ORIGINAL RESEARCH ARTICLE

Prevalence of Antihypertensive Medication Nonadherence and Its Determinants among Urban Hypertensive Patients in Tirupati: A Community-Based Cross-Sectional Study

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ABSTRACT

Background: Poor adherence to prescribed medication contributes to uncontrolled hypertension and increases the risk of stroke, myocardial infarction, renal failure, heart failure, and blindness, creating a major burden on healthcare systems. The objective was to estimate the prevalence of antihypertensive medication non-adherence among hypertensive patients in urban Tirupati and to identify factors associated with non-adherence.

Methods: This was a community-based cross-sectional study that included 280 patients with known and diagnosed hypertension who had been on antihypertensive medication for a minimum of 6 months and resided in urban areas of Tirupati. Medication adherence was assessed through the eight-item Morisky Medication Adherence Scale (MMAS-8). Data regarding sociodemographic characteristics, health-related factors, and other psychological and social elements were collected.

Results: Among 280 hypertensive patients, 4.6% showed poor adherence, 6.4% moderate adherence, and 88.9% high adherence to anti-hypertensive medication. Lack of awareness about complications increased the odds of non-adherence by 4.7 times (AOR 4.696; 95% CI 1.318–16.725), while tobacco users had 3.5 times higher odds of non-adherence (AOR 3.487; 95% CI 1.216–10.004).

Conclusions: Most hypertensive patients showed high adherence to treatment, with 11.1% being non-adherent. Non-adherence was significantly higher among those unaware of complications of uncontrolled hypertension and those using tobacco.

Keywords: Morisky Medication Adherence Scale (MMAS-8), Urban areas, Medication Adherence, Antihypertensive Agents, Urban Population, Cross-Sectional Studies, blood pressure control

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INTRODUCTION

Hypertension is a prevalent and major public health burden.[1] Hypertension in India constitutes a major health concern, accounting for over fifty percent of stroke fatalities and approximately 24% of the mortality from coronary heart disease (CHD).[2]

The World Health Organization defines medication adherence as "the degree to which the person's behaviour corresponds with agreed recommendations from a health care provider".[3] Medication adherence is an important determinant of treatment success. For people with hypertension to adequately manage their blood pressure, adherence to antihypertensive medication is essential. An international cross-sectional study identified a significant gap in both awareness and control of blood pressure among these individuals.[4] Adherence to a medication regimen requires a series of actions, such as acquiring the prescribed medication, taking it on time with the correct drug, dosage and method of administration, and continuing the treatment for as long as it is required.[5]

A systematic review and meta-analysis found that the pooled prevalence of nonadherence to antihypertensive medications was 45.2%.[6] The effective management of hypertension is crucial for decreasing mortality and morbidity, as well as for minimising healthcare expenses linked to treatment failure.[7]

The asymptomatic and lifelong characteristics of the disease significantly contribute to poor adherence.[8] Additional potential determinants of poor adherence include socio-demographic factors such as age and education, the socioeconomic status of the patient, the patient's awareness and perception of hypertension, the availability of medications and various lifestyle factors.[9] Identifying the factors that influence adherence is essential for enhancing overall compliance and developing targeted interventions to improve hypertension control.[10] The necessity of further research on adherence is being emphasized. A systematic evaluation of non-adherence is crucial for determining its impact on clinical outcomes. Although studies in India have examined treatment adherence among patients with hypertension, most were conducted in hospital settings or in rural[7] and slum populations.[11]

Limited evidence is available from urban community settings, especially in southern India. In addition, factors affecting medication non-adherence differ according to sociocultural conditions and access to healthcare services. The lack of data from urban Tirupati restricts the development of effective, community-specific interventions to improve medication adherence.

This study was conducted to estimate the prevalence of antihypertensive medication non-adherence among hypertensive patients in urban Tirupati and to identify factors associated with non-adherence.

