

# Assessment of Medication Adherence and Factors Among Hypertensive Patients

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**Received:** 📅 2025 July 17

**Accepted:** 📅 2025 Aug 05

**Published:** 📅 2025 Aug 20

## Summary

**Objective:** To determine factors related to the prevalence of drug compliance and insufficient adherence to lowering blood pressure treatment. Investigating patient-related factors and health systems associated with reduced compliance with blood pressure-lowering medications.

**Method:** This quantitative cross-section study was conducted in Johar Town, Lahore, from 17 to 31 March 2025 and is targeted at adult hypertensive patients. A sample of 350 18-year-old patients with hypertension diagnosed for more than 1 year took part in blood pressure-lowering medications and outpatient follow-up tests. Information was collected on health system factors and care driver factors for violations with patients with self-reported and revised scales to comply with Hill's bone.

**Result:** Of the 350 participants, 173 (49.4%) were males and 176 (50.6%) were females. Participants' income was categorized into 87 low-income class, 189 middle-income class, and 73 high-income class. The most frequent comorbidities included diabetes (72 patients) and heart failure (79 patients). Based on self-reports, 174 (49.7%) patients were unsuitable for blood pressure-lowering medications. Patients who were affected by noncompliance included the number of drugs collected, side effects, and missed appointments. Patients who received three blood pressure-lowering medications were less likely to adhere compared to drug therapy (OR 0.8; 95% CI 0.3°C). The incidence of diarrhea as a side effect also reduced the lack of compliance (OR 0.9; 95% CI 0.5°C) and clinical appointments due to lack of change in compliance (OR 0.5; 95% CI 0.2°C). According to the modified Hill bone suitability scale, patients who could name the drug were quite glued (OR 1.4; 95% CI 0.8°2.5). Health system-related factors also played a role. Self-reports noted that lack of booking significantly reduced compliance (OR 0.4; 95% CI 0.2 4.7). A moderate correlation was found between self-reported compliance and modified Columbine scales.

**Conclusion:** The prevalence of compliance among hypertensive patients was 50.3%. Side effects of dizziness and cancellations due to unavailability of transport were factors related to non-attendance. Compliance with BP drugs and counseling on medication intake were both related to decreased noncompliance.

**Keywords:** Adherence, Hypertension, Noncompliance, Side Effects, Counseling, Health system and Comorbidities

## 1. Introduction

Chronic diseases are a significant worldwide health problem that causes a substantial amount of morbidity, mortality, and escalating healthcare expenditure globally. Of these, hypertension is a top modifiable risk factor for cardiovascular conditions, stroke, and renal failure[1].

Many patients with hypertension struggle to control their blood pressure, despite the effectiveness of antihypertensive drugs, mainly due to poor medication adherence. Several factors contribute to this, including forgetfulness, fear of side effects, and lack of understanding about the disease[2, 3]. Psychological issues like depression and misconceptions about long-term medication use also play a role. Socioeco-

nomie barriers, such as low income and unemployment, further limit access to medications and healthcare. Additionally, issues with the healthcare system, like poor communication and lack of follow-ups, worsen adherence rates [4].

Existing research has suggested that simplifying treatment regimens, minimizing the pill burden, and improving patient education will result in improved medication adherence. These methods have been measurably effective across different clinical settings[5, 6]. Nevertheless, still lacking is intensive research targeted at particular areas, specifically, within low- and middle-income countries (LMICs). Healthcare access in these regions tends to be limited by cost, infrastructural, and systemic restrictions. In addition, cultural

values, indigenous healing patterns, and social stigma can significantly impact drug-taking behavior, resulting in variable or inappropriate use of medication. If a global adherence strategy is implemented without regional data and culturally responsive practice, it may be unable to address the specific challenges of these populations [7].

