1 indicating optimal adherence to antihypertensive medications, while 91.1% had scores ≥1 suggesting nonadherence. • Reasons for nonadherence were forgetfulness (35.2%), dose omission (32.2%), side effects (13.7%), nonaffordability of medication (8.3%), dislike for medication (6.4%), intentional decision to take medicine when desired (2.9%), preference of herbal medicine (0.7%), and taking too many drugs (0.6%)
4	Ambaw et al. (2012)	Northwest Ethiopia	384 hypertension patients Age 56.9 ± 12.8	• Sociodemographic and economic factors • Comorbidities, blood pressure • Distance to health facility • Dose frequency • Patient-provider relationship	MMAS-4	• Participants (64.6%) were found to be adherent to treatment. • Sex (AOR = 0.48, 95% CI = 0.28, 0.82), knowledge about HTN and its treatment (AOR = 6.21, 95% CI = 3.22, 11.97), distance from the hospital (AOR = 2.02, 95% CI =1.19–3.43) and comorbidity (AOR = 2.5, 95% CI = 1.01, 6.21) were found significantly associated with treatment adherence
5	Rampamba et al. (2018)	Rural South Africa	251 Black hypertensive patients Age 63 ± 11.4	• Gender, education, smoking • Blood pressure • Comorbidities • Family history, • Knowledge of hypertension • Physical activity	Self-reported adherence	• Patients (54.6%) were adherent to treatment. • Controlled BP ([OR] = 2.1; 95% CI: 1.1, 3.8; $p = 0.019$), comorbidity (OR = 2.0; 95% CI: 1.1, 3.6; $p = 0.032$) and smoking (OR = 0.3; 95% CI: 0.1, 0.8; $p = 0.018$) were determinants of antihypertension medication adherence
6	Okunrinboye et al. (2019)	South-West Nigeria	400 hypertension patients Age 59.6 ± 8.0	• Age, religion, marital status, education, economic factor • Depression, comorbidity • Perception of medication	MMAS-8, HAM-D, MINI	• Participants (96.8%) had high medication adherence; 2.8% and 0.4% had moderate and low adherence, respectively. Also, 97.0% with effective perception of medication have good medication adherence compared to 91.2% that do not perceive their medication as effective ($p = 0.077$). • Good medication adherence was higher (96.9%) among those aged 60 years and above compared to those less than 60 years (95.9%; p-value = 0.577). • Employment status, educational status and income per month did not really affect medication adherence

(Continues)

TABLE 1 (Continued)

