Journal of the American Heart Association

ORIGINAL RESEARCH

High Burden and Trend in Nonadherence to Blood Pressure-Lowering Medications: Meta-Analysis of Data From Over 34 000 Adults With Hypertension in Sub-Saharan Africa

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BACKGROUND: Nonadherence to blood pressure (BP)-lowering medication is a strong predictor of poor BP control. Sub-Saharan Africa has extremely low BP control rates (~10%), but it is unclear what the burden of medication nonadherence among Africans with hypertension is. This systematic review estimated the prevalence and determinants of nonadherence to BP-lowering medications in Sub-Saharan Africa.

METHODS AND RESULTS: Multiple databases were searched from inception to December 6, 2023. Two reviewers performed independent screening, extraction, and quality assessment of studies. We pooled the prevalence estimates using random effects meta-analyses and summarized the determinants using a narrative synthesis. From the 1307 records identified, we included 95 studies published between 1995 and 2023. The overall prevalence of nonadherence to BP-lowering medication among 34 102 people treated for hypertension in 27 countries was 43.9% (95% CI, 39.2–48.6). There was no change in the prevalence of nonadherence over time. Nonadherence varied by measurement method and by median age (39.4%, ≥57 years versus 47.9%, <57 years). Socioeconomic and patient-related factors were the most frequent factors influencing adherence. Active patient participation in management, accurate perceptions, and knowledge of hypertension and its treatment predicted good medication adherence, whereas high pill burden, medication cost, side effects, and comorbidities predicted poor adherence.

CONCLUSIONS: Two out of every 5 people are nonadherent to their BP treatment. With the African population projected to increase from 1.4 to ~2.5 billion by 2050, targeted strategies are urgently needed to optimize medication adherence in people with hypertension in Sub-Saharan Africa.

Key Words: Africa ■ determinants ■ hypertension ■ medication adherence ■ systematic review

Hypertension is the leading risk factor for disease burden globally, affecting nearly 1.3 billion adults[1] and contributing to over 10.8 million deaths each year.[2] The prevalence of hypertension in Sub-Saharan (SSA) is high, affecting about 1 in 3 adults and 1 in 2 people aged 50 years and over.[3–6] In SSA, over half of the women and two thirds of the men with hypertension remain undiagnosed. This high burden of hypertension

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This article was sent to Tochukwu M. Okwuosa, DO, Associate Editor, for review by expert referees, editorial decision, and final disposition.

Supplemental Material is available at https://www.ahajournals.org/doi/suppl/10.1161/JAHA.124.037555

For Sources of Funding and Disclosures, see page 10.

JAHA is available at: www.ahajournals.org/journal/jaha

CLINICAL PERSPECTIVE

What Is New?

- The burden of nonadherence to blood pressure (BP)-lowering medication in people with hypertension in Sub-Saharan Africa is high (43.9%), and for the first time, this study demonstrates that the trend has remained unchanged over nearly 3 decades.

What Are the Clinical Implications?

- With rapid population growth, increasing prevalence of hypertension and nonadherence to BP-lowering medication, we can expect health systems in Sub-Saharan Africa to be overwhelmed with patients presenting complications of high BP like stroke, heart attacks, and kidney disease.
- Clinicians and other stakeholders involved in BP control in Sub-Saharan Africa need to focus on improving patient awareness of hypertension and its treatment and facilitate active patient participation in their management to optimize adherence and BP control.

Nonstandard Abbreviations and Acronyms

SSA	Sub-Saharan Africa

contrasts with very low treatment and control rates. A recent global analysis found that only 22% to 29% of adults diagnosed with hypertension in SSA are treated; of these, only 9% of men and 13% of women have their blood pressure (BP) controlled.[1] Pharmacotherapy and lifestyle modification are the mainstay of BP control to prevent vascular complications including stroke, ischemic heart disease, chronic kidney disease, and dementia.[3]

The World Health Organization defines adherence as the extent to which an individual's behavior—taking medication, following a diet, or executing lifestyle changes—corresponds with agreed recommendations from a health care provider.[7] Nonadherence to medication has been identified as a major predictor of poorly controlled hypertension. Compared with people who are adherent to BP-lowering medication, those who are nonadherent are twice as likely to have suboptimal BP control and to develop complications of hypertension.[8] Understanding the extent of nonadherence and determinants is critical to the development of appropriate interventions to prevent the health and economic consequences for affected people and health systems. Prior reviews exploring adherence to BP-lowering medication have been limited by either narrow inclusion time periods,[9,10] restricted to 1 adherence measurement method,[9,11] lacked quality appraisal of the evidence,[9] did not assess determinants of nonadherence,[12] or had a broad geographical focus with limited representation of SSA.[8,13]

Given the high burden of hypertension, low rates of BP control in SSA, and the existing evidence gaps, this systematic review and meta-analysis sought to answer the following questions: (1) What is the contemporary burden of nonadherence to BP-lowering medication among people with hypertension in SSA, and has it changed over time? and (2) What are the determinants of (non-)adherence to BP-lowering medication in SSA?