This research aims to measure the extent of medication adherence in hypertensive patients and determine the most important determinants of adherence, such as patient behavior, drug difficulties, socioeconomic status, and inefficiencies in the health system [8]. Through the assessment of these determinants using organized surveys and analysis of clinical data, the study aims to give evidence-based suggestions to improve adherence and optimize hypertension control [9]. The importance of this research is its potential to guide healthcare professionals, policymakers, and public health programs on effective means to increase drug compliance. In addition, the results will also be part of the global efforts to fight cardiovascular diseases by dealing with one of their most preventable causes. Policymakers can utilize the findings to come up with patient-focused interventions like subsidized drugs, reminder systems, and community-level education programs [10].

This research replicates the importance of medication adherence in the management of high blood pressure and offers implementable interventions to overcome barriers with a global improvement in patient health outcomes. Targeting the underlying causes of non-adherence, such as behavioral, economic, or healthcare systems, can improve patient care, alleviate the burden of hypertension-related complications, and inch closer to realizing global cardiovascular health targets [11]. This research not only fills crucial knowledge gaps but also offers practical, scalable interventions to enhance adherence and overall patient well-being, such that hypertensive patients gain the full benefit of their prescribed therapies [12].

## 2. Methodology

### 2.1. Study Design

This study applied a quantitative cross-sectional study design that is appropriate to determine relationships between variables at one point in time. The design allowed the researchers to assess the level of medication adherence among hypertensive patients and investigate the various factors influencing it without altering any of the variables. The study was conducted from October 2024 to March 2025 in Johar Town, Lahore, which caters to a vast number of patients with chronic disease, including hypertension. The setting was chosen due to its accessibility to a large population of hypertensive patients and the availability of clinical records necessary to verify inclusion criteria [13].

### 2.2. Study Setting

The population under target included adults diagnosed with hypertension. The research used Purposive sampling, a type of non-probability sampling, to sample participants who fulfilled pre-determined eligibility criteria. The criteria for inclusion were adults aged 18 years and above diagnosed with

hypertension for more than one year already on antihypertensive drugs and regularly attending outpatient follow-up during the time of the study. These criteria ensured that participants had sufficient experience with medication use and clinical management to provide meaningful responses. Patients were excluded if they had been diagnosed with hypertension for less than a year, as their adherence behaviors might still be developing. Other exclusion criteria included pregnant women due to potential physiological changes affecting medication routines and individuals with mental or psychiatric disorders, as these conditions could affect comprehension or the ability to respond accurately to survey questions [14].

### 2.3. Study Population and Sample Size

A total of 350 participants were selected for the study. This sample size was considered adequate to yield statistically significant results and to ensure the reliability and validity of the findings. Data collection was carried out using a structured questionnaire, which was divided into three major sections.

### 2.4. Demographics profile

This part gathered information on participants' age, gender, marital status, dwelling, family history of hypertension, and monthly income. These variables were important in establishing socioeconomic and personal factors that might influence medication adherence.

### 2.5. Lifestyle and Clinical Characteristics

This section explored relevant factors, including the number of medications taken, daily frequency of missed appointments, presence of comorbidities condition reported side effects of medications, and ability of patients to remember the names of their prescribed medications. The questionnaire was adopted from previously validated tools in similar studies and underwent expert review for content and face validity by professionals in medicine and public health.

### 2.6. Medication Adherence

The Hill-Bone Adherence to High Blood Pressure Treatment Scale was employed to measure medication adherence. This validated scale evaluates patient behaviors such as taking medication regularly, refilling prescriptions, and following treatment instructions. Responses were scored and categorized into high, medium, or low adherence levels, which formed the basis for further statistical analysis [15,16].

### 2.7. Data Collection

Before carrying out data collection, ethical clearance was obtained from the University Ethics Committee, where all the protocols were in line with international standards of research ethics. Participants were informed in detail about the purpose, procedures, and confidentiality arrangements in the study. To minimize misunderstanding and increase the accuracy of data collected through face-to-face interviews conducted by trained data collectors. This approach was especially important in addressing potential literacy issues and clarifying any ambiguities in the questionnaire [12,17].

