Medication adherence, blood pressure control: healthcare financing and associated factors among hypertensive general outpatients of a tertiary hospital in south-west Nigeria.

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Abstract

Background: Medication adherence refers to how effectively individuals follow their prescribed regimens. Non-adherence and uncontrolled blood pressure, particularly in chronic illnesses like hypertension, have a global impact on health outcomes and costs. This study assessed antihypertensive medication adherence and blood pressure control among hypertensive individuals.

Methods: In this cross-sectional study, 350 adult hypertensive outpatients were systematically sampled from 600 patients over three months. Data on socio-demographics, health history, medication adherence, and financing were collected using a semi-structured questionnaire. Adherence was assessed using the Adherence to Refills and Medications Scale (ARMS). Data were analyzed using bivariate and multivariate methods with p-value set at 0.05. Blood pressure was measured using a mercury sphygmomanometer.

Results: Respondents had mean age of 56.37 ± 9.75 years, with the majority being female (62.3%) and tertiary education (61.1%). Medication adherence was high (94.0%), and 70.6% had controlled blood pressure. Age, comfort with clinic visits, and pill burden were significantly associated with higher adherence, while blood pressure control was linked to gender, medication availability, adverse effects, pill burden comfort, and belief in drug efficacy. Older age (OR=0.162, p=0.020) and clinic comfort (OR=0.221, p=0.015) predicted adherence, whereas male gender (OR=1.72, p=0.025), drug unavailability (OR=1.827, p=0.027), and disbelief in medication effectiveness (OR=4.873, p=0.013) predicted uncontrolled blood pressure. There was no relationship between healthcare financing and adherence or blood pressure control.

Conclusion: High adherence to antihypertensive medication and satisfactory blood pressure control were observed, influenced by age, medication availability, and patients' perceptions of treatment. Targeted interventions addressing these factors could further improve hypertension management outcomes.

Keywords: Medication Adherence, Blood Pressure, Health financing, Hypertension, Outpatient, Nigeria

Introduction

Medication adherence, as originally defined by Cramer et al. (2008) and cited in Aremu et al. is the "act or extent of conforming to a provider's prescription based on the timing, dosage, and frequency of medication use".[1] Also it is the "ratio of the number of drug doses taken to the number of doses prescribed over a given time period".[2] The compliance of patients to medications contributes to effective disease control [3] and better clinical outcomes of chronic illnesses like hypertension.[1]

Globally, the incidence of antihypertensive nonadherence varies from 27 to 40%.[4] About 50% of people in advanced countries and higher rates in undeveloped countries add to the global non-adherence rate.[5] A multicenter cross-sectional study conducted in Ghana and Nigeria revealed an overall nonadherence rate of 66.7% among hypertensive individuals.[6] Individuals with chronic diseases often receiving multiple medications, are at higher risk for medication non-adherence[7] and this lowers quality of life by increasing the risk of chronic symptoms, diminished functional ability, and the psychological effects of recurring episodes.[8]

Health insurance is a key strategy for achieving universal health coverage, as it helps reduce financial strain of health expenses resulting from out-of-pocket payments.[9] The National Health Insurance Authority (NHIA) formerly known as the National Health Insurance Scheme (NHIS) became fully operational in Nigeria in 2005. Despite efforts over the years to expand access, coverage remains low, with only about 5% of Nigeria's population currently enrolled.[10,11] According to the World Health Organization, health insurance could improve healthcare services utilization and enhance financial protection making it an alternative source of out-of-pocket funding and a hopeful means of realizing universal health-care coverage.[12]

One of the main reasons for poor medication adherence is the inability to afford prescribed medications.[13–15] A significant proportion of approximately 70% still rely on Out-Of-Pocket (OOP) expenditure for healthcare. Limited financial resources lead many to choose cheaper, mostly informal, and substandard healthcare options, with a considerable portion

resorting to unwholesome sources due to out-of-pocket payments.[16] The cost of health care financing presents a major challenge in low and middle-income-countries and this leads to a significant drain on expenditure patterns of most households thereby making health insurance, a social intervention policy, their best alternative.[17]

Medication adherence may directly affect patient outcomes more so than the particular treatment, according to the World Health Organization,[18] hence must be fully understood especially among persons with hypertension. While health financing's impact on hypertension medication adherence has been studied, research remains geographically fragmented and methodologically limited, particularly in low- and middle-income countries (LMICs). Also, there has been research on adherence for over 50 years, however only a few of the dozen of instruments used have been validated in a population of chronically ill patients.[19] This study assessed the antihypertensive medication adherence levels of adult patients with hypertension and examined the relationship between antihypertensive medication adherence and healthcare financing characteristics of the patients. These findings will guide the identification of supportive financing model to recommend and counseling efforts that promote better adherence.

Methods

Study area and Participants

The study was conducted at the General Outpatient Clinics of the Department of Family Medicine in a tertiary hospital in southwest Nigeria.[20] The study was conducted among 350 adult outpatients aged 18 years and above with hypertension presenting within the stipulated period and who meet the inclusion criteria.

Study design, Sample size, and Sampling

The study was a descriptive cross-sectional study which spanned 3 months from 1st September -30th November 2022.

The sample size was calculated using the Leslie-Kish formula for cross-sectional studies[21] for estimating sample size 95% level of confidence.

Where,

n = sample size for a population >10,000

Z_α = standard normal deviate (1.96 for 95% confidence interval)

P = 0.351, estimated proportion of medication adherence among hypertensive patients, based on Ajayi et al.'s[22] study in Ibadan

q = 1 − P = 0.649, proportion with poor adherence

d = 0.05, desired margin of error

$n = Z^2 pq/d^2$

Therefore, n= 350 patients

Participants were selected using a systematic sampling technique from the medical records of the General Outpatient

Clinic, UCH, Ibadan. Based on statistics from the medical records department, an estimated 600 hypertensive patients were predicted for the three-month research period. With an intended sample size of 350 patients (n = 350) and data collection taking place five days a week, 6 patients were recruited each day using a sampling interval (K) = 2.

The sample interval (K) was calculated as follows:

K = N/n   = 600/350   = 1.71 ≈ 2

The first patient (a) was selected by simple random sampling (balloting) conducted by an independent observer, and subsequent participants by systematic sampling until the required sample size was achieved. A total of 350 consenting participants were selected. Adult patients who had been on antihypertensive for at least six months and had a consistent mode of healthcare financing for at least six months were included in the study. Hypertensive patients who had emergencies, were critically ill and pregnant were excluded from the study.

Study instruments

A semi-structured questionnaire was used to elicit information with sections on: sociodemographic, health status, healthcare financing and medication adherence level. The Adherence to refill and medication scale (ARMS) was used to assess the respondent's level of anti-hypertensive medication adherence. Participants also had their blood pressures measured with an England version of Accoson® mercury sphygmomanometer.

Data collection and management

The questionnaire was pretested for reliability among hypertensive patients attending a secondary care facility within the city which was an outstation of the teaching hospital. The data collected from the pre-test was evaluated, questions were adjusted to better align with the desired responses, and any required modifications were implemented. Patients' case notes were screened by the researcher as they waited to be seen by the physician on each clinic day and patients who met the inclusion criteria for the study were selected. After informed consent had been obtained from each participant; a structured interviewer administered questionnaire was used to get information from the participants.

Questionnaires were checked for completeness and accuracy on collection daily. Afterward, it was transferred to Statistical Package for Social Science (SPSS), version 21 for analysis.