SN	Author & year	Country	Population	Variables: Determinants	Variables: Tool	Key findings
7	Teshome et al. (2017)	Debre Tabor General Hospital, northwest Ethiopia	346 participants Age 58.3 ± 13.7	• Age, residence, • Number of drugs • Knowledge about hypertension and its treatment	4-item Morisky–Green–Levine Scale	• Prevalence of medication adherence was 75.1% as urban residence (AOR = 2.10, 95% CI: 1.15, 3.85), taking less than two drugs per day (AOR = 3.04, 95% CI: 1.53, 6.06), and having knowledge about hypertension and its treatment (AOR = 8.86, 95% CI: 4.67, 16.82) were positively and significantly associated with medication adherence. • Age > 60 years (AOR = 0.33, 95% CI: 0.11, 0.98) was negatively and significantly associated with good medication adherence
8	Mweene et al. (2010)	Lusaka, Zambia.	237 Adult patients Age 57.8 ± 12.0	• Age, education • Number of drugs • Counsel by nurse	Modified Hill–Bone adherence scale and self-report	• The prevalence of adherence was 83% by self-report and 70% using modified Hill–Bone scale. • Patients on three antihypertensive drugs were less probably to be nonadherent (OR 0.21; 95% CI 0.06–0.79) than patients taking only one drug. Patients counselled by the nurse were more probably to be adherent than those not counselled by the nurse (OR 2.7: 95% CI 1.0–7.3). • Those who were counselled for more than 5 minutes had threefold likelihood of less nonadherence as reported by both self-report and modified Hill–Bone (OR 0.3: 95% CI 0.2–0.8 and 0.3: 95% CI 0.1–0.5), respectively
9	Kretchy et al. (2020)	Ghana	358 participate Age 56.2 ± 13.5	• Sociodemographic factors, economic • Psychological distress, insomnia • Duration of treatment, number of drugs	MAQ	• Medication adherence showed significant associations with age, marital status, educational level, income level, length of diagnosis and number of medications taken ($p < 0.05$). • High medication adherence levels among the younger participants compared with the older ones (low-59.3 ± 13.3 vs. medium-55.1 ± 13.2 vs. high-51.6 ± 13.0, $p < 0.001$). • The odds of a patient adhering to medication decrease by 3% with every year advancement in age (AOR: 0.97, 95% CI: 0.95–0.99). • Study participants who were married had 21% lesser odds of having better medication adherence than those who were single
10	Kretchy et al. (2014)	Southern and northern Ghana.	400 hypertensive patients Age <20 to ≥70	• Side effects • LoC	MMAS-8 18-item HMSEES	• Most patients (93.3%) poorly adhered to medications. Participants with high internal LoC had 68% lower odds of nonadherence than those with low internal LoC (OR = 0.32 (95% CI 0.11–0.95), $p = 0.039$). • Participants exhibiting low internal LoC had 5.64 times greater odds of being nonadherent than participants with low external LoC (OR = 5.64 (1.14–27.87), $p = 0.034$). Participants who experienced moderate to high side effects were more probably to be nonadherent than those who had low experiences of side effects (OR = 4.84 (1.07–21.85), $p = 0.04$). • Participants reporting both medication side effects and external LoC had 2.4 times greater odds of nonadherence than participants with side effects and internal LoC (OR = 2.4 (0.35–16.31), $p < 0.001$)

Abbreviations: aOR, adjusted odds ratio; BIPQ, Brief Illness Perception Questionnaire; BMQ, 9 item beliefs about Medicine Questionnaire; CI, confidence interval; HAM-D, Hamilton Rating Scale for Depression; HMSEES, Hypertension Medication Side effects Experience Scale; LoC, Locus of Control; MAQ, Medication Adherence Questionnaire; MINI, the Mini International Neuropsychiatric Interview; MMAPS-9, 9-Item Modified Morisky Adherence Predictor Scale; MMAS-4, 4-item Morisky Medication Adherence Scale; MMAS-8, 8-item Morisky Medication Adherence Scale; OR, odds ratio; SMBP, Self-Monitoring of Blood Pressure.

TABLE 2 Prevalence and key determinants of medication adherence

Reference	Adherence prevalence	Key determinants
Adeoye et al. (2019)	High (4.1%) Moderate (68.9%) Low (27.0%)	• Knowledge ($p = 0.002$) • Motivation ($p < 0.001$) • Obesity ($p = 0.035$)
Adidja et al. (2018)	Nonadherence (66.7%)	• Forgetfulness ($p < 0.001$) • Lack of finances ($p = 0.024$) • Multiple daily doses ($p = 0.02$) • Drug side effects ($p = 0.007$)
Adisa et al. (2018)	Optimal adherence (8.9%) Nonadherence (91.1%)	• Forgetfulness (35.2%) • Dose omission (32.2%) • Side effects (13.7%) • Nonaffordability of medication (8.3%) • Dislike for medication (6.4%)
Ambaw et al. (2012)	Adherence (64.6%)	• Sex (AOR = 0.48), • Knowledge (AOR = 6.21) • Distance to hospital (AOR = 2.02) • Comorbidity (AOR = 2.5)
Rampamba et al. (2018)	Adherence self-report Excellent (54.6%) Very good (21.9%) Good (16.7%) Fair (4.8%) Poor (1.2%) Very poor (0.8%)	• Blood pressure controlled ($p = 0.019$) • Comorbidity ($p = 0.032$) • Smoking ($p = 0.018$)
Okunrinboye et al. (2019)	High (96.8%) Low (3.2%)	• Comorbidity ($p = 0.012$)
Teshome et al. (2017)	Adherence (75.1%)	**Positive** • Urban residence (AOR = 2.10) • Fewer drugs per day (AOR = 3.04) • Knowledge (AOR = 8.86) **Negative** • Age > 60 years (AOR = 0.33)
Mweene et al. (2010)	Adherence Self-report (83.0%) Hill–Bone scale (70.0%)	• Fewer drugs (OR = 0.21) • Counselled by the nurse (OR = 2.7). • Counselled for more than 5 min (OR = 0.3)
Kretchy et al. (2020)	High (42.2%) Medium (39.9%) Low (17.9%)	• Age ($p < 0.001$) • Income ($p = 0.044$) • Number of medications ($p = 0.035$) • Marital status ($p = 0.017$) • Length of diagnosis ($p = 0.011$)
Kretchy et al. (2014)	Adherence 93.3%	• Locus of control • Side effects of drugs