METHODS

All data underpinning this review are provided in the main article and supplementary files.

Search Strategy and Selection Criteria

The review protocol is registered in the International Prospective Register of Systematic Reviews database (CRD42017079838) and published.[14] This review was reported according to the Preferred Reporting Items for Systematic Reviews and Meta-analysis (2020) guidelines.[15] Institutional review board approval was not required for this article as it is a review and synthesis of already published primary research. All supporting data are available within the article and supplementary material. MEDLINE via Ovid, SCOPUS, Web of Science, African Journals Online databases and gray literature (via Google Scholar) were searched to identify all relevant articles from the inception of databases until December 6, 2023. Search terms related to BP-lowering medication and adherence were combined with relevant Boolean operators and a validated African search filter[16] to improve the sensitivity and precision of the search. No language restrictions were applied. See Tables S1 through S6 for the detailed search strategies and study inclusion.

We included primary observational studies reporting the prevalence of or factors associated with (non-)adherence to BP-lowering medication among adults with hypertension residing in SSA. Studies were excluded if they were conducted out of SSA, selected participants based on their medication adherence status, had incomplete data or lacked relevant data to compute the prevalence of nonadherence, and those with <30 participants. In addition, letters to the editor, commentaries, reports without primary data, or explicit descriptions of the methods were excluded. Duplicate studies based on the same data were excluded and only the most comprehensive report was retained.

Screening and Data Extraction

Following the database search, all records were uploaded to the Rayyan systematic review software[17] and duplicates were removed. Two investigators (L.N.A. and F.N.T.) independently screened titles and abstracts. Full texts of potentially eligible studies were assessed for final inclusion (L.N.A. and V.N.A.), and data were independently extracted by 3 pairs of reviewers (LNA, VNA, NTF, MAN, CAN and CN). We resolved any disagreements by consensus discussion. The following data were extracted from individual studies: the last name of the first author and year of publication, year(s) of recruitment, the country, study design, study setting (rural versus urban) and study type (community-based versus hospital-based), method or tool used to define medication adherence, approach to data collection (interview-administered versus self-administered), sample size, total number of patients nonadherent to BP-lowering medication, mean or median age, and the male proportion. Only baseline data were extracted for cohort studies. For multinational studies, the combined data were extracted and, where possible, the disaggregated (country-specific) data. For studies reporting on factors associated with medication adherence, we extracted measures of association and CIs for variables based on multivariable regression analyses.

Risk of Bias Assessment and Certainty of the Evidence

The risk of bias tool developed by Hoy et al.[18] was used to evaluate the methodological quality of prevalence studies. The tool assesses selection/sampling methods, response rate, outcome measurement, and validity of reporting. The Newcastle-Ottawa Scale was used to assess cohort studies.[19] The Newcastle-Ottawa Scale includes 8 items spread across 3 domains: selection of participants, comparability, and outcome assessment. Two reviewers (L.N.A. and C.A.N.) independently assessed the quality of studies, and any disagreements were resolved by consensus.

The overall quality of the evidence was assessed using the Grading of Recommendations Assessment, Development and Evaluation approach.[20] In the absence of specific guidance for systematic reviews of prevalence estimates, we followed the Grading of Recommendations Assessment, Development and Evaluation framework proposed for assessing confidence in incidence estimates from prognostic studies.[21]

Statistical Analysis

A random effects meta-analysis using the DerSimonian-Laird method was used to estimate the pooled prevalence of nonadherence to BP-lowering medication. Given the challenges with interpretation and limitations of transformation techniques,[22,23] we used raw proportions for this meta-analysis.[23] Heterogeneity was assessed using the weighted SD of the study-specific proportions as well as the Cochran's Q test and the I^2 statistic.[24] In addition, prediction intervals for the pooled prevalence were estimated to depict the degree of uncertainty in the meta-analysis. Subgroup analyses were conducted to investigate potential sources of heterogeneity. The Q test based on the analysis of variance was used to compare between subgroups. For studies reporting high, medium, and low adherence levels, as opposed to adherent versus nonadherent, nonadherence was defined as having low adherence levels in the main analysis. Sensitivity analyses was performed reclassifying individuals with medium adherence levels as nonadherent. Additionally, the prevalence of nonadherence was estimated using only studies with a low risk of bias. Influence analysis was used to investigate the impact of individual studies on the pooled estimate. To determine if the burden of nonadherence to BP-lowering medication has changed over time, we conducted a meta-regression analysis of prevalence estimates by publication years using a Poisson model with sample size as an offset and robust SEs and report the estimated relative rates.

Small study effects were examined using the Doi plot and the Luis-Furuya Kanamori index. A Luis-Furuya Kanamori index of zero represents complete symmetry in the Doi plot. Any indices between –1 and +1 represent plot symmetry, and any values beyond ±1 are consistent with plot asymmetry. Compared with the traditional funnel plot and Egger's regression test, these measures have been shown to have better visual representation of asymmetry and diagnostic accuracy in detecting small study effects.[25,26] All statistical analyses were conducted in R Studio (R version 4.2.3) using the 'meta' and 'metasens' packages.

