**THE NIGERIAN JOURNAL OF SOCIOLOGY AND ANTHROPOLOGY**

ISSN: 0331-4111
E-ISSN: 2736-075X
Volume 24, No. 2 (November, 2026)
**DOI: 10.36108/NJSA/6202.42.0210**

# Antihypertensive Medication Adherence among Patients in Tertiary Healthcare Facilities in Abuja, Nigeria: A Cross-sectional Study

**Chris Chukwunyere Njoku[1], Judith Ifunanya Ani[2], Prosper-Njoku Udochi[3], Usa Stephen[4], Munir Muhammad Iya[5], Franklin Dike[6], George-Oloja Nkechinyere[7], Chigozie Njemanze[8], Olusola Obajimi[9], Olufunmilayo Oduniyi[10], Chioma Deborah Uzodimma[11]**

[1,8,9] Inspire World International Foundation, Abuja, Nigeria
[*2] School of Public Health, Faculty of Medicine and Health Sciences, Walter Sisulu University, South Africa
[3]Achieving Health Nigeria Initiative (AHNi), Anambra State, Nigeria
[4,7]Ahmadu Bello University, Zaria
[5]Aminu Kano Teaching Hospital, Kano State, Nigeria
[6]Excellent Community Education Welfare Scheme, Asaba, Nigeria
[10]Overflow Advisory, United Kingdom
[11]Goodhope Women Flourish Initiative, Owerri, Imo State, Nigeria

**Abstract**

**Objectives:** Hypertension is a leading cause of cardiovascular morbidity and mortality worldwide, and long-term adherence to antihypertensive therapy is a key determinant of blood pressure control. Yet, the combination of factors associated with this behaviour in tertiary care settings is poorly characterised. This study examined the prevalence and correlates of antihypertensive medication adherence among patients attending three tertiary healthcare facilities in Abuja, Nigeria. A cross-sectional survey was conducted between 7 January and 15 May 2026 among adult hypertensive patients recruited by convenience sampling at three tertiary healthcare facilities in Abuja. A structured, self-administered questionnaire comprising an 8-item adherence scale adapted from the Morisky Medication Adherence Scale (MMAS-8), and study-specific perceived-barrier and patient-education scales was completed by 166 participants. Data were analysed using chi-square tests, Welch's t-tests, and hierarchical binary logistic regression. Non-adherence (adherence score <6) was found in 68.1% of participants (95% CI: 61.0–75.2%). At bivariate analysis, adherence was associated with educational attainment, income, health insurance status, marital status, and distance to the facility (all $p<0.05$), but not with age, gender, duration of hypertension, or comorbidities. Non-adherent patients reported higher mean perceived-barrier scores (3.44 vs 1.63, $p<0.001$) and lower mean patient-education scores (3.58 vs 4.47, $p<0.001$) than adherent patients. Among

socio-demographic and economic factors, tertiary education (AOR=3.59, 95% CI: 1.24–10.42), upper-bracket income (AOR=2.57, 95% CI: 1.08–6.13), and living within 10 km of the facility (AOR=2.98, 95% CI: 1.34–6.64) were independently associated with adherence. The patient-education score was associated with adherence after adjustment for these factors (AOR=2.91, 95% CI: 1.62–5.21). When the perceived-barrier score was added, it was the only factor that remained independently associated with adherence (AOR=0.12, 95% CI: 0.05–0.26). Non-adherence was highly prevalent among hypertensive patients attending the study facilities. Lower educational attainment, lower income, greater distance from the facility, and less favourable experiences of patient education were associated with non-adherence, and perceived barriers were the strongest correlate. Because of the cross-sectional design and convenience sample, these associations do not establish causality; interventions that address patients' perceived barriers, strengthen patient education, and reduce cost and access barriers warrant evaluation in tertiary care settings.

**Keywords*:*** Hypertension; medication adherence; tertiary care; perceived barriers; patient education

## Introduction

Hypertension remains one of the most pressing global public health challenges, affecting an estimated 1.28 billion adults aged 30–79 years and ranking among the leading preventable causes of premature death and disability worldwide (World Health Organization [WHO], 2023). Its burden falls disproportionately on low- and middle-income countries, where blood pressure control rates are often poor and uncontrolled disease drives much of the regional risk for stroke, myocardial infarction, heart failure, and chronic kidney disease (Mills et al., 2016). Sustained adherence to prescribed antihypertensive medication is the cornerstone of effective management and has been shown to substantially lower the risk of these complications (Lewington et al., 2002; Choudhry et al., 2022). Yet global estimates place non-adherence to antihypertensive therapy at 27–40% (Lee et al., 2022; Nielsen et al., 2017), making inconsistent medication use one of the most important -and modifiable -contributors to poor blood pressure control, treatment failure, and rising healthcare costs (Kim et al., 2025; Peng et al., 2025).

Adherence itself is not a single behaviour but a complex outcome shaped by the interplay of patient-related, therapy-related, condition-related, socio-economic, and health-system factors (WHO, 2023). Sociodemographic characteristics such as age, gender, marital status, education, and place of residence show variable associations with adherence: older patients often adhere better than younger adults, although the very elderly may be disadvantaged by polypharmacy and cognitive decline (Krousel-Wood et al., 2017; Choi et al., 2018; Tola Gemeda et al., 2020; Uchmanowicz et al., 2019), while lower educational attainment and rural residence are more consistently linked with poorer adherence (Karakurt et al., 2025; Kokenge et al., 2024; Konlan et al.,

2023). Socio-economic circumstances -income, health insurance coverage, employment status, social support, and health literacy -further shape adherence, largely by determining a patient's capacity to sustain the direct and indirect costs of long-term treatment (Noreen et al., 2023; Sokol et al., 2005; Lee et al., 2024).

Beyond these structural determinants, more immediate, patient-perceived barriers shape day-to-day medication-taking behaviour. Forgetfulness, complex dosing regimens, unfavourable health beliefs, medication costs, and unpleasant side effects are among the most frequently reported barriers to antihypertensive use (Al-Noumani et al., 2019; Noreen et al., 2023; Zhou et al., 2024). Patient education and counselling can offset these barriers: when patient-centred, delivered in plain language, and reinforced through follow-up contact, they have been shown to improve knowledge, health literacy, and ultimately adherence (Morrissey et al., 2017; Ayodapo et al., 2020; Paczkowska et al., 2021; Rhamttallah et al., 2025).