METHODOLOGY

This community-based cross-sectional study was conducted among known and diagnosed hypertensive patients residing in the urban field practice area of the Medical College. Participants included adults aged 30 years and above with essential hypertension who had been receiving antihypertensive treatment for at least six months. Patients with secondary hypertension, pregnant women, individuals with incomplete treatment details or those on medications that might increase blood pressure, as well as those newly diagnosed within the last six months, were excluded from the study. Data were collected from July to December 2024 (6 months). In a Study done in Urban areas of Karnataka, the rate of non-adherence among hypertensives was 24%.[11] Based on these criteria, the minimum required sample size was determined to be 280, calculated using the formula $n = Z(1-\alpha/2)^2 P(1-P)/d^2$ where p=24%, d = 5% of absolute precision, and $Z(1-\alpha/2) = 1.96$ at 95% confidence intervals. There were 1114 known hypertensives in the study area, among them, 280 hypertensives were chosen by simple random sampling using a computer-generated random number table.

Data collection was done utilising a pretested semi-structured questionnaire. The questionnaire was adapted from previously published studies and was pretested in 10% of the sample population outside the study area. Necessary modifications were made for clarity and local relevance. The study tool includes socio-demographic characteristics such as age, sex, education, occupation, marital status, and socio-economic status (Socio-economic status was assessed using the modified BG Prasad classification updated for the year 2024)[12] and type of family, along with habits including tobacco smoking, chewing, and alcohol consumption and information regarding the nature of treatment of hypertension, like number of tablets, frequency of medication, mode of transport to health centre, distance to health centre, duration of treatment, treatment regularity, reasons for irregularity, etc., and questions regarding knowledge of hypertension, it's treatment and prevention.

Blood pressure (BP) was measured according to the standard procedures recommended in the Centers for Disease Control and Prevention (CDC) guidelines for blood pressure assessment.[13] Study participants were asked about the timing of their most recent meal, and data collection was conducted one hour after food intake. Information regarding smoking and alcohol consumption habits was also obtained. None of the participants had smoked or consumed alcohol within 30 minutes prior to data collection.

Prior to blood pressure measurement, hypertensives were instructed to rest in a seated position for at least 10 minutes. Blood pressure was then measured in the right arm using the OMRON 7141T1 Digital Blood Pressure Monitor and recorded in mmHg. Two

measurements were obtained from each participant in the sitting position, and the average of the two readings was used to assess whether the target blood pressure had been achieved.

Controlled or target blood pressure was defined as an average blood pressure of less than 140/90 mmHg based on the average of two readings among hypertensive patients, in accordance with the International Society of Hypertension 2020 guidelines.[14]

Uncontrolled or high blood pressure was defined as an average of two readings taken one minute apart measuring ≥140/90 mmHg, according to the 2020 guidelines of the International Society of Hypertension.[14]

Medication adherence was assessed using the eight-item Morisky Medication Adherence Scale-8. It has eight questions with dichotomous (yes/no) responses, while the final item is rated on a five-point Likert scale ranging from "never" to "always." Overall adherence was determined by the total score obtained from the responses: high adherence was defined as a score of 8, average adherence as 6 to less than 8, and poor adherence as a score of less than 6. For the purpose of analysis, ≥8 was considered as adherent and <8 was considered as non-adherent. We have obtained permission from Donald E. Morisky and the team before using MMAS-8.[15]

Ethical Approval: Written informed consent was obtained from all participants before data collection. Ethics approval was granted by the Institutional Ethics Committee of SVIMS before commencement of the research (RAC No. AS/11/IEC/SVIMS/2017, IEC No. 1279 dated 11.04.2022). The study was conducted in accordance with the guidelines of the STROBE checklist for observational cross-sectional studies.

The collected data were entered into Microsoft Excel for analysis. Categorical variables were summarized using numbers and percentages, while continuous variables were presented as means and standard deviations. The primary outcome (dependent variable) was the proportion of non-adherence to antihypertensive medication. Independent variables included socio-demographic characteristics such as age, sex, education, occupation, marital status, socioeconomic status, and type of family; behavioural factors such as tobacco use (smoking and chewing) and alcohol consumption; and treatment-related factors including number of tablets, dosing frequency, mode of transport to the health centre, distance to the health facility, duration of treatment, treatment regularity, and reasons for irregularity.

The association between categorical variables was assessed using the Chi-square test or Fisher's exact test, as appropriate. Crude odds ratios (ORs) with corresponding p-values were calculated for each independent variable, and those with $p < 0.05$ were included in the multivariable logistic regression model. Statistically significant factors were identified based on adjusted odds ratios (AORs) with 95% confidence intervals and p-values less than 0.05. All the statistical analyses were performed using IBM SPSS Statistics 26th version. A P-value of less than 0.05 was considered significant.