RESULTS

Overview of Included Studies

The search identified 1315 records. After removing duplicates and screening titles and abstracts, we assessed 158 full texts for eligibility. We included 95 studies comprising 34 102 adults with hypertension in the systematic review and meta-analysis (Figure 1). There were 2 multicountry studies, one with 12 countries[27] and the other with 2 countries.[28] Overall, most of the studies were conducted in Western SSA countries (n=50, 47.2%), including Nigeria (n=29), Ghana (n=11), Côte d'Ivoire (n=4), Togo (n=2), and Benin, Guinea, Mauritania, Senegal with 1 study each. The second most represented region was Eastern SSA (n=34, 32.1%), including Ethiopia (n=23), Kenya (n=3), Eritrea and Tanzania with 2 studies each, and Malawi, Mozambique, Seychelles, and Uganda with 1 study

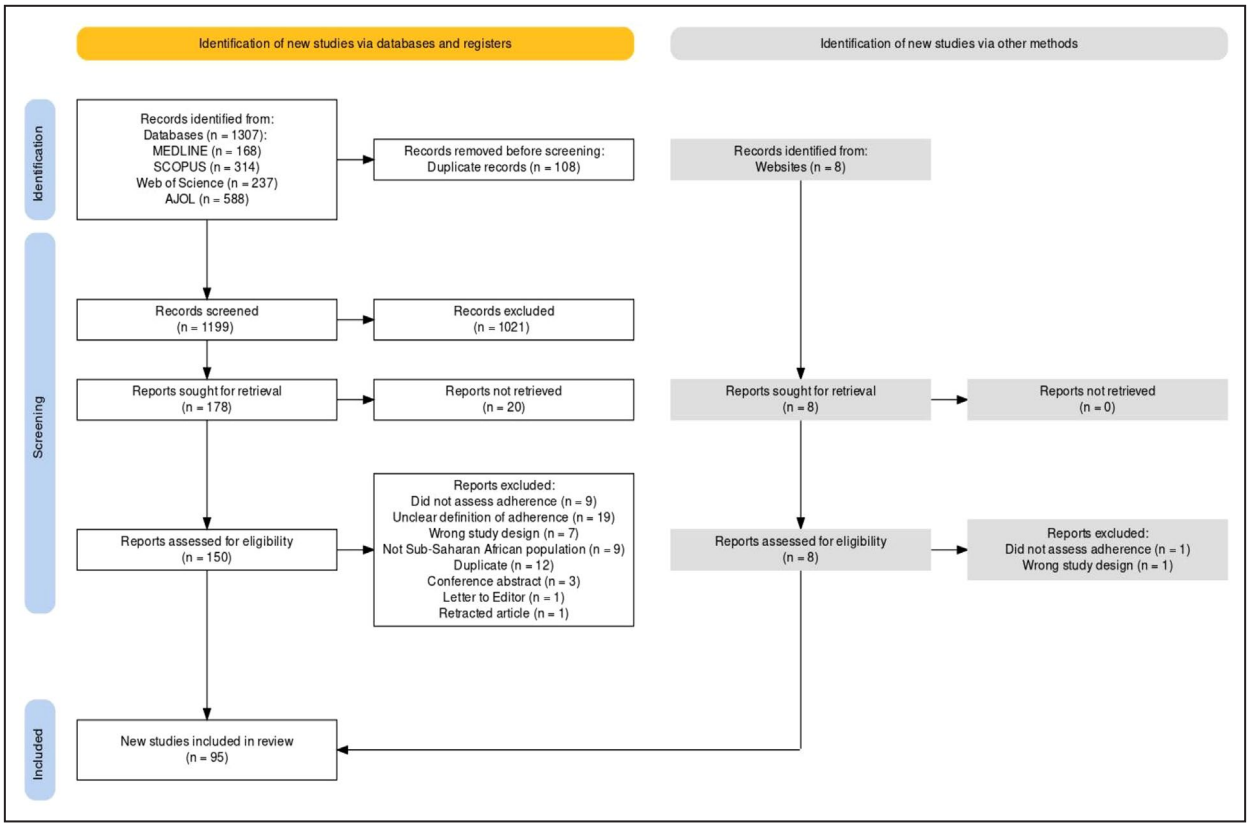

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram depicting the selection of studies for inclusion in the review.
AJOL indicates African Journals Online.

each. Next was Southern SSA (n=13, 12.3%), with studies conducted in South Africa (n=5), Zimbabwe (n=3), Namibia (n=2) and 1 each in Botswana, Lesotho, and Zambia. Finally, studies from Central SSA (n=9, 8.5%) included Cameroon (n=4), the Democratic Republic of Congo (n=2), Congo (n=2), and Gabon (n=1).