Patients at tertiary healthcare facilities may present with more severe or complex hypertension, sometimes complicated by comorbidities and multi-drug regimens that could amplify both structural and perceptual barriers to adherence (Shah et al., 2018). Yet how sociodemographic, economic, perceptual, and educational factors combine in relation to adherence within this setting remains insufficiently characterised in many local contexts, including Nigeria. This study therefore investigated factors associated with adherence to antihypertensive medication among patients receiving treatment at tertiary healthcare facilities, with three objectives: (1) to identify the sociodemographic and socio-economic factors associated with adherence; (2) to assess the association between perceived barriers to consistent medication use and adherence; and (3) to examine the association between patients' perceptions of the education and counselling they received and adherence. The findings are intended to inform healthcare providers, administrators, and policymakers in strengthening patient education and counselling, implementing barrier-focused counselling, and addressing the financial determinants of non-adherence in tertiary care.

This study is guided by the World Health Organization's multidimensional model of medication adherence, which conceptualises non-adherence as the product of five interacting domains: patient-related, condition-related, therapy-related, socio-economic, and health-system factors (WHO, 2003). This framework informed the study's focus on socio-economic and sociodemographic characteristics (the socio-economic domain), perceived barriers to consistent use (the patient-related domain), and the quality of patient education and counselling (the health-system domain).

## Methods

### Study Design and Setting

This study used a quantitative, cross-sectional survey design, allowing simultaneous collection of data on the independent variables (sociodemographic and socio-economic factors, perceived barriers, and patient education) and the dependent variable (medication adherence) at a single point in time. This design

is well-suited to estimating the prevalence of non-adherence and exploring its correlates (Creswell, 2014). The study was conducted at three tertiary healthcare facilities in Abuja, Nigeria (the National Hospital Abuja, Federal Medical Centre Jabi, and University of Abuja Teaching Hospital Gwagwalada), hereafter referred to as the study facilities. The facilities were selected purposively because they provide cardiology and internal medicine outpatient services and manage a high volume of patients with hypertension. Data were collected between 7 January and 15 May 2026.

**Study Population**

The target population comprised adult patients with essential hypertension attending cardiology and internal medicine outpatient follow-up clinics at the study facilities during the data-collection period.

**Eligibility Criteria**

Inclusion criteria were: (i) age ≥18 years; (ii) a diagnosis of essential hypertension for at least six months, verified from the clinic record; (iii) current prescription of at least one antihypertensive medication, with at least one month on the current regimen; and (iv) ability to provide informed consent and to complete the self-administered questionnaire independently or with minimal, non-leading assistance. Exclusion criteria were: (i) secondary hypertension; (ii) severe cognitive impairment or a psychiatric condition precluding accurate self-report; and (iii) acute illness or hospitalisation at the time of data collection.

**Sample Size and Sampling**

Sample size was estimated using the single-proportion formula, $n = Z^2P(1-P)/d^2$, assuming a 95% confidence level ($Z = 1.96$), an anticipated prevalence of non-adherence of 50% (to maximise the sample size in the absence of a reliable local estimate), and a margin of error of 7%, yielding a minimum of 196 respondents (Hulley et al., 2013). Participants were recruited by convenience sampling: on clinic days, members of the research team approached available patients in the outpatient waiting area, screened them against the eligibility criteria, and invited eligible patients to participate. Convenience sampling was adopted for feasibility within a time-constrained, single-round data collection exercise (Etikan et al., 2016). Because participants were not randomly selected, patients who attended on recruitment days and agreed to participate may differ systematically from the wider clinic population (for example, in illness severity, frequency of clinic attendance, or engagement with care). The resulting selection bias limits the generalisability of the prevalence estimate beyond the study facilities.

A total of 171 responses were received. Five respondents declined consent and provided no further data, leaving 166 participants, all of whom answered every questionnaire item; there were therefore no missing data and no exclusions for incompleteness. In four instances, one respondent selected two options for a single-choice item (comorbidity, two adherence items, and one patient-education item). These were coded conservatively: as 'no' for comorbidity, as the

non-adherent response for the adherence items, and as missing for the patient-education item, whose score was then computed from that respondent's remaining nine items. Recruitment ended at the close of the data-collection period, before the target of 196 was reached. With 166 participants, the achieved precision for the observed non-adherence prevalence of 68.1% was ±7.1 percentage points (95% CI: 61.0–75.2%), close to the planned ±7%. However, the smaller sample, and in particular the small number of adherent participants (n = 53), limited statistical power and the number of predictors that could reliably be included in the regression models (see Strengths and Limitations).

**Data Collection**

Data were collected using a structured, self-administered, 40-item questionnaire administered in English. The instrument comprised four sections: (A) sociodemographic and socio-economic characteristics (10 items); (B) medication adherence, measured with an 8-item scale adapted from the Morisky Medication Adherence Scale (MMAS-8) (8 items); (C) perceived barriers to consistent medication use, rated on a 5-point Likert scale from strongly disagree (1) to strongly agree (5) (12 items); and (D) patient education and counselling experience, rated on the same scale (10 items). Sections C and D were developed by the study team from the literature (Al-Noumani et al., 2019; Morrissey et al., 2017; Zhou et al., 2024). Internal consistency in the present sample was high: Cronbach's α was 0.96 for the perceived-barrier scale and 0.94 for the patient-education scale, and the Kuder–Richardson-20 coefficient was 0.83 for the adherence scale.

The adherence scale was modelled on the MMAS-8 but differs from the validated instrument in the wording or response format of three items (the number of missed doses in the past two weeks, recorded in four categories; difficulty remembering to take medication, recorded on a five-point frequency scale; and taking medication as prescribed). It should therefore be regarded as an adapted, MMAS-8-based measure rather than the validated MMAS-8.