## 2.8. Data Analysis

Statistical Package for the Social Sciences software (SPSS) was utilized in data analysis. Descriptive statistics such as frequencies, percentages, means, and standard deviations were utilized to describe the medication adherence levels and demographic characteristics of the participants in the first analysis. To explore relationships between variables and Chi chi-square test was employed. These tests helped identify significant associations between the level of medication adherence and various factors such as demographics, lifestyle behaviors, and clinical characteristics. Finally, binary logistic regression analysis was conducted to determine which variables were the most significant predictors of adherence. This statistical method allowed for the control

of confounding variables and provided insights into which factors had the strongest influence on patients' adherence to their prescribed antihypertensive medications.

## 2.9. Ethical Considerations

Ethical Considerations is rewarded by the ethical committee of UCP.

## 3. Results

After pilot testing and calibration of the 50 survey, 350 patients were surveyed. After excluding patients with missing data, 350 patients were available for analysis.

### Demographic and Clinical Patient Characteristics

		N	Adherent (%)	Non-Adherent (%)	OR (95% CI)
<b>Total</b>		350	146 (41.7)	204 (58.2)	
<b>Gender</b>	Male	174	75 (43.1)	99 (56.8)	0.9(0.5-1.6)
	Female	176	71 (40.3)	105 (59.6)	
<b>Income</b>	Low	87	38 (43.6)	49 (56.3)	1
	Middle	189	87 (45.7)	103 (54.2)	1.9(0.9-3.8)
	High	73	21 (28.7)	52 (71.2)	3.7(1.5-8.9)
<b>Family History of Hypertension</b>	Yes	210	81 (38.5)	130 (61.9)	0.9(0.5-1.7)
	No	139	65 (46.7)	74 (53.2)	
<b>Co-morbidities</b>	Diabetes Mellitus	72	14 (19.4)	58 (80.5)	0.7(0.3-1.7)
	Heart Failure	79	22 (27.8)	57 (72.1)	0.7(0.2-2.6)
<b>Able to Name Drugs</b>	Yes	205	93 (45.3)	112 (54.6)	1.3(0.7-2.5)
	No	143	53 (37)	91 (63)	
<b>Side effects (Cough)</b>	Yes	184	63 (34.2)	121 (65.7)	0.5(0.3-1.0)
	No	165	83 (50)	82 (50)	
<b>Dizziness</b>	Yes	154	59 (38.3)	96 (62.3)	0.7(0.4-1.3)
	No	195	87 (44.6)	108 (55.3)	
<b>Diarrhea</b>	Yes	77	36 (46.7)	41 (53.2)	1.6(0.8-3.2)
	No	272	110 (40.4)	163 (59.6)	
<b>Excessive Urination</b>	Yes	127	50 (39.3)	77 (60.6)	0.9(0.6-1.4)
	No	221	95 (42.9)	127 (57.4)	
<b>Missed Appointments</b>	Yes	193	65 (33.5)	129 (66.4)	0.5(0.3-1.0)
	No	156	81 (51.9)	75 (48)	
<b>Missed Appointments due to a lack of Transport</b>	Yes	137	49 (35.5)	89 (64.4)	0.8(0.4-1.5)
	No	212	97 (45.7)	115 (54.2)	

**Table 1: Patient Factors Associated with Medication Non-Adherence as Measured by Patient Self-Report**

173 (49.4%) were males and 176 (50.6%) females. The majority of participants were distributed by income clips: low (87 patients), medium (189 patients), and high (73 patients) as follows: income clips. The most common comorbidities were diabetes and heart failure, from which 72 or 79 cases were created. [10] The most common drug side effects in this

research are cough and dizziness, which occurred in 44% or 52% of patients. Demographics of patients are presented in Table 1.