RESULTS

A total of 280 hypertensive patients were included in the study. The mean age of the participants was 60.69 years, with a standard deviation of 10.65 years. Males were 74 (26.4%), and females were 206 (73.6%).

Table 1: Distribution of MMAS grade

MMAS grade	Frequency	Percentage (95% CI)
<6	13	4.6 (95% CI: 2.2-7.1)
6 to <8	18	6.4 (95% CI: 3.6-9.3)
8	249	88.9 (95% CI: 85.3-92.6)
Total	280	100.0

88.9% (95% CI: 85.3-92.6) of hypertensives were highly adherent to medication, 6.4% (95% CI: 3.6-9.3) were in average adherence and 4.6% (95% CI: 2.2-7.1) were poorly adherent to medication. For the purpose of analysis, 8 was considered adherent (88.9% (95% CI: 85.3-92.6), and <8 was considered non-adherent (11.1% (95% CI: 7.4-14.8). (Table 1)

Nonadherence to antihypertensive medication was highest among individuals aged 30–45 years (25%), followed by 46–60 years (12.5%) and >60 years (7.6%), showing a statistically significant decline with increasing age. Females showed greater nonadherence compared to males. Higher nonadherence was also observed among Christians, separated/widowed individuals, semi-professionals, clerical/shop owners/farmers, individuals belonging to socioeconomic class III, those with lower educational status, and members of nuclear families; however, these associations were not statistically significant. Only one participant didn't have ration card and was adherent. (Table 2)

Higher nonadherence to antihypertensive medication was found among patients without comorbidities or family history of hypertension, those lacking knowledge about complications of uncontrolled hypertension, patients on single-tablet or once-daily regimens, individuals collecting medications more than once a month, those on treatment for less than one year, patients taking calcium channel blockers, smokers/alcohol users, individuals with irregular exercise habits, and those with uncontrolled blood pressure. Significant associations with nonadherence were found for poor knowledge regarding complications (3.4% vs 14.7%), shorter duration of treatment (23.3% within one year), irregular treatment-taking behaviour (0% vs 44.3%), smoking/chewing tobacco (21.9% vs 9.7%), and lack of regular exercise (5.3% vs 14.1%). (Table 3)

Among the 31 hypertensives who were irregular

with treatment, the commonest reason for non-adherence was feeling better after taking medication (64.5%), followed by being busy or late for work (51.6%), forgetting to take medicines, and being away on weekends/vacations. (Table 4)

Regarding knowledge of hypertension and its risk factors, less than half of the participants had awareness of the target blood pressure levels and the role of aging and smoking in hypertension control. Around 50% of the participants knew that being overweight is a risk factor for uncontrolled blood pressure, and exercise helps in hypertension control. Awareness regarding complications of uncontrolled hypertension affecting the heart, brain, and kidneys was also limited. A small proportion believed that antihypertensive medication could be stopped once symptoms improved. In contrast, most participants recognized fatty food intake as a risk factor and were aware of the need to restrict salt intake. (Table 5)

Variables found significant in the bivariate analysis were entered into the multivariate logistic regression model. Patients who were not aware of hypertension-related complications were 4.7 times more likely to be non-adherent compared to those who had such awareness (AOR: 4.696; 95% CI: 1.318–16.725). Similarly, hypertensive individuals who smoked or chewed tobacco were 3.5 times more likely to be non-adherent than non-users of tobacco (AOR: 3.487; 95% CI: 1.216–10.004). Even though the variable of taking regular treatment is significant in bivariate analysis, it was not included in the multivariate analysis as it is likely collinear with the outcome (Treatment non-adherence). (Table 6)

Table 2: Association of socio-demographic factors with adherence status among study participants