**Study Variables**

The dependent variable was medication adherence. Each adherence item was scored 1 for the adherent response and 0 otherwise (for the missed-doses item, 1 = 'never'; for the difficulty-remembering item, 1 = 'never' or 'rarely'), giving a total score of 0 to 8, with higher scores indicating better adherence. Following the cut-off used for the MMAS-8, in which scores below 6 denote low adherence (Morisky et al., 2008), participants scoring ≥6 were classified as adherent and those scoring <6 as non-adherent. This dichotomisation is widely used in studies of antihypertensive adherence (Uchmanowicz et al., 2019) and permits binary logistic regression; because the scale was adapted, however, the cut-off has not been validated for this version.

Independent variables were defined as follows. Age was recorded in five categories (18–29, 30–39, 40–49, 50–59, and ≥60 years); educational attainment (highest level completed) in five categories, from no formal education to

postgraduate; employment status in six categories (full-time, part-time, self-employed, retired, student, and unemployed); and marital status in four categories (married/cohabiting, single, divorced/separated, and widowed). Average monthly household income was recorded in two self-reported brackets (lower and upper); the questionnaire did not specify naira values for the brackets. Health insurance status was defined by whether insurance covered the participant's medication costs: not at all, partially, or fully. Duration of hypertension was recorded in four categories (<1, 1–5, 6–10, and >10 years); comorbidity as any self-reported additional chronic condition (e.g., diabetes or kidney disease); and distance from home to the facility in four categories (<5, 5–10, 11–20, and >20 km). The perceived-barrier score was the mean of the 12 items in Section C (range 1–5; higher scores indicate greater perceived barriers), and the patient-education score was the mean of the 10 items in Section D (range 1–5; higher scores indicate more positive perceptions of the education and counselling received). The patient-education score reflects patients' reported experience of education and counselling; it is not a measure of health literacy, which was not assessed in this study.

**Analysis**

Data were cleaned and coded, and all analyses were performed in Python 3.13 using SciPy 1.18 and statsmodels 0.15. Descriptive statistics (frequencies, percentages with 95% confidence intervals, means, and standard deviations) summarised participant characteristics and the prevalence of adherence. Associations between categorical variables and adherence status were assessed using Pearson's chi-square test, reported with degrees of freedom and exact p-values; where any expected cell count was <5, a Monte Carlo exact p-value based on 20,000 permutations was used. Mean perceived-barrier and patient-education scores were compared between adherent and non-adherent participants using Welch's t-test, because variances were unequal for the perceived-barrier score (Levene's test $p = 0.011$), and are reported as means, standard deviations, mean differences with 95% confidence intervals, and Cohen's d. Item-level barrier ratings were compared using the Mann–Whitney U test. Variables with $p < 0.25$ at the bivariate level were entered into the multivariable analysis: educational attainment, employment status, income, marital status, health insurance status, comorbidities, distance to the facility, and both scores. Age ($p = 0.43$), gender ($p = 0.99$), and duration of hypertension ($p = 0.62$) did not meet this criterion and were not entered. To avoid sparse cells and separation (no participant with primary or no formal education was adherent), and to limit the number of parameters relative to the 53 outcome events, multi-category variables were collapsed into conceptually meaningful binary categories: educational attainment (tertiary vs secondary or less), employment (in paid employment, including self-employment, vs not), marital status (married/cohabiting vs not), and distance (≤10 km vs >10 km). Health insurance retained three categories. Guided by the WHO multidimensional adherence framework, variables were entered hierarchically: Model 1 included

socio-demographic and economic factors; Model 2 added the patient-education score (health-system domain); and Model 3 added the perceived-barrier score (patient-related domain). Change in fit between models was assessed by the likelihood-ratio test. Results are expressed as adjusted odds ratios (AOR) with 95% confidence intervals. Multicollinearity was assessed using variance inflation factors (VIF; values >5 considered problematic), and model performance was assessed using the omnibus likelihood-ratio test, the Hosmer–Lemeshow goodness-of-fit test (deciles of risk), Nagelkerke $R^2$, classification accuracy at a 0.5 cut-off, and the area under the receiver operating characteristic curve (AUC). Because the facility at which each participant was recruited was not recorded in the dataset, clustering of participants within the three facilities could not be accounted for. A two-sided p-value $< 0.05$ was considered statistically significant throughout.

**Ethical Considerations**

Participation was entirely voluntary. An information sheet describing the study's purpose, procedures, risks, and benefits was shared with respondents, and informed consent was obtained from each respondent before completing the questionnaire; respondents retained the right to withdraw at any time without penalty. No personally identifiable information was collected, and access to the dataset was restricted to the study team. Data were stored on a password-protected device in accordance with institutional data protection practice and are scheduled for secure destruction after a defined retention period. Ethical approval for the study was granted by the Federal Capital Territory Health Research Ethics Committee with the approval number FHREC/2025/01/478/22-12-25.

## Results

**Sociodemographic and Economic Characteristics**

Of the 166 participants, 54.8% were female, and the largest age group was 50–59 years (28.9%). Just over a third (35.6%) had secondary education or less, and just over half (51.2%) were in the lower income bracket. The majority (60.2%) had no health insurance coverage. Most had been hypertensive for five years or less (71.7%), and 76.5% reported no comorbidities (Table 1).

**Table 1: Sociodemographic and Economic Characteristics of Study Respondents (N = 166)**

| Variable | Category | n | % | 95% CI |
|---|---|---|---|---|
| Age | 50–59 years | 48 | 28.9 | 22.0–35.8 |
| | 60 years and above | 43 | 25.9 | 19.2–32.6 |
| | 40–49 years | 36 | 21.7 | 15.4–28.0 |
| | 30–39 years | 21 | 12.7 | 7.6–17.7 |
| | 18–29 years | 18 | 10.8 | 6.1–15.6 |