The most frequently used tool to measure adherence was the 8-item Morisky Medication Adherence Scale (n=25, 26.3%).[27–51] In 21 studies (22.1%), the authors used the proportion of days medication was taken (≥80%) per week.[52–72] The next most frequently used tool was the Hill-Bone Compliance Questionnaire (n=11, 11.6%).[73–83] The pill count method was used in 6 studies (6.3%),[84–89] and only 1 study used biological assays.[90] Most studies were cross-sectional (n=89, 93.7%), whereas 6 were cohort studies (6.3%). Forty-eight (50.5%) studies were conducted in urban settings, 5 (5.3%) in rural, and 42 (44.2%) in both urban and rural settings. Almost all the included studies were hospital based (93.7%) (Table and Table S7).

Quality of the Evidence

About three quarters (n=67, 70.5%) of studies were rated as having a low risk of bias, whereas the remaining studies (n=28, 29.5%) had a moderate risk of bias (Tables S8 and S9). Overall, the predominant methodological shortcomings in studies were target populations that were not nationally representative (96.8%), and about two thirds of studies that were based on nonrandom samples (64.2%). However, most studies used an acceptable measurement tool (88.4%), that had good reliability and validity (75.8%).

The overall quality of the evidence was rated as moderate certainty, which was driven by the serious inconsistency in estimates between individual studies and the wide prediction intervals around the pooled prevalence. The detailed Grading of Recommendations Assessment, Development and Evaluation assessment is shown in Table S10.

Burden and Trend in Nonadherence to BP-Lowering Medication

The prevalence of nonadherence to BP-lowering medication from individual studies ranged from 3.5%[29] to 92.9%.[72] The pooled prevalence of nonadherence across all studies was 43.9% (95% CI, 39.2–48.6). There was substantial between-study heterogeneity demonstrated in the large weighted SD (18.5%) of the

Table Subgroup Analysis Exploring Differences in Prevalence of Nonadherence to BP-Lowering Medication in Sub-Saharan Africa

Grouping variable	Subgroup	Number (%) of studies	Number of observations	Prevalence % (95% CI)	τ^2	I^2, %	*P* value for heterogeneity	*P* value for subgroup differences
Overall	…	95 (100)	34 102	43.9 (39.2–48.6)	0.054	99.0	<0.001	…
African regions	Central SSA	9 (8.5)	2354	43.4 (34.1–52.7)	0.019	95.6	<0.0001	0.647
	Eastern SSA	34 (32.1)	11 835	43.7 (37.8–49.6)	0.029	97.9	<0.0001	
	Southern SSA	13 (12.3)	4427	36.4 (26.6–46.2)	0.032	98.3	<0.0001	
	Western SSA	50 (47.2)	15 486	42.7 (34.9–50.4)	0.078	99.3	<0.001	
Adherence measurement	MMAS-8	25 (26.3)	11 020	40.6 (31.7–49.6)	0.052	99.2	<0.001	0.030
	Hill-Bone Compliance Questionaire	11 (11.6)	3281	48.9 (33.4–64.5)	0.068	99.1	<0.0001	
	MMAS-4	10 (10.5)	3131	46.0 (37.6–54.5)	0.018	95.9	<0.0001	
	Morisky-Green-Levine scale	6 (6.3)	2111	43.3 (14.2–72.4)	0.132	99.6	<0.0001	
	Pill count	6 (6.3)	2438	47.8 (28.0–67.6)	0.060	99.0	<0.0001	
	Girerd scale	5 (5.3)	1896	48.3 (38.2–58.5)	0.013	94.2	<0.0001	
	Medication Adherence Rating Scale	4 (4.2)	1551	61.9 (51.8–71.9)	0.010	94.4	<0.0001	
	Other questionnaires	6 (6.3)	1887	30.3 (16.7–43.9)	0.028	98.2	<0.0001	
	Proportion of days per week medication was taken and related	21 (22.1)	6600	42.7 (33.9–51.4)	0.041	98.4	<0.0001	
Risk of bias	Low risk	67 (70.5)	25 735	43.4 (37.7–49.2)	0.057	99.2	<0.0001	0.737
	Moderate risk	28 (29.5)	8367	45.1 (37.1–53.1)	0.045	98.5	<0.0001	
Median age (57 y)	At or above	41 (49.4)	16 818	39.4 (34.1–44.8)	0.029	98.4	<0.001	0.048
	Below	42 (50.6)	13 297	47.9 (41.4–54.4)	0.045	98.6	<0.001	
Sex	Female	43 (49.4)	9903	47.4 (40.1–54.7)	0.058	98.5	<0.001	0.893
	Male	44 (50.6)	16 733	48.1 (41.5–54.6)	0.047	97.2	<0.001	
Median sample size (329 people)	At or above	50 (52.6)	25 546	43.9 (37.3–50.5)	0.057	99.4	<0.001	0.999
	Below	45 (47.4)	8556	43.9 (37.4–50.4)	0.048	97.9	<0.001	
Study location	Urban	58 (79.5)	18 890	43.9 (36.8–50.9)	0.074	99.3	<0.001	0.295
	Rural	15 (20.5)	3169	49.6 (41.5–57.7)	0.024	95.6	<0.001	
Study setting	Hospital	89 (93.6)	32 691	43.8 (38.9–48.7)	0.055	99.1	<0.001	0.831
	Community	6 (6.3)	1411	45.4 (32.1–58.6)	0.026	96.2	<0.001	
Study design	Cross-sectional	89 (93.6)	31 138	43.9 (39.1–48.7)	0.053	99.0	<0.001	0.966
	Cohort	6 (6.3)	2964	44.4 (20.5–68.3)	0.089	99.5	<0.001	
Period of data collection	Before 2010	13 (13.7)	4059	48.9 (33.9–63.9)	0.074	99.1	<0.0001	0.914
	2010 to 2014	20 (21.1)	5935	44.7 (37.2–52.2)	0.028	97.3	<0.0001	
	2015 to 2019	38 (40.0)	15 607	43.5 (35.1–51.9)	0.069	99.4	<0.001	
	2020 onward	17 (17.9)	6610	40.8 (31.7–49.9)	0.036	98.7	<0.001	
	Not reported	7 (7.4)	1891	42.4 (32.6–52.2)	0.016	95.0	<0.001	
Sampling method	Probabilistic	35 (36.8)	12 034	41.6 (34.5–48.7)	0.045	98.8	<0.001	0.631
	Non-probabilistic	55 (57.9)	20 793	44.7 (38.4–51.1)	0.056	99.1	<0.001	
	Unclear	5 (5.3)	1275	50.7 (31.0–70.4)	0.049	98.3	<0.001	
Data collection approach	Interviewer-administered	89 (93.6)	29 983	43.5 (38.5–48.5)	0.057	99.0	<0.001	0.465
	Self-administered	6 (6.3)	4119	50.1 (33.0–67.2)	0.045	99.1	<0.001	