Variable	Adherence status		Total (%)	P Value
	Adherent (n=249) (%)	Non-Adherent (n=31) (%)		
Age (Years)				
30-45	18 (75)	6 (25)	24	0.035
46-60	98 (87.5)	14 (12.5)	112	
>60	133 (92.4)	11 (7.6)	144	
Sex				
Male	68 (91.9)	6 (8.1)	74	0.344
Female	181 (87.9)	25 (12.1)	206	
Religion				
Hindu /Muslim	217 (89.7)	25 (10.3)	242	0.319
Christian	32 (84.2)	6 (15.8)	38	
Caste				
OC	89 (89.9)	10 (10.1)	99	0.48
OBC	139 (89.7)	16 (10.3)	155	
SC	14 (77.8)	4 (22.2)	18	
ST	7 (87.5)	1 (12.5)	8	
Marital status				
Unmarried	11 (91.7)	1 (8.3)	12	0.944
Married	138 (89)	17 (11)	155	
Separated/Widowed	100 (88.5)	13 (11.5)	113	
Occupation				
Unemployed	165 (88.7)	21 (11.3)	186	0.526
Unskilled (Daily wager)	38 (95)	2 (5)	40	
Semiskilled/Skilled	24(85.7)	4 (14.3)	28	
Clerical/farmer/shop owner	12 (80)	3 (20)	15	
Semi-professional/Professional	4 (80)	1 (20)	5	
Retired	6 (100)	0 (0)	6	
SES (Modified BG Prasad classification 2024)				
Class I	69 (93.2)	5 (6.8)	74	0.076
Class II	52 (89.7)	6 (10.3)	58	
Class III	59 (80.8)	14 (19.2)	73	
Class IV	48 (88.9)	6 (11.1)	54	
Class V	18 (100)	0 (0)	18	
Literacy				
Illiterate	90 (88.2)	12 (11.8)	102	0.814
Primary/Middle	82 (87.2)	12 (12.8)	94	
Secondary	40 (90.9)	4 (9.1)	44	
Higher Education	36 (92.3)	3 (7.7)	39	
Type of Family				
Nuclear	188 (87.9)	26 (12.1)	214	0.5
Joint	5 (100)	0 (0)	5	
Three Generation	56 (91.8)	5 (8.2)	61	
Type of ration card				
White/Pink Card	248 (88.9)	31 (11.1)	279	0.724
No Ration card	1 (100)	0 (0)	1	

Table 3: Association of family history, medication details and habits with adherence status among study participants

Variable	Adherence status		Total (%)	P Value
	Adherent (n=249) (%)	Non-Adherent (n=31) (%)		
Comorbidities				
Yes	156 (90.7)	16 (9.3)	172	0.234
No	93 (86.1)	15 (13.9)	108	
Family members with HTN				
Yes	86 (89.6)	10 (10.4)	96	0.801
No	163 (88.6)	21 (11.4)	184	
Knowledge about complications				
Yes	86 (96.6)	3 (3.4)	89	0.005
No	163 (85.3)	28 (14.7)	191	
No. of Tablets per Day				
1	203 (87.9)	28 (12.1)	231	0.224
2-4	46 (93.9)	3 (6.1)	49	
Frequency of Intake				
OD	211 (87.6)	30 (12.4)	241	0.068
BD/TID/QID	38 (97.4)	1 (2.6)	39	
Collecting Medications				
Once a month	192 (89.7)	22 (10.3)	214	0.447
Twice/Thrice/>3 times in a month.	57 (86.4)	9 (13.6)	66	
Distance to Hospital				
Less than 2 km	148 (87.6)	21 (12.4)	169	0.373
Greater than 2 km	101 (91)	10 (9)	111	
No. of Years of Treatment				
≤ 1 year	23 (76.7)	7 (23.3)	30	0.016
2-5 years	68 (85)	12 (15)	80	
6-10 years	68 (89.5)	8 (10.5)	76	
≥ 10 Years	90 (95.7)	4 (4.3)	94	
Type of Drug				
ACEI/ARBs	49 (92.5)	4 (7.5)	53	0.659
Beta Blockers	24 (92.3)	2 (7.7)	26	
Calcium channel blockers	55 (85.9)	9 (14.1)	64	
Combination and others	121 (88.3)	16 (11.7)	137	
Regularity in Taking Medications				
Regular	210 (100)	0 (0)	210	<0.001
Irregular	39 (55.7)	31 (44.3)	70	
Habit of Smoking/Chewing Tobacco				
Yes	25 (78.1)	7 (21.9)	32	0.038
No	224 (90.3)	24 (9.7)	248	
Alcohol Intake				
Yes	15 (88.2)	2 (11.8)	17	0.925
No	234 (89)	29 (11)	263	
Regular Exercise				
Yes	90 (94.7)	5 (5.3)	95	0.026
No	159 (85.9)	26 (14.1)	185	
Symptoms at the Time of Diagnosis				
Yes	167 (88.8)	21 (11.2)	188	0.94
No	82 (89.1)	10 (10.9)	92	
Advice by Health Care provider				
Yes	244 (88.7)	31 (11.3)	275	0.426
No	5 (100)	0 (0)	5	
Blood pressure status				
Controlled	137 (90.7)	14 (9.3)	151	0.299
Uncontrolled	112 (86.8)	17 (13.2)	129	