| | | | | |
|---|---|---|---|---|
| Gender | Female | 91 | 54.8 | 47.2–62.4 |
| | Male | 75 | 45.2 | 37.6–52.8 |
| Educational attainment | College/University | 67 | 40.4 | 32.9–47.8 |
| | Postgraduate | 40 | 24.1 | 17.6–30.6 |
| | Secondary school | 31 | 18.7 | 12.7–24.6 |
| | Primary school | 22 | 13.3 | 8.1–18.4 |
| | No formal education | 6 | 3.6 | 0.8–6.5 |
| Income | Lower bracket | 85 | 51.2 | 43.6–58.8 |
| | Upper bracket | 81 | 48.8 | 41.2–56.4 |
| Health insurance | No | 100 | 60.2 | 52.8–67.7 |
| | Yes, fully covered | 34 | 20.5 | 14.3–26.6 |
| | Yes, partially covered | 32 | 19.3 | 13.3–25.3 |
| Duration of hypertension | 1–5 years | 65 | 39.2 | 31.7–46.6 |
| | Less than 1 year | 54 | 32.5 | 25.4–39.7 |
| | 6–10 years | 32 | 19.3 | 13.3–25.3 |
| | More than 10 years | 15 | 9.0 | 4.7–13.4 |
| Comorbidities | No | 127 | 76.5 | 69.4–82.4 |
| | Yes | 39 | 23.5 | 17.0–29.9 |

***Prevalence of Medication Adherence***

Adherence scores ranged from 0 to 8 (mean 4.09, SD 2.59; median 3.5). Using the cut-off described above (score ≥6 = adherent), 53 participants (31.9%) were classified as adherent and 113 (68.1%) as non-adherent, giving a non-adherence prevalence of 68.1% (95% CI: 61.0–75.2%) (Table 2).

**Table 2: Prevalence of Antihypertensive Medication Adherence (N = 166)**

| **Adherence Status** | **n** | **%** | **95% CI** |
|---|---|---|---|
| Adherent (adherence score ≥6) | 53 | 31.9 | 24.8–39.0 |
| Non-adherent (adherence score <6) | 113 | 68.1 | 61.0–75.2 |
| **Total** | **166** | **100.0** | — |

***Bivariate Associations with Adherence***

At bivariate analysis, adherence was significantly associated with educational attainment ($p < 0.001$), income ($p < 0.001$), health insurance status ($p < 0.001$), distance to the facility ($p < 0.001$), and marital status ($p = 0.011$) (Table 3). None of the 28 participants with primary or no formal education was adherent, compared with 46.3% of those with college or university education. Adherence was highest among participants with full insurance coverage (58.8%), whereas those with partial coverage (21.9%) had adherence similar to the uninsured (26.0%). Adherence was 51.4% among participants living less than 5 km from the facility but 12.2% among those living 11–20 km away. Divorced or separated (11.8%) and widowed (11.5%) participants had lower adherence than those who were married or cohabiting (39.6%) or single (37.0%). Age, gender, employment

status, duration of hypertension, and comorbidities were not significantly associated with adherence.

**Table 3: Adherence Status by Sociodemographic and Economic Characteristics (N = 166)**

| Variable | Category | Adherent, n (%) | Non-adherent, n (%) | $\chi^2$ (df) | p-value |
|---|---|---|---|---|---|
| Age | 18–29 years | 6 (33.3) | 12 (66.7) | 3.84 (4) | 0.428 |
| | 30–39 years | 6 (28.6) | 15 (71.4) | | |
| | 40–49 years | 16 (44.4) | 20 (55.6) | | |
| | 50–59 years | 12 (25.0) | 36 (75.0) | | |
| | ≥60 years | 13 (30.2) | 30 (69.8) | | |
| Gender | Male | 24 (32.0) | 51 (68.0) | 0.00 (1) | 0.986 |
| | Female | 29 (31.9) | 62 (68.1) | | |
| Educational attainment | No formal education | 0 (0.0) | 6 (100.0) | 22.93 (4) | <0.001 |
| | Primary school | 0 (0.0) | 22 (100.0) | | |
| | Secondary school | 6 (19.4) | 25 (80.6) | | |
| | College/University | 31 (46.3) | 36 (53.7) | | |
| | Postgraduate | 16 (40.0) | 24 (60.0) | | |
| Employment status | Employed full-time | 21 (48.8) | 22 (51.2) | 9.51 (5) | 0.087 |
| | Employed part-time | 7 (35.0) | 13 (65.0) | | |
| | Self-employed | 11 (26.2) | 31 (73.8) | | |
| | Retired | 10 (27.0) | 27 (73.0) | | |
| | Student | 1 (25.0) | 3 (75.0) | | |
| | Unemployed | 3 (15.0) | 17 (85.0) | | |
| Income | Lower bracket | 14 (16.5) | 71 (83.5) | 19.15 (1) | <0.001 |
| | Upper bracket | 39 (48.1) | 42 (51.9) | | |
| Marital status | Married/cohabiting | 38 (39.6) | 58 (60.4) | 11.07 (3) | 0.011 |
| | Single | 10 (37.0) | 17 (63.0) | | |
| | Divorced/separated | 2 (11.8) | 15 (88.2) | | |
| | Widowed | 3 (11.5) | 23 (88.5) | | |
| Health insurance | None | 26 (26.0) | 74 (74.0) | 14.42 (2) | <0.001 |
| | Partial coverage | 7 (21.9) | 25 (78.1) | | |
| | Full coverage | 20 (58.8) | 14 (41.2) | | |
| Duration of hypertension | Less than 1 year | 16 (29.6) | 38 (70.4) | 1.85 (3) | 0.622 |
| | 1–5 years | 21 (32.3) | 44 (67.7) | | |
| | 6–10 years | 9 (28.1) | 23 (71.9) | | |
| | More than 10 years | 7 (46.7) | 8 (53.3) | | |
| Comorbidities | No | 45 (35.4) | 82 (64.6) | 3.06 (1) | 0.080 |
| | Yes | 8 (20.5) | 31 (79.5) | | |
| Distance to facility | Less than 5 km | 18 (51.4) | 17 (48.6) | 16.95 (3) | <0.001 |
| | 5–10 km | 21 (40.4) | 31 (59.6) | | |
| | 11–20 km | 6 (12.2) | 43 (87.8) | | |
| | More than 20 km | 8 (26.7) | 22 (73.3) | | |

**Note**: values are n (row %). $\chi^2$, Pearson's chi-square statistic; df, degrees of freedom.

### Comparison of Mean Perceived-Barrier and Patient-Education Scores by Adherence Status

Non-adherent respondents reported a substantially higher mean perceived-barrier score than adherent respondents (3.44 ± 0.98 vs 1.63 ± 0.65; mean difference 1.81, 95% CI 1.56 to 2.07; Welch's t(145.0) = 14.19, p < 0.001; Cohen's d = 2.05). Adherent participants reported a higher mean patient-education score than non-adherent participants (4.47 ± 0.78 vs 3.58 ± 0.86; mean difference 0.89, 95% CI 0.62 to 1.16; Welch's t(111.4) = 6.62, p < 0.001; Cohen's d = 1.06) (Table 4).