Dependent/ outcome variables were medication adherence and blood pressure control. Medication adherence was the primary outcome variable. The 12 items ARMS questionnaire comprised two subscales: adherence to taking medications (eight items) and adherence to refilling prescriptions (four items). Each item was structured for response on a Likert scale with responses of "none", "some", "most", or "all" the time, allocated values from 1 to 4. Most items were written so that

lower scores indicated better adherence. Item score were summed to produce an overall adherence score of 14 – 56 with 14 being the lowest obtainable score and 56 being the maximum, with lower scores indicating better adherence.[21] Scores below 25 were designated as indicative of high adherence, scores between 25- 31 as medium adherence, while scores of 32 and above were indicative of low adherence. The advantage of a multi-measure approach with ARMS is that, it is better suited to assess medication adherence of patients with chronic illnesses with a low level of literacy.

Blood pressure control as a secondary outcome variable was measured as the systolic and diastolic blood pressure value judged as either controlled or uncontrolled based on SBP being <140mmHg or ≥140mmHg and or DBP being <90mmHg or ≥90mmHg.[22]

Healthcare financing characteristics as independent variable included; mode of healthcare financing and duration of health insurance. In responding to mode of healthcare financing, participants were asked if they were enrolled on the health insurance scheme, if YES, what type of insurance plan it was and the Insurer. Duration of healthcare financing in this study was defined as the cumulative number of years that a study participant has used the Social Health Insurance (SHIP) or Out-of-Pocket (OOP) to pay for clinic care and treatment of hypertension.

Socio-demographic and economic characteristics of respondents as an independent variable included; age at last birthday (in years), sex, highest educational qualification, marital status, employment status, and average monthly income.

Health history of respondents also as an independent variable included the duration of diagnosis of chronic illness, number of different medications being taken, comfortability with frequency of clinic appointments, treatment during refill visits, availability of drugs in pharmacy, and number of hypertensive pills recommended daily. Respondents were asked if there were adverse side effects of the drugs, if drugs were good enough for their BP control and if they use complementary and alternative medicine.

Factors associated with medication adherence and blood pressure control

Chi-square test was conducted to determine factors associated with medication adherence and blood pressure control. Factors significantly associated with medication adherence and blood pressure (at p < 0.05) and other factors known to be associated from literature were imputed into the logistic regression model and used to ascertain the predictors of medication adherence and blood pressure control. Also, variables significant up to 10% in bivariate analysis were also fitted into the logistic regression model.

Ethical considerations

Approval of the study was obtained from the Ethical Review Committee of the Institutional Review Board with approval number UI/EC/21/0048 before conducting the study. Informed consent was obtained from participants after the study's objectives and purpose were clearly explained. They were assured of the confidentiality of their responses and informed that participation was entirely voluntary, with the option to withdraw at any time without any consequences.

Data Analysis

Data was entered, cleaned, analyzed and presented using simple percentages, frequency tables, and charts with the use of Statistical Package for Social Sciences (SPSS 21 version). Chi square and fisher exact test were used to test for association between health insurance and medication adherence of respondents for categorical variables and Mann Whitney U (Wilcoxon Rank Sum) test was used for continuous variables. Multivariate analysis (Logistic regression) was used to determine the predictors of poor medication adherence of the respondents. Level of statistical significance for all tests was set at 5%.

Results

Findings of the study constitute information gathered from 350 respondents who participated in the study while receiving primary care in GOP clinic, UCH, Ibadan. Frequency tables, charts, means, standard deviations, medians as well as interquartile ranges were used to present the information while Chi-square and Fisher Exact tests were used to determine statistical significance at 5% level. Significant variables were further subjected to logistic regression to obtain odds ratio and co-factors among the significant variables.

Socio-demographic and Socio-economic Characteristics of Respondents

Table 1 shows the average age of the respondents was 56.37 ± 9.75 years. A higher percentage 134 (38.3%) of the respondents were older than 60 years of age. More than half 218 (62.3%) were female while 132 (37.7%) were male. Majority 214 (61.1%) had tertiary education while 61 (17.4%) and 42 (12.0%) had secondary and primary education respectively. Three hundred (300) respondents (85.7%) were married, A higher percentage 154 (44.0%) were self-employed while 104 (29.7%) were government workers. Less than half 80 (22.9%) were long-distance travelers. Three-quarters 265 (75.7%) received between N30,000 and N250,000 on average as monthly income, 48 (13.7%) get less than N30,000 while 37 (10.6%) recorded more than N250,000 on average per month.

Socio -demographic variables	Frequency	Percentage
Age		
31 - 40 years	20	5.7
41 - 50 years	73	20.9
51 - 60 years	123	35.1
> 60 years	134	38.3
Mean ±SD (years)	56.37 ± 9.75	
Gender		
Male	132	37.7
Female	218	62.3

Highest Educational Qualification

None	18	5.2
Primary	42	12.0
Secondary	61	17.4
Tertiary	214	61.1
Others	15	4.3

Marital Status

Single	2	0.6
Married	300	85.7
Separated	7	2.0
Divorced	6	1.7
Widowed	35	10.0

Employment Status

Self-Employed	154	44.0
Private Owned Organization Employee	10	2.9
Government Owned Organization	104	29.7
Retired	72	20.5
Unemployed	10	2.9

Average Monthly Income

< ₦30,000.00	48	13.7
₦30,000.00 - ₦250,000.00	265	75.7
> ₦250,000.00	37	10.6

Being a Long-distance traveler

Yes	80	22.9
No	270	77.1

Health History of Respondents

Majority of respondents 234 (66.9%) were diagnosed with hypertension less than 10 years ago. Respondents taking one medication were 108 (30.9%), more than half 198 (56.6%) were taking two medications, while 44 (12.6%) were taking three medications. Majority 306 (87.4%) reported that they were comfortable with the frequency of their clinic appointments for drug refill, 320 (91.4%) reported that they were comfortable with how they were treated during their refill visits, 329 (94.0%) reported that they were routinely able to afford their antihypertensive medications, 54 (15.4%) experienced adverse effects that discourages them from taking their antihypertensive, 331 (94.6%) were comfortable with the number of antihypertensive pills they were recommended to take every day while 337 (96.3%) reported that they thought their drugs were good enough to control their blood pressure. Forty-eight 48 respondents (13.7%) made use of Complementary and Alternative Medicine (CAM) to control their blood pressure.

Table 2: Health History of the Respondents

Variables (n = 350)	Frequency	Percentage
Duration of Diagnosis of Hypertension		
< 10 years	234	66.9
10 - 20 years	96	27.4
> 20 years	20	5.7
Number of medications being taken		
One Medication	108	30.9
Two Medications	198	56.6
Three or More Medications	44	12.6
Frequency of clinic appointments for drug refill		
Comfortable	306	87.4
Not comfortable	44	12.6
Treatment during refill visits		
Comfortable	320	91.4
Not comfortable	30	8.6

Adverse effects discouraging taking antihypertensive		
Present	54	15.4
Absent	296	84.6
Medications available at the hospital pharmacy		
Yes	268	76.6
No	82	23.4
Number of antihypertensive pills recommended every day		
Comfortable	331	94.6
Not comfortable	19	5.4
Perception of drug on control of blood pressure		
Yes	337	96.3
No	13	3.7
Use of complementary and alternative medicine		
Yes	48	13.7
No	302	86.3

Antihypertensive Medication Adherence among Respondents

The majority 329 (94.0%) of the respondents were adherent to their antihypertensive medication, while 21 (6.0%) were low/moderately adherent (Figure 1).
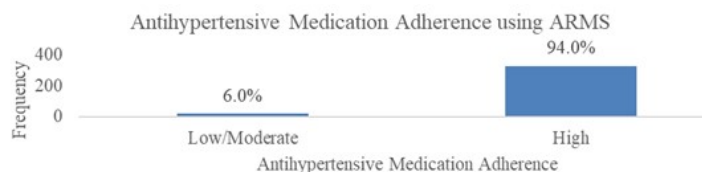

Figure 1: Antihypertensive Medication Adherence among Respondents

Figure 1 illustrates the levels of antihypertensive medication adherence among respondents, categorized by adherence scores based on the Adherence to Refills and Medications Scale (ARMS).