Abbreviations: aOR, adjusted odds ratio; OR, odds ratio.

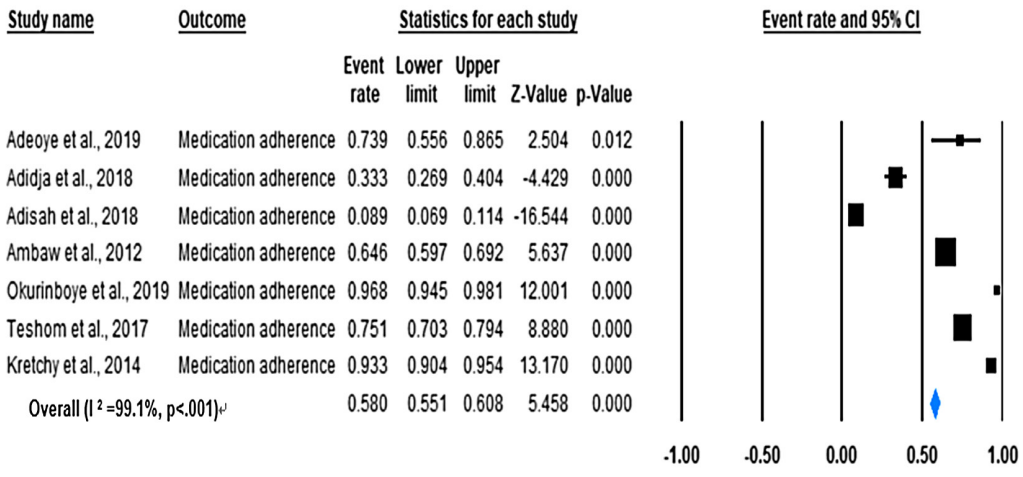

FIGURE 2 Forest plot of the prevalence of medication adherence according to the Morisky scale.

4.6.2 | Knowledge on medication

It was also shown that knowledge on long-term benefits of medication use in hypertension control and being motivated to control hypertension were associated with adherence (Adeoye et al., 2019). It was also shown that forgetfulness was associated with poor adherence (Adidja et al., 2018; Adisa et al., 2018). The intentional decisions by the hypertension patient not to take the medication at the prescribed time were associated with poor adherence (Adisa et al., 2018). Beliefs about antihypertensive medication among participants showed that 92.2% had score > 50% indicating 'stronger' beliefs about necessity for antihypertensive medication (Adisa et al., 2018) culminating in a good medication adherence. Also, 97.0% with effective perception of medication have good medication adherence compared to 91.2% who do not perceive medication as effective ($p = 0.077$; Okunrinboye et al., 2019). Patients counselled by the nurse were more probably to be adherent than those not counselled by the nurse (OR 2.7: 95% CI 1.0–7.3: Mweene et al., 2010).

4.6.3 | Drug-related factors

Other factors that influence drug adherence were adverse drug reactions (Adidja et al., 2018) and multiple drug doses requirement (Adidja et al., 2018). Taking medication along other drugs (Adidja et al., 2018; Adisa et al., 2018) and including herbal medication use were associated with poor medication adherence (Adisa et al., 2018). Patients on three antihypertensive drugs were less probably to be nonadherent (OR 0.21; 95% 95% CI 0.06–0.79) than patients taking only one drug (Adidja et al., 2018; Adisa et al., 2018; Mweene et al., 2010). Presence of side effects perceived to be fatal was associated with medication nonadherence (Kretchy et al., 2014; Mweene et al., 2010). It was also shown that 41.5% with score > 50% suggesting 'stronger' concern about side effects of medication affected the level of medication adherence (Adisa et al., 2018). It was also noted that the experience of the side effects of dizziness is positively associated with medication nonadherence (Mweene et al., 2010). Participants were more probably to be nonadherent by self-report if they had experienced the side effect of dizziness (Kretchy et al., 2014).