**Table 4: Comparison of Mean Perceived-Barrier and Patient-Education Scores by Adherence Status**

| Variable | Mean ± SD (Adherent, n = 53) | Mean ± SD (Non-adherent, n = 113) | Welch's t (df) | p-value | Mean difference (95% CI) |
|---|---|---|---|---|---|
| Perceived-barrier score | 1.63 ± 0.65 | 3.44 ± 0.98 | −14.19 (145.0) | <0.001 | −1.81 (−2.07 to −1.56) |
| Patient-education score | 4.47 ± 0.78 | 3.58 ± 0.86 | 6.62 (111.4) | <0.001 | 0.89 (0.62 to 1.16) |

**Note**: scores range from 1 to 5. Welch's t-test (unequal variances); mean difference = adherent minus non-adherent. Cohen's d (pooled SD): perceived-barrier score 2.05; patient-education score 1.06.

### Perceived Barriers at Item Level

The most frequently endorsed barriers (agree or strongly agree) were stopping medication when blood pressure readings were normal (56.0%), concern about the long-term effects of medication (54.8%), regimen complexity (44.6%), medication cost (43.4%), and skipping doses to make medication last longer (43.4%) (Table 5). Every barrier item was rated significantly higher by non-adherent than by adherent participants (all p < 0.001).

**Table 5: Perceived Barriers to Medication Adherence at Item Level, by Adherence Status (N = 166)**

| Barrier item | Agree/strongly agree, n (%) | Mean ± SD (Adherent) | Mean ± SD (Non-adherent) | p-value |
|---|---|---|---|---|
| I sometimes stop taking my medication when my blood pressure readings are normal | 93 (56.0) | 2.04 ± 1.26 | 3.83 ± 1.22 | <0.001 |
| I am concerned about the long-term effects of taking this medication | 91 (54.8) | 2.06 ± 1.25 | 3.87 ± 1.16 | <0.001 |
| The medication regimen is too complicated to follow | 74 (44.6) | 1.68 ± 0.80 | 3.64 ± 1.28 | <0.001 |
| The cost of my medication is a major barrier to taking it consistently | 72 (43.4) | 1.70 ± 1.17 | 3.58 ± 1.38 | <0.001 |
| I sometimes skip doses to make my medication last longer | 72 (43.4) | 1.55 ± 1.01 | 3.59 ± 1.41 | <0.001 |

| Barrier item | Agree/strongly agree, n (%) | Mean ± SD (Adherent) | Mean ± SD (Non-adherent) | p-value |
|---|---|---|---|---|
| My high blood pressure is not serious enough to require daily medication | 70 (42.2) | 1.68 ± 0.89 | 3.45 ± 1.32 | <0.001 |
| I often forget to take my medication because I am busy or distracted | 66 (39.8) | 1.57 ± 0.77 | 3.44 ± 1.22 | <0.001 |
| Unpleasant side effects make me want to stop taking my medication | 65 (39.2) | 1.57 ± 0.77 | 3.50 ± 1.38 | <0.001 |
| I have difficulty getting to the pharmacy or clinic to refill on time | 58 (34.9) | 1.49 ± 0.72 | 3.35 ± 1.39 | <0.001 |
| I do not have enough support from family or friends to help me remember | 52 (31.3) | 1.53 ± 0.77 | 3.26 ± 1.31 | <0.001 |
| I prefer traditional or herbal remedies to my prescribed medication | 45 (27.1) | 1.26 ± 0.49 | 2.95 ± 1.39 | <0.001 |
| I have trouble swallowing the pills, which makes me skip doses | 42 (25.3) | 1.43 ± 0.80 | 2.88 ± 1.33 | <0.001 |

Note: items rated from 1 (strongly disagree) to 5 (strongly agree); ordered by frequency of agreement. p-values from the Mann–Whitney U test

## Multivariable Analysis

In Model 1 (socio-demographic and economic factors), tertiary education (AOR = 3.59, 95% CI: 1.24–10.42, p = 0.019), upper-bracket income (AOR = 2.57, 95% CI: 1.08–6.13, p = 0.033), and living within 10 km of the facility (AOR = 2.98, 95% CI: 1.34–6.64, p = 0.008) were independently associated with higher odds of adherence (Table 6). Health insurance status, employment, marital status, and comorbidities were not independently associated with adherence. Adding the patient-education score (Model 2) significantly improved model fit (likelihood-ratio $\chi^2(1) = 15.40$, $p < 0.001$): each one-point increase in the score was associated with 2.91 times higher odds of adherence (95% CI: 1.62–5.21, $p < 0.001$), distance remained significant (AOR = 2.55, 95% CI: 1.09–5.94, p = 0.031), and the associations of education (p = 0.064) and income (p = 0.103) were attenuated. Adding the perceived-barrier score (Model 3) further improved fit (likelihood-ratio $\chi^2(1) = 46.64$, $p < 0.001$): each one-point increase was associated with 88% lower odds of adherence (AOR = 0.12, 95% CI: 0.05–0.26, $p < 0.001$), and no other variable, including the patient-education score (AOR = 1.07, 95% CI: 0.54–2.11, p = 0.843), remained independently associated with adherence. All models showed adequate fit (Hosmer–Lemeshow $p \geq 0.31$) and no problematic multicollinearity (VIF ≤ 2.17). Model 3 explained 66.6% of the variation in adherence (Nagelkerke $R^2$), correctly classified 87.3% of participants, and had an AUC of 0.94.