Blood Pressure Control among Respondents

The blood pressure control of the respondents depicted in figure 2 showed that a significant proportion 247 (70.6%) had their blood pressure controlled (< 140/90 mmHg). The mean Systolic BP (SBP) of all respondents was 132.98mmHg while the mean Diastolic BP (DBP) of all respondents was 109.03mmHg (Figure 2).
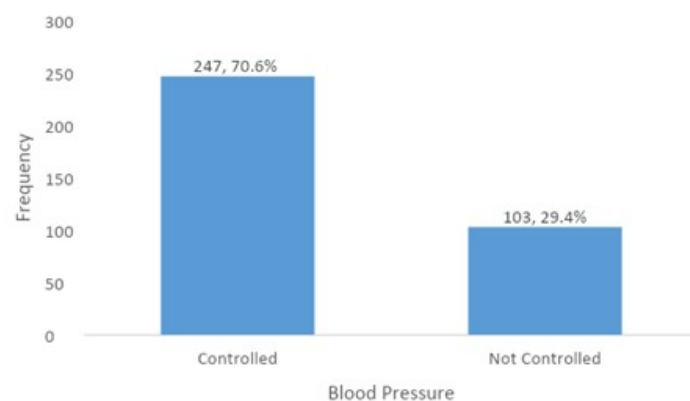

Figure 2: Blood Pressure Control among Respondents
Figure 2 illustrates the distribution of blood pressure control

Highest Educational Qualification

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Others	15	4.3

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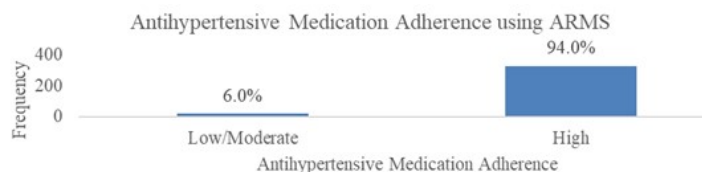

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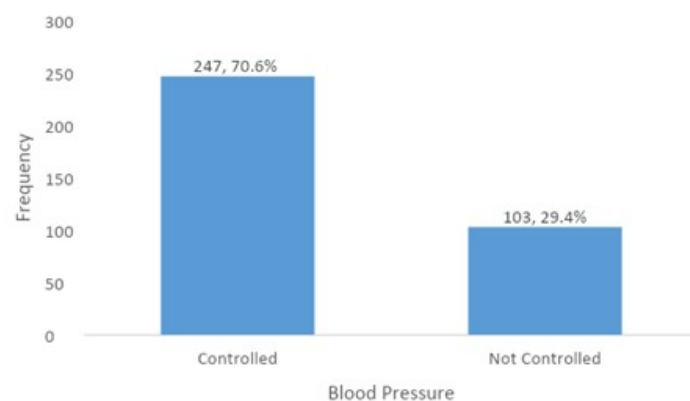

Figure 2: Blood Pressure Control among Respondents
Figure 2 illustrates the distribution of blood pressure control

status among respondents, showing the proportion of participants with controlled and uncontrolled blood pressure.

Mode of Health Care Financing among Respondents

Regarding the mode of healthcare financing, more than half 195 (55.7%) were on healthcare insurance scheme while some 155 (44.3%) utilized out-of-pocket payment to finance their health care (Figure 3).
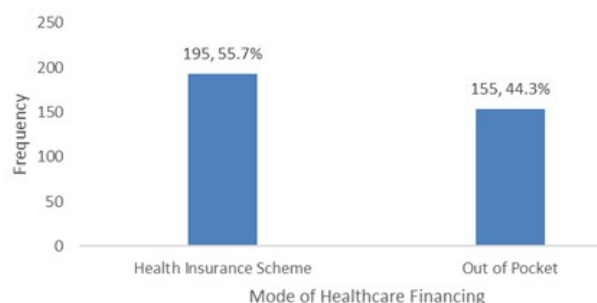

Figure 3: Respondents' Mode of Healthcare Financing

Figure 3 illustrates the distribution of respondents by their primary mode of healthcare financing, including out-of-pocket payments, and insurance coverage.

Factors Associated with Medication Adherence

Age was significantly associated with adherence (p <0.001), while gender, highest education qualification, marital status, and employment status were not statistically significant (Table 3a).

Table 3a Factors Associated with Antihypertensive Medication Adherence

Socio-Demographic and Economic Characteristics	Antihypertensive Medication Adherence				
	Low (%)	High (%)	χ^2	df	p-value
Age Group			22.937^f	6	<0.001*
31 - 40 years	4 (1.1)	16 (4.6)			
41 - 50 years	11(3.2)	62 (17.7)			
51 - 60 years	2 (0.6)	121 (34.6)			
>60 years	4 (1.1)	130 (37.1)			
Gender			3.859^f	2	0.104
Male	12 (3.4)	120 (34.3)			
Female	9 (2.6)	209 (59.7)			
Highest Educational Qualification			4.484^f	8	0.857
None	0 (0.0)	18 (5.1)			
Primary	2 (0.6)	40 (11.4)			
Secondary	5 (1.5)	56 (16.0)			
Tertiary	14 (4)	200 (57.1)			
Others	0 (0.0)	15 (4.3)			
Marital Status			11.256^f	8	0.391
Single	1 (0.3)	1 (0.3)			
Married	19 (5.4)	281 (80.3)			
Separated	0 (0.0)	7 (2.0)			
Divorced	0 (0.0)	6 (1.7)			
Widowed	1 (0.3)	34 (9.7)			
Work Status			7.633^f	8	0.490
Self-Employed	8 (2.3)	146 (41.7)			
Private owned organisation	1 (0.3)	9 (2.6)			
Government owned organization	9 (2.6)	95 (27.1)			
Retired	3 (0.8)	69 (19.7)			
Unemployed	0 (0.0)	10 (2.9)			
Average Monthly Income			5.423^f	4	0.196
< N30,000	2 (0.6)	46 (13.1)			
N30,000 - N250,000	15 (4.3)	250 (71.4)			
> N250,000	4 (1.2)	33 (9.4)			

Medication adherence was significantly associated with respondents' comfort with clinic appointment frequency (p = 0.028) and the number of daily antihypertensive pills (p = 0.024). Other factors, including duration of diagnosis, number of medications, comfort during refills, adverse effects, belief in drug efficacy, and use of Complementary and Alternative Medicine (CAM), showed no significant association (p = 0.253) (Table 3b).

Table 3b Factors Associated with Antihypertensive Medication Adherence

Health History Characteristics	Antihypertensive Medication Adherence				
	Low (%)	High (%)	χ^2	df	p-value
Duration of Diagnosis of Hypertension			2.936^f	4	0.489
< 10 years	14 (66.7)	220 (66.9)			
10 - 20 years	5 (23.8)	91 (27.7)			
> 20 years	2 (9.5)	18 (5.5)			
Number of medications being taken			1.274^f	4	0.947
One Medication	8 (42.1)	100 (30.4)			
Two Medications	11 (57.7)	187 (56.8)			
Three or More Medications	4 (0.2)	40 (12.8)			
Frequency of clinic visits for drug refill			8.689^f	2	0.009*
Comfortable	14 (66.7)	292 (88.8)			
Not comfortable	7 (33.3)	37 (11.2)			
Treatment during refill visits			4.074^f	2	0.174
Comfortable	17 (81.0)	303 (92.1)			
Not comfortable	4 (19.0)	26 (7.9)			
Adverse effects discouraging taking antihypertensive			0.259^f	2	1.000
Present	3 (14.3)	51 (15.5)			
Absent	18 (85.7)	278 (84.5)			
Number of antihypertensive pills recommended every day			7.654^f	2	0.024*
Comfortable	17 (81.0)	314 (95.4)			
Not comfortable	4 (85.7)	15 (4.6)			

Factors Associated with Blood Pressure Control

Age, and gender were significantly associated with blood pressure control (p < 0.05). Females had better control (75.2%) than males (62.9%) (p < 0.05). Other variables, including education, marital status, employment, and income, showed no significant association. (Table 4a).