4.6.4 | Sociocultural-related factors

In a logistic regression model, age, income level, number of medications, marital status and the number of years the study participants had been diagnosed of hypertension were significantly associated with medication adherence (Kretchy et al., 2020). Participants were more probably to be nonadherent by self-report if they had attained a primary level of education, had missed appointments due to lack of transport or had experienced the side effect of dizziness (Mweene et al., 2010). Factors like distance from the hospital (AOR = 2.02, 95% CI =1.19–3.43; Ambaw et al., 2012), comorbidity (AOR = 2.5, 95% CI = 1.01, 6.21; Ambaw et al., 2012; Rampamba et al., 2018) and smoking (Rampamba et al., 2018) were found significantly associated with hypertension medication adherence. Good medication adherence was higher (96.9%) among those aged 60 years and above compared to those less than 60 years (95.9%, p-value of 0.577; Okunrinboye et al., 2019). The odds of a patient adhering to medication decrease by 3% with every year advancement in age (AOR: 0.97, 95% CI: 0.95–0.99; Kretchy et al., 2020). Study participants who were married had 21% lesser odds of having better medication adherence than those who were single (Kretchy et al., 2020). People who had associated obesity were said to have higher adherence to medication (Adeoye et al., 2019) compared to those who had a normal body weight.

4.6.5 | Financial-related factors

Lack of finances was associated with medication nonadherence among hypertension patients (Adidja et al., 2018). Nonaffordability of prescribed medications was also associated with poor medication adherence (Adisa et al., 2018). Participants with high internal LoC had 68% lower odds of nonadherence than those with low internal LoC (OR = 0.32 (95% CI 0.11–0.95), $p = 0.039$; Kretchy et al., 2014). Participants were more probably to be nonadherent by self-report if they had missed appointments due to lack of transport (Kretchy et al., 2014).

5 | DISCUSSION

This review identified determinants and prevalence of medication adherence among hypertension patients in Africa as addressing important issues is considered a key factor in control of hypertension. Studies that are related to medication adherence in Africa are geographically sporadic and largely cross-sectional in design. A systematic search and subsequent critical evaluation selected ten studies that were deemed to be suitable because they assessed the factors that are associated with medication adherence in Africa between 2010 to 2021. This review was critical as it allowed for the coalescing of the factors that are associated with medication adherence among hypertension patients. As far as we know, this is the first systematic review on this subject in Africa. The results of this review are of significance for improving the quality of care for hypertensive patients by showing a summary of the determinants of adherence and suggesting possible strategies to ensure improvement.

Medication adherence rates in hypertensive patients varied significantly in primary studies ranging from 8.9% to 96.8% across various studies cited in diverse geographical regions in Africa. In this synthesis, we conducted a meta-analysis using seven studies that used the Morisky medication adherence scale or its derivative to assess adherence among hypertension patients and the results showed heterogeneity within the prevalence. The heterogeneity of the prevalence of medication adherence can be attributed to