### Patient-Related Factors to Non-Adherence

		N	Adherent (%)	Non-Adherent (%)	OR (95% CI)
<b>Total</b>		350	175(50.3)	174(49.7)	
<b>Gender</b>	Male	173	81(46.8)	92(53)	0.5(0.3-0.9)
	Female	176	94(53.4)	82(46.5)	
<b>Income</b>	Low	87	35(40.2)	52(59.7)	1
	Middle	189	96(50.7)	93(49.2)	0.7(0.4-1.4)
	High	73	44(60.2)	29(39.7)	0.5(0.2-1.01)

<b>Family History of Hypertension</b>	Yes	210	97(46.1)	113(53.8)	0.4(0.2-0.8)
	No	139	78(56)	61(43.8)	
<b>Co-morbidities</b>	Diabetes Mellitus	72	41(56.9)	31(43)	1.1(0.5-2.2)
	Heart Failure	79	40(50.6)	39(49.3)	1.1(0.4-3.3)
<b>Number of BP Drugs</b>	1	57	26(45.6)	31(54.3)	1
	2	89	49(55)	40(44.9)	0.4(0.2-1.1)
	3	121	57(47)	64(52.8)	0.8(0.3-2.0)
	4	82	43(52)	39(47.5)	0.5(0.2-1.4)
<b>Able to Name Drugs</b>	Yes	205	116(56.5)	89(43.4)	1.4(0.8-2.5)
	No	143	58(40.5)	85(59.4)	
<b>Side effects (Cough)</b>	Yes	184	99(53.8)	85(46.1)	1.3(0.8-2.2)
	No	165	76(46)	89(53.9)	
<b>Dizziness</b>	Yes	154	78(50.6)	76(49.4)	1.2(0.7 -2.1)
	No	195	97(49.7)	98(50.3)	
<b>Diarrhea</b>	Yes	77	27(35)	50(65)	0.5(0.2-0.9)
	No	272	148(54.4)	124(45.5)	
<b>Excessive Urination</b>	Yes	127	61(48)	66(52)	1.1(0.7-1.8)
	No	221	114(51.5)	107(48.4)	
<b>Missed Appointments</b>	Yes	193	78(40.4)	115(59.5)	0.4(0.2-0.7)
	No	156	97(62)	59(37.8)	
<b>Missed Appointments due to a lack of Transport</b>	Yes	137	57(41.6)	80(58.3)	0.9(0.5-1.5)
	No	212	118(55.6)	94(44.3)	

**Table 2: Patient Factors Associated with Medication Non-adherence as Measured by Modified Hill-Bone Scale**

Self-report found 174 of 350 patients had not taken their medication as prescribed. The table presents the non-adherence patient factors, as operationalized by self-report and the modified Hill-Bone Compliance Scale [18]. The odds ratio (OR) for non-adherence is a 95 percent confidence interval (CI). According to self-reported information, patients who had received three different antihypertensive drugs were less likely to be non-adherent (or 0.8, 95% confidence interval 0.3-2.0) compared to patients who received a single drug. Patients with diarrhea side effects were less likely to be adherent (OR 0.5, 95% CI 0.2-0.9). The study was published in the Journal of Clinical Oncology. Patients who were

unable to attend their scheduled clinic appointments due to transportation were less likely to adhere to their treatment plan (0.9, 95% (CI) 0.5-1.5). The modified Hill-Bone scale indicated that patients who could correctly name drugs were more likely to adhere to their treatment compared to those who could not (1.4, 95% confidence interval 0.8-2.5). Similarly, as reported in self-reported surveys, individuals who experienced dizziness as a side effect were more likely to adhere to their prescribed treatment [19,20].