Table 4a: Factors Associated with Blood Pressure Control among the respondents

Socio-Demographic	Blood Pressure		χ^2	p-value
	Control	Not Control		
Age Group			8.081	0.044*
31 - 40 years	16 (80.0)	4 (20.0)		
41 - 50 years	42 (57.5)	31 (42.5)		
51 - 60 years	89 (72.4)	34 (27.6)		
> 60 years	100 (74.6)	34 (25.4)		
Gender			6.039	0.014*
Male	83 (62.9)	49 (37.1)		
Female	164 (75.2)	54 (24.8)		
Highest Educational Qualification			8.918	0.063
None	13 (72.2)	5 (27.8)		
Primary	22 (52.4)	20 (47.6)		
Secondary	45 (73.8)	16 (26.2)		
Tertiary	158 (73.8)	56 (26.2)		
Others	9 (60.0)	6 (40.0)		

			6.699f	0.115
Marital Status				
Single	1 (50.0)	1 (50.0)		
Married	206 (68.7)	94 (31.3)		
Separated	7 (100.0)	0 (0.0)		
Divorced	4 (66.7)	2 (33.3)		
Widowed	29 (82.9)	6 (17.1)		
Employment Status			6.857f	0.138
Self-Employed	106 (68.8)	48 (31.2)		
Private owned organization	6 (60.0)	4 (40.0)		
Government owned organization	70 (67.3)	34 (32.7)		
Retired	59 (81.9)	13 (18.1)		
Unemployed	6 (60.0)	4 (40.0)		
Average Monthly Income			3.396	0.183
< N30,000	39 (81.3)	9 (18.8)		
N30,000 - N250,000	181 (68.3)	84 (31.7)		
> N250,000	27 (73.0)	10 (27.0)		

Availability of antihypertensive medications at the hospital pharmacy and not experiencing adverse effects that discouraged medication use was significantly linked to better BP control (p <0.05). Also, comfort with the number of daily pills and belief in the efficacy of medication (p <0.01) were significantly associated with better BP control. However, duration of hypertension diagnosis, number of medications taken, comfort with appointment frequency, treatment during refill visits, and use of complementary and alternative medicine showed no significant association (Table 4b).

Table 4b: Factors Associated with Blood Pressure Control among the respondents

Health History Characteristics	Blood Pressure		χ^2	p-value
	Control	Not Control		
Duration of diagnosis of hypertension			0.217	0.897
< 10 years	165 (70.5)	69 (29.5)		
10 - 20 years	67 (69.8)	29 (30.2)		
> 20 years	15 (75.0)	5 (25.0)		
Number of medications being taken			0.357	0.837
One	74 (68.5)	34 (31.5)		
Two	141 (71.2)	57 (28.8)		
Three	32 (72.7)	12 (27.3)		
Frequency of clinic visits for drug refill			0.000	0.985
Comfortable	216 (70.6)	90 (29.4)		
Not comfortable	31 (70.5)	13 (29.5)		
Treatment during refill visits			0.587	0.444
Comfortable	224 (70.0)	96 (30.0)		
Not comfortable	23 (76.7)	7 (23.3)		
Availability of medication at the hospital pharmacy			4.748	0.029*
Yes	197 (73.5)	71 (26.5)		
No	50 (61.0)	32 (39.0)		
Adverse effects discouraging taking antihypertensive			5.328	0.021*
Yes	31 (57.4)	23 (42.6)		
No	216 (73.0)	80 (27.0)		
Number of antihypertensive pills recommended every day			7.839	0.005*
Comfortable	239 (72.2)	92 (27.8)		
Not comfortable	8 (42.1)	11 (57.9)		
Perception of drug on control of blood pressure			f	0.003*
Yes	243 (72.1)	94 (27.9)		
No	4 (30.8)	9 (69.2)		

Use of Complementary and Alternative Medicine		
Yes	33 (68.8)	15 (31.3)
No	214 (70.9)	88 (29.1)

Predictors of Medication Adherence

In table 5a, Respondents aged 31–40 and 41–50 were significantly less likely to adhere to antihypertensive medication compared to those over 60 (OR= 0.162, CI= 0.035-0.749, p = 0.020; OR=0.221, 95%CI=0.065-0.748, p = 0.015, respectively). Those comfortable with the frequency of clinic appointments were 3.28 times more likely to adhere (OR=3.289, 95%CI=1.139-9.497, p = 0.028).

Table 5a: Predictors of Antihypertensive Medication Adherence

Variables	Odd Ratio (OR)	p-value	95% C.I. for OR	
			Lower	Higher
Age				
31 - 40 years	0.162	**0.020***	0.035	0.749
41 - 50 years	0.221	**0.015***	0.065	0.748
51 - 60 years	2.610	0.291	0.439	15.513
> 60 years **(Ref)**				
Comfortability with the frequency of clinic appointments for drug refill				
Yes	3.289	**0.028***	1.139	9.497
No (Ref)				

Predictors of Blood Pressure Control

Males were significantly more likely to have uncontrolled blood pressure than females (OR = 1.720, 95%CI= 1.071-2.764, p = 0.025). In contrast, age was not a significant predictor (Table 5b).

Table 5b: Predictors of Blood Pressure Control among the Participants

Variables	Blood pressure (Uncontrolled)			
	Odds Ratio (OR)	p-value	95% C.I. for OR	
			Lower	Higher
Gender				
Male	1.720	**0.025***	1.071	2.764
Female	1			
Availability of medication at the hospital pharmacy				
No	1.827	**0.027***	1.071	3.117
Yes (ref)				
Perception of drug on control of blood pressure				
No	4.873	**0.013***	1.405	16.893
Yes (ref)				

Participants without access to medication at the hospital pharmacy were 2 times more likely to have uncontrolled blood pressure (OR= 1.827, 95%CI= 1.071–3.117 p= 0.027). Similarly, those who did not believe in the effectiveness of their medications were 4.873 times more likely to have uncontrolled blood pressure (OR = 4.873, 95% CI= 1.405–16.893, p = 0.013).

Discussion

This study was a cross-sectional study to assess the medication adherence and level of blood pressure control among hypertensive patients in a tertiary hospital in southwest Nigeria, and the factors that could affect their adherence to medication including health financing mode.