factors that include the wider geographical area, discrepancies in culture and illness perception, difference in language and issues pertaining to individual studies. Those issues pertaining to individual studies related to study design, population and sample sizes used and the level of adoption of the Morisky adherence tool. This level of heterogeneity in the data demands the use of national-level data in assessing medication adherence as continental-level data give limited information. Previous results of medication adherence in developing countries also showed that medication adherence rates varied from 31.4% to 89.98% in hypertension patients (Gemeda et al., 2020). The wide discrepancies (on prevalence) associated with medication adherence may be associated with the differences in the tool used to assess adherence or limited to health knowledge and geographical cultural variations. This may make certain areas have higher susceptibility while others may not. Various tools including the basic MMAS and its related derivatives are used to assess medication adherence. An accurate, critical and most important means of assessing medication adherence is expected to be the individualized self-reported medication adherence that involves the counting of pills but has the risk of allowing over-reporting or self-exaggeration. This makes the widely used MMAS tool an integral tool for individualized validation (Labaran et al., 2018; Shankar et al., 2019) and has been used to assess adherence in various parts of the world. MMAS is one of the most widely self-reported tools to assess drug adherence in hypertensive patients as its noted to be simple, cost-effective and easy to administer in clinical practice (Jankowska-Polańska et al., 2016). Indeed, all other tools for assessing medication adherence will require adaptation and validations for suitability in cultural context. The use of appropriate medication adherence depends on the level of the tool's reliability, practicality, cost-effectiveness and acceptability (Hawkshead & Krousel-Wood, 2007) across cultures and patients. Following the shortcomings that are associated with the various tools used to assess the medication adherence, a comprehensive robust tool is needed in this regard. However, because there are no complete medication adherence assessments tool currently, a combination of methods can provide a more accurate assessment acceptability (Hawkshead & Krousel-Wood, 2007).

We identified the determinants to antihypertensive medication adherence as social and economic factors (knowledge on medication, and income level), treatment-related factors (drug and adverse drug effect) and patient-related factors (comorbidity, age and obesity, smoking, number of medications, number of years since diagnosed) and healthcare system-related factors (distance from the hospital, missed appointments due to lack of transport) to be important in hypertension medication adherence. These forms of determinants of medication adherence were also identified in similar studies (Gast & Mathes, 2019). Among them, social and economic factors (knowledge on medication) and therapy-related factors (adverse drug effects and drug factors) were identified as significant factors in drug adherence. Africa generally is one of the poor regions of the world, and general literacy including health literacy is said to be low. There are also limited concerted efforts that are aimed at increasing lay health knowledge with empowerment of people towards positive health care. Increasing knowledge, client motivation and mitigating the side effects associated with medication remain critical in ensuring that client build a positive medication-adherent attitude (Jaam et al., 2017). There is evidence for a positive impact of education on compliance in cardiovascular disease medication adherence (Jaam et al., 2017).

The influence of other factors including the presence of comorbidities and the taking of multiple medications were identified to influence an individual likelihood of adherence. The presence of multiple and varied comorbidities (mostly associated with hypertension) is probably to lead to a situation where the client is prescribed multiple medications. This leads to a higher pill burden, drug–drug interactions and drug side effects that can reduce the likelihood of medication adherence. When the intake of multiple drugs becomes an imperative, patients will need detailed education, instructions and possible reminders to remain medication adherent. Sometimes the use of supportive family members could be of essence (Kang et al., 2020). Comorbidities affect medication adherence due to the nature of the drugs that must be taken together to cater for other diseases (Saadat et al., 2015). Hypertension is usually asymptomatic, making patients overlook the importance of managing high blood pressure. This then makes it critical the role of primary healthcare providers among hypertension patients to be weary of this risk and implement measures to mitigate the same. The clinic's primary healthcare provider team should review forms and patient education on treatment adherence (Kang et al., 2020).

In developed jurisdictions, several interventions are instituted to ensure medication adherence and the best possible means is the conducting and testing hypothesis that are associated with medication adherence. A cursory look at the various studies conducted in Africa was all cross-sectional in design, and none were conducted as an intervention study or an experimental study to identify the effective and cost-efficient way of ensuring medication adherence. A systematic review and meta-analysis for study interventions to improve medication adherence in hypertensive patients suggested adherence problem-solving and increased integration of services and activities among healthcare providers as key in ensuring positive medication adherence, especially in long-term diseases (Conn et al., 2015). Healthcare providers must understand the challenges of health behaviour change and make it a priority in providing care. Our study pointed out that knowledge of hypertension among patients is one factor related to medication adherence. A similar finding was found in Ethiopia, which supported the view that antihypertension medication adherence was largely influenced by the level of knowledge of the patients (Gemeda et al., 2020). This greatly increases the very essence of increasing client knowledge on hypertension medication as a panacea for improvement in adherence in Africa. Healthcare providers will be more successful in controlling medication nonadherence if they repeatedly address issues related to drug taking during various clinic visits.