#### Health Care System-Related Factors to Non-Adherence

Category	N	Adherence (%)	Non-adherence (%)	OR (95% CI)
<b>Number of Reviews</b>				
0 or 1	54	44 (81%)	10 (19%)	1
2	211	177 (84%)	34 (16%)	0.8 (0.0-2.1)
3	46	33 (71%)	13 (29%)	1.3 (0.5-5.3)
4	27	25 (94%)	2 (6%)	0.3 (0.1-1.8)
5 or more	12	11 (88%)	1 (12%)	0.6 (0.3-6.7)
<b>Spacing of Reviews (months)</b>				
1	33	28 (84%)	5 (16%)	1
2	61	46 (76%)	15 (24%)	1.7 (0.6-4.7)
3	205	176 (86%)	29 (14%)	0.9 (0.4-2.1)
4 or more	25	18 (72%)	7 (28%)	1.3 (0.3-5.6)
<b>Unable to be seen due to late arrival</b>				
Yes	33	27 (82%)	6 (18%)	1.1 (0.4-3.4)
No	317	276 (87%)	41 (13%)	
<b>Reported drugs not available in the pharmacy</b>				

Yes	292	246 (84%)	46 (16%)	0.8 (0.3–1.7)
No	58	50 (86%)	8 (14%)	
<b>Distance from Home to Hospital</b>				
< 5 km	52	43 (83%)	9 (17%)	1
5–10 km	209	180 (86%)	29 (14%)	0.8 (0.3–2.1)
> 10 km	111	88 (79%)	23 (21%)	1.6 (0.6–4.8)

**Table 3: Healthcare System Related Factors Associated with Medication Non-Adherence as Measured by Self-Report (N = 350)**

The majority of the patients (211; 60%) had been visited at least twice within the last six months on the interview day. Three-month review periods were the most frequent and were observed in 205 patients (54%). Using self-reporting (Table 3), non-attenders by appointment due to transport problems were more likely to be non-adherent to antihypertensive medication with an Odds Ratio (OR) of 3.2

and a 95% Confidence Interval (CI) of 1.1–9.5. Proximity to the hospital was also a strong predictor, and residents over 10 km from the hospital correlated with non-attendance ( $P = 0.02$ ). Compliance fell to 79% in those residing over 10 km from 83% in those residing within 5 km. The risk of non-compliance was elevated (OR: 1.6, 95% CI: 0.6–4.8) in this group [21].

Category	N	Adherence (%)	Non-adherence (%)	OR (95% CI)
<b>Number of Reviews</b>				
0 or 1	54	38 (69%)	16 (31%)	1 (ref)
2	211	148 (70%)	63 (30%)	1.0 (0.4–2.7)
3	46	29 (64%)	17 (36%)	1.3 (0.5–2.5)
4	27	21 (78%)	6 (22%)	0.7 (0.2–2.4)
5 or more	12	7 (63%)	4 (37%)	1.4 (0.3–6.7)
<b>Spacing of Reviews (months)</b>				
1	73	54 (74%)	19 (26%)	1
2	61	34 (56%)	27 (44%)	1.7 (0.6–4.7)
3	190	139 (73%)	51 (27%)	0.9 (0.3–2.1)
4 or more	25	18 (70%)	8 (30%)	1.3 (0.3–5.6)
<b>Reported drugs not available in the pharmacy</b>				
Yes	292	200 (68%)	92 (32%)	1.3 (0.6–2.9)
No	58	43 (74%)	15 (26%)	
<b>Distance from Home to Hospital</b>				
< 5 km	52	42 (80%)	10 (20%)	1
5–10 km	209	155 (74%)	54 (26%)	1.4 (0.6–3.6)

**Table 4: Healthcare System Related Factors Associated with Medication Non-Adherence (Modified Hill-Bone Scale, N = 350)**

Furthermore, those patients who were late for their clinical appointments were nearly seven times more likely to be non-adherent than those who were on time. This can be seen from an (OR) of 7.6 and a 95% (CI) of 2.9–20.4, according to the modified Hill-Bone scale (Table 4). Furthermore, those patients who were late for their clinical appointments were

nearly seven times more likely to be non-adherent than those who were on time. This can be seen from an (OR) of 7.6 and a 95% (CI) of 2.9–20.4, according to the modified Hill-Bone scale (Table 4).