One critical aspect of effective healthcare is ensuring that patients adhere to their prescribed medication regimens, particularly for chronic conditions such as hypertension.[23] Despite the importance of medication adherence, research indicates that adherence rates to chronic medications hover around 50%.[8] This trend persists even among patients with good insurance and prescription benefits, with around 50% to 60% of persons adhering to their prescribed medications for chronic conditions, including hypertension and diabetes.[24] Research conducted by Li et al.[25] highlights that only 53.4% of hypertensive patients in both rural and urban areas of China demonstrate satisfactory medication adherence. Similarly, a study in the United States found that about 51% of individuals receiving treatment for hypertension were compliant with their healthcare provider's recommendations regarding long-term medications.[26],[27]

In current study, assessment utilizing the Adherence to Refills and Medications Scale (ARMS) show an adherence rate of 94% demonstrating high adherence to their medication regimens. These findings align with other studies but show higher adherence rates compared to 61.2% in Ido-Ekiti, Nigeria, 61.8% and 63.4% in Ethiopia [28,29] and 61% in Kathmandu, Nepal [30]all measured using the Morisky Medication Adherence Scale (MMAS-4 or MMAS-8). The high adherence observed in this study may be explained by differences in assessment tools, as ARMS and MMAS measure adherence differently despite both being validated scales.[31]

In Nigeria, self-reported medication adherence among hypertensive individuals is particularly low, as evidenced by a study utilizing the 8-item Morisky Medication Adherence Scale, which revealed that 89.2% of respondents had moderate adherence, while only 1.0% reported high adherence.[32] However, at a specialized clinic, at least 75% of patients exhibited strong compliance with their antihypertensive treatment, potentially due to high-quality health education and communication.[33] Additionally, a study by Pallangyo et al. reported that three-quarters (75%) of their participants adhered well to antihypertensive prescriptions. Yet, among those who were adherent, only 2.7% correctly identified the target range for optimal blood.[34] Conversely, adherence rates in Saudi Arabia have been notably lower, with studies indicating adherence rates of 42% in Riyadh [35] and 47% in Taif.[36] It is important to note that these studies categorized participants strictly as adherent or non-adherent, and the research in Taif was limited to male patients with hypertension. The Morisky scale was also employed in these studies to assess adherence, similar to the current study, although it incorporated the ARMS for a multidimensional perspective on adherence. Despite the high adherence rates observed in the present study, these findings underscore the necessity of exploring the multifaceted factors that influence medication adherence and establishing clear treatment goals. Antihypertensive medication therapy remains crucial for optimal blood pressure control, significantly reducing the risks of stroke, myocardial infarction, and heart failure [37]. Globally, BP control rates remain suboptimal, with only about 25% of hypertensive patients achieving target levels.[38] In this study, 70.6% of respondents had well-controlled blood pressures irrespective of their mode of health care financing. These results surpass the 51.3% BP control rate reported by Li et al. in a 2016 population-based study in China, which included both rural and urban participants.[25] Several factors, including differences in healthcare access and study settings, may account for this variation.

Also, a nine-year cohort study in Japan among 518 hypertensive patients reported lower BP control rates than this study, with control declining as outpatient visits decreased [39]. Similarly, another long-term cohort study observed improved BP and weight reduction over a 10.5-year period, along with increased antihypertensive use, yet still reported slightly lower BP control rates than ours.[40] These differences may be attributed to the cross-sectional nature of the present study compared to the longitudinal design of others, as well as variations in study populations and healthcare systems.

In this study, slightly more than half of the respondents were enrolled in a health insurance scheme, contrasting with previous findings where the majority relied on out-of-pocket payments for healthcare expenses.[32] This difference may reflect the broader Nigerian context, where about 60% of total health spending is paid directly by households, and out-of-pocket payments constitute nearly 90% of all private health expenditures, placing a significant burden on families.[41] Such financial pressure often limits healthcare access, especially among underprivileged populations.[42] Nigeria's unequal resource distribution has an impact on health care finance as well, with out-of-pocket payments being the primary method used there.[41] The higher insurance coverage in our study may be due to a sample biased towards more educated individuals and a greater number of women, who generally exhibit better health-seeking behaviors. Research indicates that women tend to have lower uninsured rates compared to men, with U.S. data from 2014 showing 10.5% uninsured women versus 12.9% uninsured men.[43,44]

The most common form of health insurance among respondents was the Formal Sector Social Health Insurance Programme (FSSHIP), a component of the former National

Health Insurance Scheme (NHIS), now under the National Health Insurance Authority (NHIA). This program aimed at improving healthcare access and lowering out-of-pocket costs.[45,46] Additionally, many participants were enrolled under United Healthcare International HMO, likely due to its association with the University College Hospital (UCH), which served staff and students of the University College Hospital, Ibadan. For the College of Medicine, University of Ibadan (COMUI),
Ronsberger HMO managed COMUI staff; Princeton Health managed COMUI undergraduates; and Bastion Health managed COMUI postgraduate students. This explains the preponderance of respondents affiliated with United Healthcare International HMO in this study sample. This connection may explain the HMO's significant presence in our study. While comparable studies on this insurance structure are few to non-existent, a study in a Lagos State local government area reported that 74.4% of participants viewed NHIS as the best alternative for healthcare financing.[47]
Medication adherence is a complex behavior influenced by factors across the care continuum, including patient demographics, provider interactions, and systemic support.[48] Age was the only significant sociodemographic predictor of medication adherence in this study. This study found younger patients (ages 31–50 and 41-50) were significantly less likely to adhere to medication than those over 60, possibly due to lower perceived health risks and riskier lifestyle choices. In a study, medication adherence increased among patients 65 and older[49] suggesting that as people age, their awareness of mortality may generally leads to a greater focus on health, increasing medication adherence. Younger people, on the other hand, may not perceive hypertension as serious due to their physical vitality and are more likely to participate in risky behaviors that harm their health. Chronic diseases such as hypertension, diabetes, and glaucoma become increasingly common in older persons as their life expectancy increases.[50] The presence of many chronic conditions improves adherence in this group, especially when healthcare institutions offer individualized assistance for efficient disease management.[51] Contrasting findings from the U.S. suggest younger patients may adhere more due to poor health[50] hence failing health status may be the pointer to medication compliance.
Sociodemographic variables such as sex, income, and education were not significantly linked to adherence in this study. But some studies have shown inconsistent findings on the role of gender on medication adherence.[52] However, adherence was positively associated with health history factors comfort with clinic visits and number of daily antihypertensive pills to take. Although comfort with the clinic visits was the only significant predictor. These findings are similar to those in Tanzania. Those who visited recently had higher adherence rates than others [34]. Conversely, other

studies have found no such association,[53] though dissatisfaction with care may reduce both attendance and trust in prescriptions.[54]
Medication adherence is also influenced by complex regimens, limited provider access, drug costs, and unclear instructions.[48] Respondents in this study were generally comfortable with their pill burden, which may have supported higher adherence. Still, polypharmacy remains a key barrier[55], particularly for older adults, though some studies report regimen complexity as a non-significant factor.[56] Health professionals are encouraged to simplify regimens through fixed-dose combinations or synchronized dosing schedules.[57]
The mode of health financing was not significant with medication adherence. Previous studies show that cost-saving initiatives like discount cards and copayment programs improve medication adherence [58] and high costs and copayments have been observed to influence medication adherence in research.[48] Despite the observation in this study, out-of-pocket expenses remains a barrier to medication adherence.[59] U.S. patients with commercial insurance paid an average of $4.13 per antihypertensive prescription in 2014, and adherence varied by insurance type—Medicaid patients showed the lowest adherence.[59,60]
Findings show that age and gender are significantly associated with blood pressure (BP) control, with gender alone being a significant predictor. This finding aligns with another which suggests that age is not necessarily a major predictor of blood pressure regulation.[61] However, older age was associated with poorer control of blood pressure [62] in another study. This heterogeneity could be due to differences in study populations, age distribution, or the existence of comorbidities among cohorts.
Females demonstrated better control than males, aligning with other studies[63]. The higher prevalence of females in the study sample may partly explain their superior BP control; however, other factors could contribute. Females frequently exhibit better health-seeking behaviors and greater adherence to medication regimens.[63] In a Nigerian study, a greater proportion of females reported visiting healthcare providers (16.0% vs. 8.7%) for hypertension-related care.[64] Males were more likely to have uncontrolled blood pressure, which may be related to poorer health habits or decreased engagement in care among men, as described in numerous contexts.[65]
The relationship between the availability of antihypertensive drugs and blood pressure control highlights the importance of regular medication access in managing hypertension. Research indicates that populations with the availability of ≥4 antihypertensive drug classes have a better chance of controlling blood pressure.[66] The belief in medication efficacy was also a significant predictor. These finding aligns with the Health Belief Model, which suggests that patients' beliefs about their medications influence adherence and treatment

outcomes.[67] Prior research has shown that patients who trust in the effectiveness of their medication and are comfortable with their regimen are more likely to achieve blood pressure control.[68] Overall, both structural factors (such as medication availability) and individual attitudes (such as belief in efficacy) are critical for successful hypertension management. This study found no significant association between healthcare financing options and blood pressure control. However, a research of 441 hypertensive patients in Calabar, Nigeria, found that comprehensive insurance coverage can enhance blood pressure control, underlining the potential importance of financial protection in promoting improved health outcomes.[62]