MMAS indicates Morisky Medication Adherence Scale; and SSA, Sub-Saharan Africa Other questionnaires included the Medication Adherence Questionnaire (1 study), the Brief Medication Questionnaire (1 study), the Adherence to Refills and Medication Scale (2 studies), the Adherence in Chronic Disease Scale (1 study), and the General Medication Adherence Scale (1 study).

observed study prevalences and heterogeneity statistics (τ^2=0.054; I^2=99.0%, P<0.0001) (Figure 2). The prediction interval ranged from 0% to 90.3%, suggesting that we can expect the prevalence of nonadherence to BP-lowering medication from future studies in different settings across SSA to vary within that range. Meta-regression analysis of all the included evidence published between 1995 and 2023 showed no change in the prevalence of nonadherence over time (estimated relative rate, 1.001 [95% CI, 0.977–1.026]) (Table and Figure S1).

Subgroup Analyses

The burden of nonadherence to BP-lowering medication varied by age (P=0.048), with younger (<median age 57 years) participants having greater nonadherence compared with older (≥57 years) participants (47.9% versus 39.4%) (Table and Figure S2). Nonadherence also varied by measurement tool (P=0.030). The prevalence of nonadherence was 40.6% (n=25 studies) for the most frequently used tool (Morisky Medication Adherence Scale-8), lowest (30.3%) among studies using other questionnaires (n=7 studies) and highest (61.9%) in studies using the Medication Adherence Rating Scale (n=4 studies) (Table and Figure S3). There was no sex difference in nonadherence to BP-lowering medication (47.4%, 43 studies with 9903 women versus 48.1%, 44 studies with 6830 men, P=0.892). There was no statistical difference in the prevalence of nonadherence between Southern SSA (36.4%, n=13 studies) compared with Western SSA (42.7%, n=50 studies), Central SSA (43.4%, n=9 studies), and Eastern SSA (43.7%, n=34 studies) (P=0.646). Similarly, the prevalence of nonadherence did not differ by location (49.6% for rural versus 43.9% for urban; P=0.295), study settings, study design, sample size, sampling method, period of data collection, or data collection approach (Table and Figures S4 through S13).

Sensitivity Analysis and Publication Bias

In sensitivity analysis, the prevalence of nonadherence was similar to the main analysis estimate when considering only studies with low risk of bias (Figure S14). However, classifying people in the medium adherence category (n=19 studies) as being nonadherent to their medication resulted in a higher overall prevalence of nonadherence (50.7% [95% CI, 44.2–57.3]) with substantial heterogeneity (τ^2=0.106; I^2=99.6%) (Figure S15).