**Table 6: Hierarchical Binary Logistic Regression of Factors Associated with Adherence to Antihypertensive Medication (N = 166; 53 adherent)**

| Variable (reference) | Model 1 AOR (95% CI) | p | Model 2 AOR (95% CI) | p | Model 3 AOR (95% CI) | p |
|---|---|---|---|---|---|---|
| Tertiary education (secondary or less) | 3.59 (1.24–10.42) | 0.019 | 2.84 (0.94–8.55) | 0.064 | 2.61 (0.67–10.09) | 0.165 |
| Upper income bracket (lower) | 2.57 (1.08–6.13) | 0.033 | 2.11 (0.86–5.20) | 0.103 | 1.06 (0.34–3.26) | 0.919 |
| Partial insurance coverage (none) | 0.42 (0.14–1.27) | 0.124 | 0.47 (0.15–1.50) | 0.203 | 0.50 (0.13–1.96) | 0.317 |
| Full insurance coverage (none) | 1.45 (0.53–3.97) | 0.473 | 1.31 (0.46–3.75) | 0.618 | 0.94 (0.26–3.48) | 0.931 |
| In paid employment (not in paid employment) | 1.12 (0.48–2.61) | 0.802 | 1.11 (0.45–2.77) | 0.816 | 0.76 (0.23–2.49) | 0.652 |
| Married/cohabiting (not married) | 1.64 (0.69–3.88) | 0.261 | 1.33 (0.53–3.34) | 0.542 | 0.59 (0.18–1.92) | 0.383 |
| Comorbidity present (none) | 0.89 (0.31–2.53) | 0.829 | 1.09 (0.35–3.42) | 0.885 | 1.70 (0.39–7.33) | 0.478 |
| Distance ≤10 km (>10 km) | 2.98 (1.34–6.64) | 0.008 | 2.55 (1.09–5.94) | 0.031 | 1.58 (0.55–4.58) | 0.401 |
| Patient-education score (per 1 point) | — | | 2.91 (1.62–5.21) | <0.001 | 1.07 (0.54–2.11) | 0.843 |
| Perceived-barrier score (per 1 point) | — | | — | | 0.12 (0.05–0.26) | <0.001 |
| **Model performance** | | | | | | |
| Likelihood-ratio $\chi^2$ (df) | 45.24 (8) | <0.001 | 60.64 (9) | <0.001 | 107.27 (10) | <0.001 |
| Change from previous model, $\chi^2$ (1) | — | | 15.40 | <0.001 | 46.64 | <0.001 |
| Nagelkerke $R^2$ | 0.334 | | 0.428 | | 0.666 | |
| Hosmer–Lemeshow $\chi^2$ (8) | 3.63 | 0.889 | 5.94 | 0.654 | 9.44 | 0.306 |
| Correctly classified (%) | 72.9 | | 78.3 | | 87.3 | |
| AUC | 0.80 | | 0.85 | | 0.94 | |
| VIF range | 1.09–1.54 | | 1.10–1.60 | | 1.15–2.17 | |

**Note:** *AOR, adjusted odds ratio; CI, confidence interval; AUC, area under the receiver operating characteristic curve; VIF, variance inflation factor. Reference categories are shown in parentheses. Scores range from 1 to 5; odds ratios are per one-point increase. Model 1: socio-demographic and economic factors; Model 2: Model 1 plus patient-education score; Model 3: Model 2 plus perceived-barrier score*

## Discussion

This study found that more than two-thirds of patients receiving antihypertensive treatment at the study facilities were non-adherent. Among socio-demographic and economic factors, educational attainment, income, and proximity to the facility were independently associated with adherence, and more positive experiences of patient education were associated with adherence beyond these factors. Perceived barriers were by far the strongest correlate of non-adherence; once they were taken into account, no other factor remained independently associated with adherence. These findings are consistent with the multi-factorial nature of antihypertensive medication non-adherence described in the wider literature and extend this evidence to patients attending tertiary care in Nigeria.

The prevalence of non-adherence observed here is markedly higher than global pooled estimates of 27–40% (Lee et al., 2022; Nielsen et al., 2017). It has been suggested that patients managed in tertiary settings may face compounded barriers because of more complex disease and costlier regimens (Shah et al., 2018); however, this explanation should be interpreted cautiously here, because most participants (76.5%) reported no comorbidities and comorbidity was not associated with adherence. Other plausible contributors include the high proportion of participants without health insurance (60.2%) or in the lower income bracket (51.2%), the many participants living more than 10 km from the facility (47.6%), differences in how adherence is measured and categorised across studies, and the selection effects inherent in convenience sampling. The strong association between perceived barriers and adherence is consistent with evidence identifying cost, side effects, beliefs about medication, and forgetfulness as common obstacles to consistent use (Noreen et al., 2023; Zhou et al., 2024; Al-Noumani et al., 2019). In this sample, the most commonly endorsed barriers were stopping medication when blood pressure readings were normal and concern about long-term effects, both of which reflect beliefs about the necessity and safety of treatment (Al-Noumani et al., 2019), followed by regimen complexity and cost. However, the perceived-barrier score correlated strongly with the adherence score ($r = -0.82$), and several barrier items (for example, forgetting doses or stopping medication when blood pressure is normal) describe behaviours similar to those captured by the adherence scale. The barrier score therefore partly measures non-adherent behaviour itself. Its dominance in Model 3 should be interpreted in light of this conceptual overlap, although it may also reflect a pathway through which socio-economic disadvantage and access difficulties translate into non-adherence. The association between patient-education scores and adherence is consistent with findings that better knowledge of one's condition and treatment is associated with more consistent medication-taking (Karakurt et al., 2025; Rhamttallah et al., 2025; Paczkowska et al., 2021) and with the value of patient-centred counselling delivered in accessible language (Morrissey et al., 2017). Because the patient-education score captured perceptions of counselling received rather than health literacy, and both scores were self-reported at the same time as adherence, reverse causation or shared response tendencies cannot be excluded.