Conclusion

The findings demonstrated a notable level of adherence, among hypertensive patients in south-west Nigeria, significantly higher than adherence levels reported in similar studies across different regions. Factors such as the choice of assessment tool and the level of education may have contributed to these findings. Despite the high adherence rate, blood pressure control was achieved in only 70.6% of participants, indicating room for improvement and the need for targeted interventions. The study also reveals that a significant proportion of patients are enrolled in health insurance schemes, contrasting with trends of out-of-pocket payments typically observed in Nigeria. These results emphasize the importance of addressing multifaceted factors influencing medication adherence and blood pressure management to optimize health outcomes for hypertensive patients. Future research should focus on longitudinal studies to explore these dynamics further within diverse populations.

Limitations
The study had several limitations. Firstly, the sample population consisted solely of hypertensive patients from the General Out-patient Clinic at University College Hospital, Ibadan, Nigeria, which may limit the generalizability of the findings to this specific population, despite being a public facility. Additionally, the study did not collect information about respondents' spouses or family members, which could provide insights into interpersonal or social factors influencing adherence.

The reliance on self-reported data in this cross-sectional study raises the potential for recall bias, potentially leading to under- or overestimation of adherence rates. However, this was mitigated by using a validated adherence scale and having two independent family medicine consultants evaluate the assessments for clarity. While causal relationships between risk factors and antihypertensive medication adherence cannot be definitively established, the study did provide an overview of adherence levels, blood pressure control, and

factors influencing adherence.

Variables not significant at the 5% level in chi-square analysis were not included in the logistic regression model, potentially overlooking other confounders that could affect the results.

References
1. Aremu TO, Oluwole OE, Adeyinka KO, Schommer JC. Medication Adherence and Compliance: Recipe for Improving Patient Outcomes. Pharm (Basel, Switzerland). 2022 Aug;10(5):106. doi:10.3390/pharmaceutics10050106

2. Morrison A, Stauffer ME, Kaufman AS. Defining medication adherence in individual patients. Patient Prefer Adherence. 2015;9:893–7. doi:10.2147/PPA.S85315

3. Ekinci F, Tuncel B, Merder Coşkun D, Akman M, Uzuner A. Effects on Blood Pressure Control and Compliance For Medical Treatment in Hypertensive Patients By Sending Daily SMS as a Reminder. Konuralp Med J. 2017;9(2):136–141. https://dergipark.org.tr/en/pub/ktd/article/288633

4. Lee EKP, Poon P, Yip BHK, Bo Y, Zhu MT, Yu CP, et al. Global Burden, Regional Differences, Trends, and Health Consequences of Medication Nonadherence for Hypertension During 2010 to 2020: A Meta-Analysis Involving 27 Million Patients. J Am Heart Assoc. 2022;11(17). doi:10.1161/JAHA.122.025371

5. Ge L, Heng BH, Yap CW. Understanding reasons and determinants of medication non-adherence in community-dwelling adults: a cross-sectional study comparing young and older age groups. BMC Health Serv Res [Internet]. 2023;23(1):905. Available from: https://doi.org/10.1186/s12913-023-09904-8. doi:10.1186/s12913-023-09904-8

6. Boima V, Ademola AD, Odusola AO, Agyekum F, Nwafor CE, Cole H, et al. Factors Associated with Medication Nonadherence among Hypertensives in Ghana and Nigeria. Int J Hypertens. 2015;2015:205716. doi:10.1155/2015/205716

7. Culig J, Leppée M. From Morisky to Hill-bone; self-reports scales for measuring adherence to medication. Coll Antropol. 2014;38(1):55–62. https://hrcak.srce.hr/file/178674

8. Kim J, Combs K, Downs J, III FT. Medication Adherence: The Elephant in the Room. US Pharm [Internet]. 2018;43(1):30–4. Available from:

https://www.uspharmacist.com/article/medication-adherence-the-elephant-in-the-room

9. Aikins M, Tabong PTN, Salari P, Tediosi F, Asenso-Boadi FM, Akweongo P. Positioning the National Health Insurance for financial sustainability and Universal Health Coverage in Ghana: A qualitative study among key stakeholders. PLoS One. 2021;16(6):e0253109. doi:10.1371/journal.pone.0253109

10. Adewole DA, Dairo MD, Bolarinwa OA. Awareness and coverage of the national health insurance scheme among formal sector workers in Ilorin, Nigeria. African J Biomed Res. 2016;19(1). https://africanjournalofbiomedicalresearch.com/index.php/AJBR/article/view/532/490

11. Uzobo E, Ayinmoro AD. Health effects of the National Health Insurance Scheme (NHIS): A study among federal civil servants in Bayelsa State, Nigeria. J Heal Soc Sci. 2019;4(2):265–76. DOI:10.19204/2019/hlth10

12. Kwesiga B, Zikusooka CM, Ataguba JE. Assessing catastrophic and impoverishing effects of health care payments in Uganda. BMC Health Serv Res. 2015;15(1). doi:10.1186/s12913-014-0673-z

13. Oyati A, Orogade A, Azuh P, Yakubu P, Shidali V. Impact of national health insurance scheme on blood pressure control in Zaria. Sahel Med J. 2016;19(2):69. DOI: 10.4103/1118-8561.186037

14. Nyaaba GN, Masana L, de-Graft Aikins A, Beune E, Agyemang C. Factors hindering hypertension control: perspectives of front-line health professionals in rural Ghana. Public Health. 2020 Apr;181:16–23. doi:10.1016/j.puhe.2019.11.020

15. Abubakar I, S.A.J O. An Estimate of Average Cost of Hypertension and its catastrophic effect on the people living with hypertension: Patients' perception from two Hospitals in Abuja, Nigeria. Int J Soc Sci Econ Rev. 2020;2(2):10–9. URL: https://doi.org/10.36923/ijsser.v2i2.62

16. Alali AA. Health Insurance Coverage and Treatment Seeking Behavior of People Working in Port Harcourt. 2020;2(2):56–64. https://www.academia.edu/63372383/health_insurance_coverage_and_treatment_seeking_behaviour_of_people_working_in_port_harcourt

17. Domoh PB. Evaluating the effects of capitation as an alternate payment method for the National Health Insurance Scheme as against diagnostic related groupings: case study of Ahafo-Ano South District of Ghana (Doctoral dissertation). 2016.