The influence analysis found no evidence that any individual study significantly influenced the pooled estimate (Figure S16). The Doi plot showed mild asymmetry (Luis-Furuya Kanamori index=1.34) suggesting a potential for publication bias (Figure S17); however, small studies were not more likely to report extreme

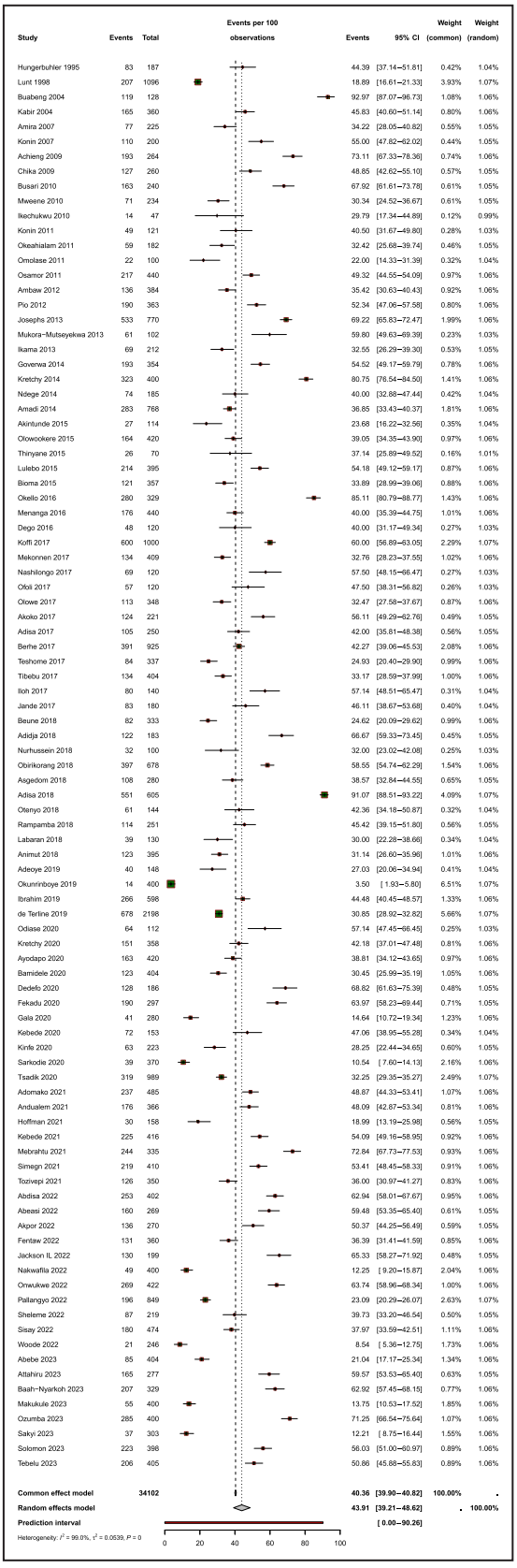

Figure 2. Meta-analysis of the prevalence of nonadherence to BP-lowering medication in Sub-Saharan Africa.
BP indicates blood pressure.

prevalence estimates compared with larger studies (P=0.999, Table and Figure S9).

Factors Associated With Medication Nonadherence

Figure 3 and Table S11 present the details of the predictors of medication nonadherence, which are summarized next.

Demographic and Socioeconomic Factors

Age, sex, and area: All but 1[72] of 6 studies found that being male was associated with nonadherence to medication.[91–95] Additionally, 3 out of 5 studies showed younger adults (generally <40 years) were more likely to be nonadherent to medication compared with older adults,[51,87,96] but 2 studies found the contrary.[92,97] One study reported that residing in rural areas was associated with nonadherence.[97]

Education: All 5 studies showed that lower levels of education were associated with nonadherence to medication.[44,70,85,89,98]

Employment and income: Being unemployed was associated with poor medication adherence in 4 studies,[35,74,93–95] whereas 3 authors found the opposite relationship.[35,46,70] Additionally, 3[27,70,79] out of 5 studies reported that higher income/wealth status was associated with good medication adherence, whereas the converse was found in 2 studies.[74,96]

Social support: All but 1[74] of 4 studies[35,44,74,78] noted that having good family/friend support was associated with good medication adherence, with odds ratios (ORs) ranging from 2[35] to over 5-fold.[78]

Distance from health facility: Two studies showed that people experiencing high cost or lack of transport had >3 times the odds of being nonadherent to medication[75,95]; individuals with shorter distances to the hospital had a 2-fold higher odds of being adherent (adjusted OR [aOR], 2.02 [95% CI, 1.19–3.43]).[91]

Medication cost and availability: Unavailability of medication was associated with nonadherence to medication,[74,84,98,99] with the odds ranging from 1.7 (95% CI, 1.1–3.3) in a study in Tanzania[84] to 5.4 (95% CI, 1.76–16.85) in Namibia.[74] All 7 studies investigating cost coverage for medication found that compared with having free medication or funded by others/insurance/government schemes, self-funded or out-of-pocket costs were associated with nonadherence to medication.[37,39,44,49,51,84,98]

Patient-Related Factors

Active participation in management: All 8 studies found that patients who actively participated in the management of their BP through regular attendance to clinic appointments,[74,78,94] health talks,[95] having good self-efficacy[85,93] and not stopping medication when asymptomatic[73,84] were more likely to have good medication adherence.