The associations of educational attainment and income with adherence are consistent with evidence that lower education and financial constraints are linked to poorer adherence (Karakurt et al., 2025; Kokenge et al., 2024; Noreen et al., 2023; Lee et al., 2024). That none of the 28 participants with primary or no formal education was adherent is notable and suggests that counselling approaches for less-educated patients warrant particular attention. The independent association with proximity to the facility suggests that access barriers, such as travel time and transport costs for clinic visits and prescription refills, may contribute to non-adherence, consistent with qualitative evidence on structural barriers (Zhou et al., 2024). Full insurance coverage was associated with markedly higher adherence at bivariate analysis, whereas partial coverage

conferred no apparent advantage over no insurance; the absence of an independent association after adjustment may reflect the overlap of insurance status with income and education, as well as limited statistical power, and contrasts with evidence that insurance coverage improves adherence (Dangaura et al., 2025). The absence of an association with age contrasts with reports of better adherence among older patients (Tola Gemeda et al., 2020; Uchmanowicz et al., 2019), while the absence of a gender difference is consistent with studies reporting little difference in adherence between men and women (Abegaz et al., 2017).

For clinical practice, the strong association between perceived barriers and non-adherence suggests that routinely asking tertiary-care hypertensive patients about modifiable barriers, particularly beliefs about stopping treatment when blood pressure is controlled, concerns about long-term effects, regimen complexity, and cost, and tailoring counselling accordingly, may be more useful than generic advice. For health systems, the associations of income and distance with adherence support exploring measures that reduce out-of-pocket and access costs, such as subsidised medication, longer prescription intervals or community-based refill points, and comprehensive rather than partial insurance coverage of antihypertensive medication. For public health, given the association of patient education with adherence, structured, plain-language, teach-back-based patient education adapted to patients with limited formal schooling merits evaluation within hypertension and broader non-communicable disease programmes. For research, prospective and intervention studies are needed to test whether combined barrier- and education-focused interventions improve adherence, and qualitative work could clarify how patients in this setting experience and prioritise these barriers.

**Strengths and Limitations**

This study's principal strength is its simultaneous assessment of sociodemographic, socio-economic, barrier-related, and patient-education domains within a single tertiary-care population, using hierarchical multivariable analysis to examine how these domains relate to adherence rather than examining each in isolation. Several limitations should be considered. First, the cross-sectional design precludes causal inference; the associations reported should not be interpreted as evidence that the identified factors cause adherence or non-adherence, and reverse causation is possible. Second, non-probability convenience sampling may have introduced selection bias, and the findings may not generalise to other tertiary facilities, to primary or secondary care, or to other regions of Nigeria. Third, the achieved sample (n = 166) was below the calculated target of 196; with 53 adherent participants and up to 10 model parameters, the number of events per parameter was low (approximately 5), which reduced power, produced imprecise estimates, and increased the risk of overfitting; multi-category variables also had to be collapsed. Fourth, adherence was measured with an adapted, MMAS-8-based scale whose cut-off has not been validated for this version, and both the outcome and all predictors were self-

reported at a single time point, so recall, social-desirability, and common-method biases may have affected the estimates; self-report may overestimate adherence relative to objective measures such as pill counts or pharmacy refill data. Fifth, the perceived-barrier and patient-education scales were developed for this study and have not been externally validated; their very high internal consistency ($\alpha \geq 0.94$) suggests item redundancy, several barrier items overlap conceptually with the adherence scale, and health literacy was not measured. Sixth, income was recorded in two self-reported brackets without specified naira thresholds, which limits interpretation and comparability. Seventh, residual confounding is likely, because potentially important determinants, including the number of antihypertensive medications, dosing frequency, pill burden, depression, and blood pressure control, were not measured. Finally, the recruiting facility was not recorded, so clustering of participants within the three facilities could not be accounted for.

**Future Research Directions**

Future work should employ longitudinal designs to track adherence trajectories and their downstream impact on blood pressure control and cardiovascular outcomes; should use the validated MMAS-8 or objective adherence measures and record the number of medications, dosing frequency, and pill burden; and should validate the barrier and education instruments, ensuring that barrier items are conceptually distinct from adherence behaviour, alongside validated health-literacy tools. Qualitative research could further illuminate the beliefs about treatment necessity and long-term safety that were the most commonly endorsed barriers in this population, while pragmatic intervention trials are needed to test whether barrier-focused counselling, structured patient education, and measures that reduce cost and access barriers improve adherence in tertiary care.

**Conclusion**

Non-adherence to antihypertensive medication was highly prevalent among patients attending the study facilities, affecting more than two in three respondents. Lower educational attainment, lower income, and greater distance from the facility were associated with non-adherence, as were less favourable experiences of patient education. Perceived barriers, most commonly stopping treatment when blood pressure is normal, concern about long-term effects, regimen complexity, and cost, were the strongest correlates of non-adherence and accounted for much of the association of the other factors. Because of the cross-sectional design, these associations do not establish causality. Nevertheless, the findings suggest that barrier-focused counselling, patient education adapted to patients with limited formal schooling, and policies that reduce the cost of and distance to care are promising strategies whose effect on adherence and blood pressure control should be evaluated in tertiary care settings.

**Declarations**

**Consent to participate:** All respondents provided informed consent prior to completing the questionnaire, and the study was conducted in accordance with standard principles of confidentiality and voluntary participation.

**Availability of data and materials:** The dataset generated and analysed during the current study is available from the corresponding author on reasonable request.

**Competing interests:** The authors declare no competing interests.

**Funding:** The study received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

**References**

Abegaz, T. M., Shehab, A., Gebreyohannes, E. A., Bhagavathula, A. S., & Elnour, A. A. (2017). Nonadherence to antihypertensive drugs: A systematic review and meta-analysis. *Medicine*, 96(4), e5641.

Al-Noumani, H., Wu, J.-R., Barksdale, D., Sherwood, G., AlKhasawneh, E., & Knafl, G. (2019). Health beliefs and medication adherence in patients with hypertension: A systematic review of quantitative studies. *Patient Education and Counseling*, 102(6), 1045–1056.