18. Brown MT BJ. Medication adherence: WHO cares? Mayo Clin Proc. 2011;86(4):304–14. DOI: 10.4065/mcp.2010.0575

19. Nguyen TMU, Caze A La, Cottrell N. What are validated self-report adherence scales really measuring?: A systematic review. Vol. 77, British Journal of Clinical Pharmacology. 2014. p. 427–45. DOI = 10.1111/bcp.12194

20. HBNU-Fogarty Global Health Training Program. University of Ibadan, University College Hospital, Nigeria- HBNU [Internet]. 2023 [cited 2023 Nov 5]. Available from: https://sites.sph.harvard.edu/global-health-research-partnership/sites-2/university-of-jos-jos-university-teaching-hospital-nigeria/

21. Nanjundeswaraswamy T. ., Divakara S. Determination of Sample Size and Sampling Methods in Applied Research. Proc Eng Sci. 2021;3:25–32. DOI: 10.24874/PES03.01.003

22. Ajayi DT, Adedokun BO, Owoeye DO, Akpa OM. Treatment Satisfaction and Medication Adherence Among Hypertensive Patients Seeking Care in Selected Hospitals in Ibadan, Nigeria. Arch basic Appl Med [Internet]. 2018;6(1):67–72. Available from: http://www.ncbi.nlm.nih.gov/pubmed/29930986%0A http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC6007840

23. Lomper K, Chabowski M, Chudiak A, Białoszewski A, Dudek K, Jankowska-Polańska B. Psychometric evaluation of the Polish version of the Adherence to Refills and Medications Scale (ARMS) in adults with hypertension. Patient Prefer Adherence. 2018;12:2661–70. DOI: 10.2147/PPA.S185305

24. Ihab R. Definition of hypertension and pressure goals during treatment (ESC-ESH Guidelines 2018). E-Journal Cardiol Pract. 2019;17. URL: https://www.escardio.org/Journals/E-Journal-of-Cardiology-Practice/Volume-17/definition-of-hypertension-and-pressure-goals-during-treatment-esc-esh-guidelin

25. Li W, Gu H, Teo KK, Bo J, Wang Y, Yang J, et al. Hypertension prevalence, awareness, treatment, and control in 115 rural and urban communities involving 47 000 people from China. J Hypertens. 2016 Jan;34(1):39–46. DOI: 10.1097/HJH.0000000000000745

26. Kleinsinger F. The Unmet Challenge of Medication Nonadherence. Perm J. 2018;22:1–3. DOI: 10.7812/TPP/18-033

27. Hamrahian SM, Maarouf OH, Fülöp T. A Critical Review of Medication Adherence in Hypertension: Barriers and Facilitators Clinicians Should Consider. Patient Prefer Adherence. 2022;16(October):2749–57. DOI**:** 10.2147/PPA.S368784

28. Millions' heart. Improving Medication Adherence

among patients with Hypertension [Internet]. Available from: https://millionhearts.hhs.gov/data-reports/factsheets/adherence.html

29. Ayodapo AO, Elegbede OT, Omosanya OE, Monsudi KF. Patient Education and Medication Adherence among Hypertensives in a Tertiary Hospital, South Western Nigeria. Ethiop J Health Sci. 2020;30(2):243–50. DOI: 10.4314/ejhs.v30i2.12

30. Asgedom SW, Atey TM, Desse TA. Antihypertensive medication adherence and associated factors among adult hypertensive patients at Jimma University Specialized Hospital, southwest Ethiopia. BMC Res Notes. 2018 Jan;11(1):27. DOI: 10.1186/s13104-018-3139-6

31. Rashid A, Ejara D, Deybasso HA. Adherence to antihypertensive medications and associated factors in patients with hypertension, Oromia, Ethiopia: a multicenter study. Sci Rep [Internet]. 2024;14(1):30712. Available from: https://doi.org/10.1038/s41598-024-80086-x

32. Sharma S, Sharma CR, Sharma S, Aryal S, Bhandari B. Adherence to antihypertensive medication and its associated factors among patients with hypertension attending a tertiary hospital in Kathmandu, Nepal. PLoS One [Internet]. 2024;19(7):1–13. Available from: https://doi.org/10.1371/journal.pone.0305941

33. Kripalani S, Risser J, Gatti ME, Jacobson TA. Development and evaluation of the Adherence to Refills and Medications Scale (ARMS) among low-literacy patients with chronic disease. Value Heal J Int Soc Pharmacoeconomics Outcomes Res. 2009;12(1):118–23. DOI: 10.1111/j.1524-4733.2008.00400.x

34. Pallangyo P, Komba M, Mkojera Z, Kisenge P, Bhalia S, Mayala H, et al. Medication Adherence and Blood Pressure Control Among Hypertensive Outpatients Attending a Tertiary Cardiovascular Hospital in Tanzania: A Cross-Sectional Study. Integr Blood Press Control [Internet]. 2022 Aug 1 [cited 2023 Dec 1];Volume 15:97–112. doaj.org/article/f5999bc493d143e290c9b23f0eca7606

35. Akintunde AA, Akintunde TS. Antihypertensive Medications Adherence Among Nigerian Hypertensive Subjects in a Specialist Clinic Compared to a General Outpatient Clinic. Ann Med Health Sci Res. 2015;5(3):173–8. ncbi.nlm.nih.gov/pmc/articles/PMC4455006/

36. Oluwole Esther O, Osibogun Olatokunbo, Adegok Oluseyi, Adejimi Adebola A, Adewole Ajoke M OA. Medication Adherence and Patient Satisfaction among Hypertensive Patients Attending Outpatient Clinic in Lagos University Teaching Hospital, Nigeria Esther. 2019;26(2):129–37. DOI: 10.4103/npmj.npmj_48_19

37. Algabbani FM, Algabbani AM. Treatment adherence among patients with hypertension: findings from a cross-sectional study. Clin Hypertens [Internet]. 2020;26(1):18. Available from: https://doi.org/10.1186/s40885-020-00151-1

38. Elbur AI. Level of adherence to lifestyle changes and medications among male hypertensive patients in two hospitals in taif; kingdom of Saudi Arabia. Int J Pharm Pharm Sci. 2015;7(4):168–72. https://journals.innovareacademics.in/index.php/ijpps/article/view/4804/8591

39. Whelton PK. The elusiveness of population-wide high blood pressure control. Annu Rev Public Health. 2015 Mar;36:109–30. DOI: 10.1146/annurev-publhealth-031914-122949

40. Xu T ying, Wang P, Tian J sheng, Qing S li, Wang S na, Huang Y hui, et al. Pharmacological characterization of MT-1207, a novel multitarget antihypertensive agent. Acta Pharmacol Sin [Internet]. 2021;42(6):885–97. Available from: https://doi.org/10.1038/s41401-021-00636-1

41. Shima A, Tatsumi Y, Ishizaki T, Godai K, Kawatsu Y, Okamura T, et al. Relationship between outpatient visit frequency and hypertension control: a 9-year occupational cohort study. Hypertens Res [Internet]. 2016;39(5):376–81. Available from: https://doi.org/10.1038/hr.2015.157

42. Ohta Y, Tsuchihashi T, Kiyohara K, Oniki H. Trend of blood pressure control status in hypertensive outpatients: with special reference to elderly hypertensives. Clin Exp Hypertens. 2012;34(4):258–63. doi:10.3109/10641963.2012.681224

43. Onwujekwe O, Ezumah N, Mbachu C, Obi F, Ichoku H, Uzochukwu B, et al. Exploring effectiveness of different health financing mechanisms in Nigeria; what needs to change and how can it happen? BMC Health Serv Res [Internet]. 2019 Dec 1 [cited 2023 Nov 19];19(1):1–13. Available from: https://bmchealthservres.biomedcentral.com/articles/10.1186/s12913-019-4512-4

44. Onah MN, Govender V. Out-of-Pocket Payments, Health Care Access and Utilisation in South-Eastern Nigeria: A Gender Perspective. PLoS One [Internet]. 2014 Apr 11 [cited 2023 Nov 19];9(4):93887. Available from: /pmc/articles/PMC3984110/