Understanding and perceptions about hypertension: Patients with a good understanding of hypertension were 3 to 9 times as likely to be adherent to their medication compared with those who had a poor understanding of the condition.[30,37,48,91–93,95]

Knowledge and skill in managing symptoms and treatment: Patients with adequate knowledge and skill had 3- to 13-fold higher odds of being adherent to medication compared with their counterparts.[33,40,73,90,91,97,98,100]

Perception of the health risk related to hypertension: All but 1[30] of 4 studies found that people with accurate perceptions had higher odds of being adherent to their medication.[35,99,100]

Comorbidities: In 6 studies, patients with 1 or more comorbidities were over twice as likely to be nonadherent to their medication.[39,46,64,87,91,98] One study reported that those without a comorbid condition were 4 four times as likely to be adherent to their medication.[37]

Alcohol use and smoking: All studies evaluating the impact of alcohol use[30,39,40,73] and smoking[64,73] found that both behaviors were associated with low or nonadherence to medication.

Stress and forgetfulness: Patients who reported being stressed were twice as likely to be nonadherent to medication, whereas being forgetful was associated with about 8-fold higher odds of nonadherence to medication.[48,49]

Others: Individuals using nonprescribed medication[99] or traditional medications[27] were twice as likely to be nonadherent to their BP-lowering medication. Similarly, being physically inactive (aOR, 1.63 [95% CI, 1.04–2.55]) was associated with nonadherence to medication.[46]

Therapy-Related Factors

Pill burden: Eight studies reported that high pill burden was associated with nonadherence to medication,[39,49,87,89,92,96,97,101] with poorer adherence in people taking 2 or more BP-lowering pills.[39,49,92,97]

Side effects: All 6 studies showed that those who experienced side effects (such as dizziness,[75] palpitation[73]) were 2 to 7 times more likely to be nonadherent to their medication.[40,49,73,75,85,99]

Duration of diagnosis and treatment: Three studies showed that people who had been diagnosed or on treatment for longer than 1,[40] 5,[101] or 10 years[96] were more likely to be no-adherent, whereas 2 studies showed that being on treatment for ≥3 years was associated with good medication adherence.[37,79]

BP control and class of BP-lowering medication: All 3 studies exploring the relation with BP control

found that people with well-controlled BPs were 2 to 3 times more likely to be adherent to their medication.[64,91,99] Two studies found a significant relationship between the use of calcium-channel blockers and medication adherence, although both had differing conclusions.[27,40]

Health Care Team/Health System Factors

Good patient–doctor relationships: This was associated with up to 4-fold higher odds of adherence,[37] whereas a poor relationship was associated with nonadherence to medication.[98]

Health education: Two studies showed that patients who did not receive health education or counseling when attending health facilities were twice as likely to be nonadherent to their medication.[44,99]

DISCUSSION

This systematic review provides a comprehensive synthesis of the burden of nonadherence to BP-lowering medication among adults with hypertension in SSA. At least 2 out of every 5 adults on treatment for hypertension in SSA were nonadherent to their medication. This high burden has remained unchanged during the past 3 decades. Nonadherence was higher in younger (mean age <57 years) adults compared with older adults, and it varied by measurement method. Socioeconomic- and patient-related factors were the most frequently reported drivers of medication adherence in SSA. There was consistent evidence that active patient participation in management, accurate understanding and perceptions, and knowledge of hypertension and its treatment predicted good adherence to medication, whereas high pill burden (mostly >2 pills per day), medication cost, experiencing side effects, and having comorbidities predicted poor adherence.

The overall prevalence of nonadherence in this study was lower than the 62.5% and 65.9% reported by previous studies in Africa.[9,10] These reviews had very narrow periods for which data were included, ranging from 7 to 11 years, as opposed to the present review, which pooled data from studies published over the past 3 decades.

Figure 3. Factors associated with medication (non-)adherence in Sub-Saharan Africa classified according to the World Health Organization dimensions for adherence to medication in people with hypertension.
Note: The upward arrows in green boxes indicate the variable was associated with good medication adherence, and the downward arrows in pink boxes indicate an association with non-adherence. The number of boxes along each variable indicate the number of studies that reported a significant association between that variable and adherence to BP-lowering medication. BP indicates blood pressure; and C-C, calcium channel.

Nevertheless, the estimates of the present study are on par with findings from a global meta-analysis that found a prevalence of nonadherence—measured using questionnaires—of 43% in low- and middle-income countries, which was higher than the 26% to 38% reported from high-income countries.[8]

Nonadherence to BP-lowering medication was higher in studies with younger populations compared with those with older people, consistent with reports from both low- and middle-income countries and high-income countries.[8,13,102] Older adults are more likely to have chronic conditions and to dedicate more time to their health and therapy. Furthermore, the use of adherence aids like pill boxes and calendars likely enhances their ability to adhere to medication.[103] There was variation in the pooled prevalence of nonadherence by the tool used in assessing medication adherence, which is consistent with previous reviews.[8,13] There is currently no gold standard for measuring adherence. Thus, the observed variation could reflect differences inherent to the respective tools.[104,105] More research is needed to develop standardized cost-effective and pragmatic tools for assessing medication adherence for research and clinical practice in SSA.