Ayodapo, A. O., Elegbede, O. T., Are, B. S., Sanni, T. A., & Akindele, M. O. (2020). Patient education and medication adherence among hypertensives in a tertiary hospital, South Western Nigeria. *Ethiopian Journal of Health Sciences.*

Choi, H. Y., Oh, I. J., Lee, J. A., Lim, J., Kim, Y. S., Jeon, T. H., Choi, Y. J., & Jang, S. I. (2018). Factors affecting adherence to antihypertensive medication. *Korean Journal of Family Medicine*, 39(6), 343–350.

Choudhry, N. K., et al. (2022). Medication adherence and blood pressure control: A scientific statement from the American Heart Association. *Hypertension.*

Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). Sage.

Dangaura, N. R., et al. (2025). Impact of national health insurance on medication adherence among hypertensive patients: A hospital-based cross-sectional study from Kailali, Nepal. *PLOS ONE*, 20(5).

Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics*, 5(1), 1–4.

Hulley, S. B., Cummings, S. R., Browner, W. S., Grady, D. G., & Newman, T. B. (2013). *Designing clinical research* (4th ed.). Lippincott Williams & Wilkins.

Karakurt, P., et al. (2025). Association between health literacy and medication adherence in patients with hypertension: A cross-sectional study. *Scientific Reports*, 15(1), 1–10.

Kim, H. J., et al. (2025). Impact of blood pressure and medication adherence on clinical outcomes in patients with hypertension. *Frontiers in Medicine*, 15.

Kokenge, M. C., et al. (2024). Factors influencing antihypertensive medication adherence among historically underrepresented adults: A meta-analysis. *Journal of Cardiovascular Nursing*, 39(5), 415–424.

Konlan, K. D., et al. (2023). Determinants of self-care and home-based management of hypertension in Ghana: A cross-sectional study. *Global Heart*, 18(1), 1–11.

Krousel-Wood, M., et al. (2017). Medication adherence: A key factor in achieving blood pressure control and good clinical outcomes in hypertensive patients. *Current Opinion in Cardiology*, 19(11), 107.

Lee, E. K. P., et al. (2022). Global burden, regional differences, trends, and health consequences of medication nonadherence for hypertension during 2010 to 2020: A meta-analysis involving 27 million patients. *Journal of the American Heart Association*, 11(17), e026582.

Lee, J. S., et al. (2024). Antihypertensive medication adherence and medical costs, health care use, and labor productivity among people with hypertension. *Journal of the American Heart Association*, 13(21).

Lewington, S., Clarke, R., Qizilbash, N., Peto, R., & Collins, R. (2002). Age-specific relevance of usual blood pressure to vascular mortality: A meta-analysis of individual data for one million adults in 61 prospective studies. *The Lancet*, 360(9349), 1903–1913.

Mills, K. T., Bundy, J. D., Kelly, T. N., Reed, J. E., Kearney, P. M., Reynolds, K., Chen, J., & He, J. (2016). Global disparities of hypertension prevalence and control: A systematic analysis of population-based studies from 90 countries. *Circulation*, 134(6), 441–450.

Morisky, D. E., Ang, A., Krousel-Wood, M., & Ward, H. J. (2008). Predictive validity of a medication adherence measure in an outpatient setting. *The Journal of Clinical Hypertension*, 10(5), 348–354.

Morrissey, E. C., Durand, H., Nieuwlaat, R., Navarro, T., Haynes, R. B., Walsh, J. C., & Molloy, G. J. (2017). The effectiveness of educational interventions to enhance medication adherence and blood pressure control in hypertension: A systematic review and meta-analysis. *Psychology & Health*, 32(1), 1–26.

Nielsen, J. Ø., Shrestha, A. D., Neupane, D., & Kallestrup, P. (2017). Non-adherence to anti-hypertensive medication in low- and middle-income countries: A systematic review and meta-analysis of 92,443 subjects. *Journal of Human Hypertension*, 31(10), 638–646.

Noreen, N., et al. (2023). Determinants of adherence to antihypertension medication in Pakistan: A cross-sectional study. *Preventing Chronic Disease*, 20.

Paczkowska, A., Hoffmann, K., Zaprutko, T., Ratajczak, P., Nowakowska, E., Bryl, W., & Kus, K. (2021). Impact of patient knowledge on hypertension treatment adherence: A systematic review. *International Journal of Environmental Research and Public Health*, 18(1), 205.

Peng, X., et al. (2025). The link between adherence to antihypertensive medications and mortality rates in patients with hypertension: A systematic

review and meta-analysis of cohort studies. *BMC Cardiovascular Disorders*, 25(1), 1–15.

Rhamttallah, M., et al. (2025). Impact of hypertension knowledge on adherence to antihypertensive therapy: A cross-sectional study in primary health care centers during the 2024 Sudan conflict. *BMC Primary Care*, 26(1), 1–10.

Shah, A. J., et al. (2018). Factors affecting compliance to antihypertensive treatment among adults in a tertiary care hospital in Mumbai. *Indian Journal of Community Medicine*, 43(1), 38.

Sokol, M. C., McGuigan, K. A., Verbrugge, R. R., & Epstein, R. S. (2005). Effect of antihypertensive therapy on hospitalization and mortality among uncomplicated and high risk hypertensive patients. *Medical Care.*

Tola Gemeda, A., et al. (2020). Adherence to antihypertensive medications and associated factors among hypertensive patients in Ethiopia: Systematic review and meta-analysis. *SAGE Open Medicine*, 8.

Uchmanowicz, B., Chudiak, A., Uchmanowicz, I., Rosińczuk, J., & Fryżel, B. (2019). Self-reported medication adherence measured with Morisky Medication Adherence Scales and its determinants in hypertensive patients aged ≥60 years: A systematic review and meta-analysis. *Frontiers in Pharmacology*, 10, 168.

World Health Organization. (2003). *Adherence to long-term therapies: Evidence for action*. World Health Organization.

World Health Organization. (2023). *Hypertension.* https://www.who.int/news-room/fact-sheets/detail/hypertension

Zhou, X., et al. (2024). Barriers and facilitators of medication adherence in hypertension patients: A meta-integration of qualitative research. *Journal of Patient Experience*, 11, 23743735241241176.`