#### Care Giver-Related Factors to Non-Adherence

Counseled by	N	Adherence (%)	Non-adherence (%)	OR (CI 95%)
<b>Doctor</b>				
Yes	331	271 (82%)	60 (18%)	--
No	19	19 (100%)	0 (0%)	
<b>Nurse</b>				

Yes	262	210 (80%)	52 (20%)	2.7 (1.0–7.3)
No	88	81 (92%)	7 (8%)	
<b>Other/Family</b>				
Yes	30	27 (90%)	3 (10%)	1.9 (0.4–8.7)
No	320	263 (82%)	57 (18%)	
<b>Total time spent</b>				
<5 minutes	215	168 (78%)	47 (22%)	1
5 minutes or more	135	123 (91%)	12 (9%)	0.3 (0.2–0.8)

**Table 5: Caregiver Factors Associated with Medication Non-Adherence As Measured by Self-Report**

According to self-report (Table 5), patients who were counseled by a nurse were more likely to be non-adherent with an Odds Ratio (OR) of 2.7 and a 95% Confidence Interval (CI) of 1.0–7.3. However, those counseled for more than five

minutes were much more adherent with an OR of 0.3 (95% CI: 0.2–0.8), which shows the duration of counseling was key to improving medication-taking behavior.

Counseled by	N	Adherence (%)	Non-adherence (%)	OR (CI 95%)
<b>Doctor</b>				
Yes	331	231 (70%)	100 (30%)	0.7 (0.2–2.2)
No	19	12 (62%)	7 (38%)	
<b>Nurse</b>				
Yes	262	197 (75%)	65 (25%)	0.4 (0.2–0.7)
No	88	48 (54%)	40 (46%)	
<b>Other/Family</b>				
Yes	320	227 (71%)	93 (29%)	0.5 (0.2–1.3)
No	30	17 (55%)	13 (45%)	
<b>Total time spent</b>				
<5 minutes	215	129 (60%)	86 (40%)	1
5 minutes or more	135	116 (86%)	19 (14%)	0.3 (0.1–0.5)

**Table 6: Caregiver Factors of Medication Non-Adherence Assessed Using Modified Hill-Bone Scale**

In contrast, the modified Hill-Bone scale (Table 6) displayed a distinct pattern. The data showed that patients who received counseling from a nurse were more likely to adhere to their treatment, with an odds ratio of 0.4 (95% confidence interval: 0.2–0.7). Furthermore, individuals who received counseling for more than five minutes showed even better adherence, with an OR of 0.3 and a 95% CI of 0.1–0.5.

The results of this study indicate that although self-reported data suggested a potential risk of non-adherence with nurse counseling, the structured modified Hill-Bone scale emphasized the positive impact of both the type of provider and the duration of counseling in encouraging adherence [22].

		Non-adherence by self-report	Non-adherence to the Hill bone scale
		OR (95% CI)	OR (95% CI)
<b>Gender</b>	Male/Female	0.9(0.5-1.6)	0.5(0.3-0.9)
<b>Income</b>	Low Middle High	1 1.9(0.9-3.8) 3.7(1.5-8.9)	1 0.7(0.4-1.4) 0.5(0.2-1.01)
<b>Family History of Hypertension</b>	Yes No	0.9(0.5-1.7)	0.4(0.2-0.8)
<b>Co-morbidities</b>	Yes No	0.7(0.3-1.7) 0.7(0.2-2.6)	1.1(0.5-2.2) 1.1(0.4-3.3)
<b>Able to Name Drugs</b>	Yes No	1.3(0.7-2.5)	1.4(0.8-2.5)