Socioeconomic and patient-related factors were the major drivers reported for nonadherence to BP-lowering medications. This is consistent with prior systematic reviews.[10,11,13] However, we found conflicting results for age and employment status. Although some studies showed that older age was associated with good adherence, 3 out of 5 studies reported an inverse relationship. The latter could be due to declining cognitive ability with aging. Being employed is correlated with higher socioeconomic status and access to health care services, which could explain better adherence.[13] In contrast, the association between employment and nonadherence could be due to patients prioritizing their job schedules. These mixed results likely indicate a complex relationship between age, employment, and medication adherence and potential differences in study settings.

Active patient participation and good knowledge of hypertension and their treatment were the main patient-specific factors consistently associated with good medication adherence. Targeted interventions promoting these attributes should be a key focus in SSA. There is growing evidence elsewhere about the benefits of active patient involvement in decision-making about their health and adherence to therapy.[103,106,107] These benefits include increased satisfaction, quality of life, and improved understanding of hypertension.

Comorbidities, experiencing medication side effects, and taking multiple pills were associated with medication nonadherence. Similar results were reported among older adults.[11] People with multiple chronic conditions are likely to have a high pill burden and incur significant out-of-pocket health expenditures.[108,109] This is a particular challenge for patients in low- and middle-income countries such as SSA with limited insurance or universal health coverage.[110] There is strong evidence that most people with high BP require 2 medications to control their BP. Hence, simplifying treatments through single-pill combinations is likely to address the problem of pill burden and adherence, with spinoffs like improved quality of life, reduced clinical inertia and lower health care costs.[111–113]

Implications of the Findings

The population of Africa is projected to increase from 1.4 billion now to ~2.5 billion by 2050, representing the fastest population growth worldwide.[114] Our analysis shows the prevalence of nonadherence to BP-lowering medication has not changed over time. With 1 in 3 adults having hypertension,[4] health systems in SSA can expect to manage ~825 million people with hypertension. Assuming this pattern continues, this would approximate to over 350 million patients not adherent to their medication and at increased risk of cardiovascular events. This represents a substantial challenge for already struggling health systems. Hence, in addition to prioritizing primordial prevention, governments in SSA need to develop sustainable long-term strategies. For example, accelerating progress toward universal health coverage for the delivery of quality and equitable health care for all, and fostering team-based care to improve health care provider-patient ratios and relationships.[115] Furthermore, with single-pill combinations now on the World Health Organization Essential Medicines List,[116] stakeholders involved in BP control should adopt simple and practical treatment guidelines incorporating single-pill combinations. Additionally, governments need to facilitate supply chains that enhance the availability of these single-pill combinations for patients. Such strategies would contribute to improving adherence to therapy, BP control and cardiovascular disease outcomes.

Strengths and Limitations

The review had some limitations. First, most of the included studies were hospital-based. Hence, the estimate of medication nonadherence may be biased by the "white coat adherence" phenomenon, whereby patients are more adherent in the days leading up to and immediately after their clinic visit.[117,118] Consequently, the prevalence presented in this study may be an underestimation of the true prevalence of medication nonadherence in SSA. Second, over half of the included studies were from Western SSA, with lower representations from central and southern SSA. Furthermore, there were comparatively fewer studies conducted in rural areas. Hence, the estimate from this review might

not be generalizable to the whole of SSA. Third, there was substantial heterogeneity between the studies, which was not completely explained by the moderator variables in the prespecified subgroup analyses. However, subgroup analyses and meta-regression are not without shortcomings. They are liable to the confounding effects of other study-level characteristics. In addition, they may suffer from aggregation bias with the identification (or not) of relationships from variables based on study-level averages that are inconsistent with individual-level analysis.[119] Fourth, although most included studies had a low risk of bias, about a quarter had moderate risk of bias which was driven by nonrandom and nonrepresentative samples. The certainty in the overall quality of the evidence was moderate. This implies that although the true burden of nonadherence to BP-lowering medication is likely to be close to the reported pooled prevalence, there remains a possibility that it is substantially different. Despite these shortcomings, this systematic review provides a comprehensive synthesis of the evidence on the burden, trend and determinants of nonadherence to BP-lowering medication in SSA.

CONCLUSIONS

This systematic review showed a substantially high burden of non-adherence to BP-lowering medication among adults with hypertension in SSA; two out of every five adults treated for hypertension are not adherent to their therapy, and this has not changed over the past 3 decades. Targeted policies are needed to address the broad range of socioeconomic, health system, therapy, and patient-related factors driving this high burden of medication nonadherence in SSA.

ARTICLE INFORMATION

Received July 7, 2024; accepted March 26, 2025.

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Sources of Funding

None.

Disclosures

Aletta E. Schutte has received speaker honoraria from Servier, Abbott, Sanofi, AstraZeneca, Medtronic, Omron, and Aktiia and serves on scientific advisory boards for Medtronic, Alnylam, AstraZeneca, SiSU Health and Sky Labs. AES is Co-Chair of STRIDE BP, an international authority on validated BP devices and measurement techniques (www.stridebp.org).

Supplemental Material

Tables S1–S11
Figures S1–S17

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