45. Women's Health Insurance Coverage | KFF [Internet]. [cited 2023 Nov 19]. Available from: https://www.kff.org/womens-health-policy/fact-sheet/womens-health-insurance-coverage/

46. Cheeseman J, Day Brett O, Hara DT. Another Difference Between the Sexes - Health Insurance Coverage [Internet]. United States Census Bureau. 2015. Available from:

census.gov/newsroom/blogs/random-samplings/2015/09/another-difference-between-the-sexes-health-insurance-coverage-3.html

47. Sarkodie AO. Effect of the National Health Insurance Scheme on Healthcare Utilization and Out-of-Pocket Payment: Evidence from GLSS 7. Humanit Soc Sci Commun [Internet]. 2021;8(1):293. Available from: https://doi.org/10.1057/s41599-021-00984-7

48. Akinyemi OO, Owopetu OF, Agbejule IO. National Health Insurance Scheme: Perception and Participation Of Federal Civil Servants in Ibadan. Ann Ibadan Postgrad Med. 2021 Jun;19(1):49–55. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8935672/

49. Christina CP, Latifat TT, Collins NF, Olatunbosun AT. National health insurance scheme: How receptive are the private healthcare practitioners in a local government area of Lagos state. Niger Med J. 2014 Nov;55(6):512–6. DOI: 10.4103/0300-1652.144712

50. Neiman AB, Ruppar T, Ho M, Garber L, Weidle PJ, Hong Y, et al. CDC Grand Rounds: Improving Medication Adherence for Chronic Disease Management - Innovations and Opportunities. MMWR Morb Mortal Wkly Rep. 2017 Nov;66(45):1248–51. doi:10.15585/mmwr.mm6645a2

51. Cross AJ, Elliott RA, Petrie K, Kuruvilla L, George J. Interventions for improving medication-taking ability and adherence in older adults prescribed multiple medications. Cochrane database Syst Rev. 2020 May;5(5):CD012419. doi:10.1002/14651858.CD012419.pub2

52. Hales CM, Kit BK, Gu Q, Ogden CL. Trends in Prescription Medication Use Among Children and Adolescents-United States, 1999-2014. JAMA. 2018 May;319(19):2009–20. URL: https://jamanetwork.com/journals/jama/fullarticle/2681195

53. Marcum ZA, Hanlon JT, Murray MD. Improving Medication Adherence and Health Outcomes in Older Adults: An Evidence-Based Review of Randomized Controlled Trials. Drugs Aging. 2017 Mar;34(3):191–201. URL: https://jamanetwork.com/journals/jama/fullarticle/2681195

54. Venditti V, Bleve E, Morano S, Filardi T. Gender-Related Factors in Medication Adherence for Metabolic and Cardiovascular Health. Metabolites. 2023 Oct;13(10). https://pmc.ncbi.nlm.nih.gov/articles/PMC10609002/

55. Whittle J, Yamal JM, Williamson JD, Ford CE, Probstfield JL, Beard BL, et al. Clinical and demographic correlates of medication and visit adherence in a large randomized controlled trial. BMC Health Serv Res [Internet]. 2016;16(1):1–11. Available from: http://dx.doi.org/10.1186/s12913-016-1471-x

56. Waari G, Mutai J, Gikunju J. Medication adherence and factors associated with poor adherence among type 2 diabetes mellitus patients on follow-up at Kenyatta National Hospital, Kenya. Pan Afr Med J. 2018;29:82. doi:10.11604/pamj.2018.29.82.12639

57. Saljoughian M. Polypharmacy and Drug Adherence in Elderly Patients. US Pharm. 2019;44(7):33–6. URL: https://www.uspharmacist.com/article/polypharmacy-and-drug-adherence-in-elderly-patients

58. Wakai E, Ikemura K, Kato C, Okuda M. Effect of number of medications and complexity of regimens on medication adherence and blood pressure management in hospitalized patients with hypertension. PLoS One [Internet]. 2021;16(6):1–10. Available from: https://doi.org/10.1371/journal.pone.0252944

59. Rankin A, Cadogan CA, Patterson SM, Kerse N, Cardwell CR, Bradley MC, et al. Interventions to improve the appropriate use of polypharmacy for older people. Cochrane database Syst Rev. 2018 Sep;9(9):CD008165. doi 10.1002/14651858.CD008165.pub4

60. Hung A, Blalock D V, Miller J, McDermott J, Wessler H, Oakes MM, et al. Impact of financial medication assistance on medication adherence: a systematic review. J Manag care Spec Pharm. 2021 Jul;27(7):924–35. doi 10.18553/jmcp.2021.27.7.924

61. Baker-Goering MM, Roy K, Howard DH. Medication Regimen and Out-of-Pocket Costs Among People Aged 35 to 64 With Employer-Sponsored Health Insurance. 2019;16. Available from: http://dx.doi.org/10.5888/pcd16.180381

62. Chang TE, Ritchey MD, Park S, Chang A, Odom EC, Durthaler J, et al. National rates of nonadherence to antihypertensive medications among insured adults with hypertension, 2015. Hypertension. 2019;74(6):1324–32. DOI: 10.1161/HYPERTENSIONAHA.119.13419

63. Gu Q, Burt VL, Dillon CF, Yoon S. Trends in antihypertensive medication use and blood pressure control among United States adults with hypertension: the National Health And Nutrition Examination Survey, 2001 to 2010. Circulation. 2012 Oct;126(17):2105–14. DOI: 10.1161/CIRCULATIONAHA.112.096156

64. Ukpeh IE, Akpan MI, Ugbe UMJ, Enyievi PB, Osuchukwu NC, Bassey EE, et al. Predictors of blood

pressure control among patients with hypertension: a cross-sectional study in a Nigerian tertiary health facility. BMJ Open. 2025 Mar;15(3):e091010. DOI: 10.1136/bmjopen-2024-091010

65. Franklin SS, Wong ND. Hypertension and cardiovascular disease: contributions of the framingham heart study. Glob Heart. 2013 Mar;8(1):49–57. DOI: 10.1016/j.gheart.2012.12.004

66. Jalo RI, Bamgboye EA, Salawu MM, Akinyemi JO, Uja U, Ogah OS, et al. Gender disparities in hypertension prevalence, awareness and healthcare seeking behaviour among young adults in Nigeria. BMC Cardiovasc Disord. 2025 Mar;25(1):151. DOI: 10.1186/s12872-025-04603-0

67. Cherfan M, Vallée A, Kab S, Salameh P, Goldberg M, Zins M, et al. Unhealthy behaviors and risk of uncontrolled hypertension among treated individuals-The CONSTANCES population-based study. Sci Rep. 2020;10(1):1–12. DOI: 10.1038/s41598-020-58685-1

68. Attaei MW, Khatib R, McKee M, Lear S, Dagenais G, Igumbor EU, et al. Availability and affordability of blood pressure-lowering medicines and the effect on blood pressure control in high-income, middle-income, and low-income countries: an analysis of the PURE study data. Lancet Public Heal. 2017 Sep;2(9):e411–9. DOI: 10.1016/S2468-2667(17)30141-X

69. Widiyanto, A. (2023). Application of the Health Belief Model to antihypertensive medication adherence: A meta-analysis. *Indonesian Journal of Global Health Research, 5*(4), 887–902. https://doi.org/10.37287/ijghr.v5i4.2544.

70. Bosworth HB, Granger BB, Mendys P, Brindis R, Burkholder R, Czajkowski SM, et al. Medication adherence: a call for action. Am Heart J. 2011 Sep;162(3):412–24. DOI: 10.1016/j.ahj.2011.06.007