<b>Side effects (Cough)</b>	Yes No	0.5(0.3-1.0)	1.3(0.8-2.2)
<b>Dizziness</b>	Yes/No	0.7(0.4-1.3)	1.2(0.7 -2.1)
<b>Diarrhea</b>	Yes /No	1.6(0.8-3.2)	0.5(0.2-0.9)
<b>Excessive Urination</b>	Yes No	0.9(0.6-1.4)	1.1(0.7-1.8)
<b>Missed Appointments</b>	Yes No	0.5(0.3-1.0)	0.4(0.2-0.7)
<b>Missed Appointments due to a lack of Transport</b>	Yes No	0.8(0.4-1.5)	0.9(0.5-1.5)

**Table 7: Logistic Regression for Non-Adherence: Self Report and Modified Hill-Bone Scale**

### 3.1. Factors Independently Associated with Non-Adherence by Self-Report

Patients who had previously not attended clinical appointments because they lacked transport were less adherent (OR 0.9, 95% CI 0.5–1.5). Patients with a family history of high blood pressure were less adherent (OR 0.4, 95% CI 0.2–0.8). Patients who experienced side effects of diarrhea were less adherent (OR 0.5, 95% CI 0.2–0.9). Patients with a history of absence from appointments were significantly less adherent (OR 0.4, 95% CI 0.2–0.7) [23].

### 3.2. Factors Independently Associated with Non-Adherence by Modified Hill-Bone Scale

Patients who had missed clinic visits due to a lack of transport were less adherent (OR 0.9, 95% CI 0.5–1.5). Patients with hypertension family history were less adherent (OR 0.4, 95% CI 0.2–0.8). Patients with side effects of cough were less adherent (OR 0.5, 95% CI 0.3–1.0). Patients who had missed visits were significantly less adherent (OR 0.5, 95% CI 0.3–1.0).

## 4. Discussion

The study assessed medication adherence among 350 hypertensive patients and revealed that 174 (49.7%) were non-adherent based on self-reporting. This significant proportion aligns with global data suggesting that nearly half of patients with chronic diseases failed to adhere to prescribed treatment regimens, highlighting a major public health concern. Comorbidities were common, with 72 patients having diabetes mellitus and 79 with heart failure. Comorbid conditions can increase pill burden and complicate treatment regimens, leading to reduced adherence. Interestingly, patients on 3 anti-hypertensive medications were found to be more adherent (OR 0.8; 95% CI 0.3-2.0) compared to those taking only one drug [22,24].

This may reflect more structured clinical management or greater disease awareness among these patients. Side effects significantly influenced adherence. Patients experiencing diarrhea were less likely to be adherent (OR 0.5, 95% CI 0.2-0.9), indicating that adverse drug reactions are a strong deterrent to consistent medication use[25, 26]. Healthcare providers must carefully monitor side effects and provide guidance or alternative treatments to support continued adherence [2,27]. This study explored healthcare system and caregiver-related factors influencing medication nonadher-

ence among hypertensive patients, using both self-reported data and the modified Hill Bone Scale for validation [15]. The findings reveal a multifaceted set of challenges to adherence, emphasizing the importance of addressing logistical, systemic, on communication-based barriers [2,28]. Healthcare system factors significantly impacted adherence factors. Regular clinical reviews reported in 60% of patients within 6 months were not sufficient on their own to ensure adherence. Transportation difficulties emerged as a prominent barrier, with patients reporting missed appointments due to lack of transport showing a significantly higher likelihood of non-adherence (OR:3.2,95% CI 1.1-9.5). This finding underscores the critical need for accessible transport solutions or decentralized care.