5.1 | Limitations

The conduct of this study could not be without related challenges as it was noted that during the various studies, the cognitive function of the patients was not assessed, as cognitive function could influence an individual's likelihood of making conscious decisions or even forgetfulness. Also, the cross-sectional and observational nature of the study did not allow for causal reasoning and did not observe adherence over time. Questionnaires for data collection, including MARS, contain self-reported variables and may potentially have the risk of recall bias. Both recall and selection bias can lead to the overestimation of adherence.

5.2 | Implications for practice and research

This study identified the prevalence of the risk factor of medication to be varied and widespread in Africa. One of the important factors that were identified to be associated with medication nonadherence was forgetfulness, lower knowledge on disease and medication and taking multiple medications with antihypertension drugs. Healthcare providers in Africa should monitor and invest resources in ensuring medication adherence, especially among hypertension patients. The prevalence of medication adherence was also noted to be varied based on the tool used or geographical location of the study. Large-scale accurate monitoring of medication adherence is needed, while considerations are made in developing and testing a comprehensive culturally sensitive tool for measuring medication adherence. Studies identified in Africa were mainly cross-sectional studies, and no single intervention study testing the efficacy of the medication adherence was seen in Africa. The development of interventional strategies with modifiable strategies that may affect hypertension medication adherence is required.

For nursing interventions to lead to successful improvement in medication adherence, multidisciplinary approaches must be incorporated to promote behaviour change, increase hypertension medication and treatment awareness, eliminate barriers and promote medication intake monitoring. For efficient implementation of interventions, nurses managing patients with hypertension must consider these diverse factors that influence medication adherence while using scientific methods to identify the factors that can promote medication utilization. It may be necessary for nursing intervention to be tailored to specific phases of hypertension medication treatment (acute, continuation or maintenance), nature of the patient situation (with or without comorbidities and related complications), presence of significant others (presence of supportive, informal caregiver) and in different treatment settings (community, primary healthcare, secondary or facility settings). Africa has a weak primary healthcare infrastructure and nurses promoting medication adherence is central to the control of hypertension. Nursing intervention research must consider compliance and persistence in promoting medication intake among hypertension patients.

6 | CONCLUSION

This systematic review investigated the prevalence and determinants of adherence among patients taking antihypertension medications in Africa. The medication adherence rate in Africa varied widely across various studies located in diverse geographic regions and used various assessment tools. The discrepancies associated with the prevalence of hypertension medication adherence make it an imperative to develop, test and use a comprehensive hypertension medication adherence e tool that is whole accepted and culturally congruent to the African context. The standardized specific tool will be key in assessment medication adherence among hypertension patients across healthcare facilities in Africa. Medication adherence was low due to disease-related knowledge and taking other medication with antihypertension drugs (hypertension, comorbidities, drugs, frequency of drug administration, drug side effects, etc.). This makes it instructive that health workers when giving medication to patients in the health facility provide clear and concise education on the essence of taking the medications and when possible, promotions are identified along with the patient to serve as reminders to take the medication. Lack of perceived health behaviour knowledge may lead to a lack of ability to address perceived individual risks, exposing them to more disease risks and complications. Policymakers and healthcare providers should consider these factors to coordinate appropriate intervention strategies on the importance of improving perceived health behaviour knowledge and adherence to medication in patients with hypertension. In addition, efforts are needed to develop interventions and strategies tailored to developing countries considering regional, cultural and cost aspects in the primary healthcare team.

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All the authors made substantial contributions to the conception, design, search and acquisition of data, extraction, and synthesis. All the researchers also contributed significantly to drafting and revising the manuscript for critically important intellectual content and gave final approval for publication of this manuscript in your esteemed journal.

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CONFLICT OF INTEREST

The authors here declare that they have no conflict of interest in the conceptualisation, drafting and publication of this manuscript.

DATA AVAILABILITY STATEMENT

Data from which the conclusions are based have been included in this manuscript, and no data are deposited in any data repository.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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