models, especially in low-resource settings[29]. Geographical distance from the hospitals also contributed to non-adherence. Patients residing more than 10 km away were more likely to miss appointments ( $p=0.02$ ), and the adherence rate dropped from 83% to 79% compared to those living within 5km. Although the odds ratios from both self-report and Hill-Bone assessments (ORs 1.6 and 1.4, respectively) did not reach statistical significance, the consistent trend suggests proximity influences adherence behavior and warrants consideration in healthcare planning. Timeliness of clinical attendance further emerged as a critical factor. Patients to arrive late are missed appointments were nearly seven times more likely to be non-adherent (OR, 7.6, 9.5% CI: 2.9 to 20.4). This emphasizes the need for a more flexible scheduling system or interventions to mitigate late arrivals, such as appointment reminders or grace periods for consultation. Caregiver factors revealed interesting discrepancies between self-imported and structured data [30].

Self-reports suggested that nurse-led counselling was associated with increased non-adherence (OR: 2.7, 95% CI: 1.0-7.3), which may reflect patient biases or the perceived quality of the interaction. In contrast, the modified Hill-Bone scale indicated that nurse counselling significantly improved adherence (OR: 0.4, 95% CI: 0.2-0.7), highlighting the value of structured, consistent counselling practices. This variability in how counselling is delivered[31]. A consistent finding across both data sources was the positive impact of the longer counselling duration. Patients to receive more than 5 minutes of counselling were significantly more adherent (self-report OR; 0.3, 95% CI 0.2-0.8, Hill-Bone OR; 0.3, 95%

CI 0.1-0.5). [32] This underscores the importance of adequate time in patient/provider interactions to build trust, clarify instructions, and address concerns, critical elements in promoting adherence. Access to healthcare emerged as a major determinant of adherence. Patients who missed clinical appointments due to lack of transport were notably less adherent (OR 0.9, 95% CI 0.5-1.5). This highlights the importance of structural barriers in a healthcare system that impede regular follow-up and medication refill visits. Similarly, general appointments' non-attendance was significantly linked to lower adherence (OR 0.4, 95% CI 0.2-0.7), suggesting that improving appointment attendance through a reminder system or transportation support could enhance medication compliance. [12, 33] According to the modified Hill-Bone Compliance Scale, patients who could name their medication were more likely to be adherent (OR 1.4, 95% CI 0.8 -0.25). This finding suggests that awareness and understanding of one's treatment a key predictor of adherence. [34] Educational interventions targeting medication literacy could therefore be an effective strategy for improving compliance.

Multivariable logistics regression confirmed that missing clinical visits due to transport issues were an independent predictor of non-adherence by both self-report and the Hill-Bone Scale (OR 0.9, 95% CI 0.5-1-5). The correlation between self-report and the Hill-Bone Scale was moderate, reflecting some variation in adherence perceptions versus structure assessment, but overall affirming the consistency of the findings across different measurement tools. This study confirms that medication non-adherence among hypertensive patients is influenced by a combination of patient/related factors (e.g., knowledge and side effects), socioeconomic status, and healthcare system barriers. Interventions to improve adherence should therefore be multi-faceted, addressing transportation challenges, enhancing patient education, managing drug side effects, and supporting regular follow-up tailored to the realities of the patient's environment [2, 35]. The findings emphasize the need for collaborative efforts for the healthcare providers, policymakers, and community health programs to implement sustainable, patient/centered strategies for improving hypertension management [20, 36].

## 5. Conclusion

This study highlights that nearly half of hypertensive patients struggle with medication adherence, driven by a complex interplay of clinical, socioeconomic, and systemic healthcare factors. Key barriers identified include adverse drug effects, limited patient knowledge, transport difficulties, missed appointments, and inadequate counseling duration. Although improved structured counseling and increased provider contact time were found to improve adherence, particularly by nurses, distance from health facilities and absence of transport continue to obstruct regular treatment uptake. This implication means making sure patients have easy access to healthcare, providing them with the right information, helping them manage any side effects from treatments, and offering support systems like reminders, are more flexible care options. Addressing these areas is key to enhancing adherence and, ultimately, better hypertension control and

cardiovascular outcomes.

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