Among participants aged ≤60 years, lack of awareness regarding hypertension-related complications was significantly associated with non-adherence to antihypertensive medication (AOR: 9.431; 95% CI: 1.164–76.41). Other factors, such as shorter treatment duration, smoking or chewing tobacco, and lack of regular exercise, were not significantly associated after adjustment. Regression analysis could not be performed for frequency of drug intake because there were no non-adherent individuals in BD/TID/QID group.

In participants aged >60 years, smoking or chewing tobacco showed a significant association with non-adherence (AOR: 6.495; 95% CI: 1.694–24.90). No significant association was observed with awareness regarding complications, frequency of drug intake, treatment duration, or regular exercise. (Table 7)

Table 4: Reasons for irregularity of medications

Reasons for irregularity	Frequency (n=31)*(%)
Having side effects	2 (6.5)
Sick due to other reasons	2 (6.5)
Feeling better	20 (64.5)
Tablets are not available in hospital/clinic	1 (3.2)
Religious beliefs and cultural practices	1 (3.2)
Forgot to take medicine	9 (29)
Poor communication /insufficient patient information	3 (9.7)
Interruptions of daily routine	2 (6.5)
Being busy or late for work	16 (51.6)
Being away on weekend/vacation	8 (25.8)

*One study participant may have multiple responses

Table 5: Knowledge regarding complications and risk factors of uncontrolled blood pressure

Correct Knowledge about	Participants (%)
Target BP	122 (43.6)
Can be cured	53 (18.9)
Affects heart	104 (37.1)
Affects brain	87 (31.1)
Affects Kidney	85 (30.4)
Stop medication	36 (12.9)
Aging is risk factor	129 (46.1)
Smoking is risk factor	97 (34.6)
Eating fatty foods is risk factor	200 (71.4)
Overweight is risk factor	145 (51.8)
Exercise helps in control	170 (60.7)
Salt to be restricted	270 (96.4)

Table 6: Binary logistic regression showing association of non-adherence with various determinants

Variable	COR (95% CI)	P value	AOR (95% CI)	P value
≤60 years of Age (Ref >60 years)	2.085 (0.959-4.533)	0.064	2.111 (0.898-4.960)	0.087
No Awareness about complications (Ref Aware)	4.924 (1.455-16.66)	0.010	4.696 (1.318-16.725)	0.017
OD Frequency of drug intake (Ref BD/TID/QID)	5.403 (0.715-40.81)	0.102	4.249 (0.535-33.714)	0.171
≤1 year of treatment (Ref>1 year of treatment)	2.866 (1.114-7.373)	0.029	2.173 (0.761-6.202)	0.147
Smoking or chewing tobacco (Ref No)	2.613 (1.023-6.676)	0.045	3.487 (1.216-10.004)	0.020
No Regular exercise (Ref doing it)	2.943 (1.092-7.933)	0.033	2.741 (0.976-7.695)	0.056

COR: Crude Odds ratio, AOR: Adjusted Odds ratio, 95% CI: 95% Confidence intervals

Table 7: Subgroup analysis of factors associated with Non-Adherence among hypertensives aged ≤60 years and >60 years

Variable	COR (95% CI)	P value	AOR (95% CI)	P value
Age group ≤60 years				
No Awareness about complications (Ref Aware)	11.611 (1.501-89.79)	0.019	9.431 (1.164-76.41)	0.036
OD Frequency of drug intake (Ref BD/TID/QID)	-		-	
≤1 year of treatment (Ref>1 year of treatment)	2.886 (0.961-8.664)	0.059	2.661 (0.792-8.942)	0.114
Smoking or chewing tobacco (Ref No)	1.178 (0.238-5.824)	0.841	1.471 (0.231-9.372)	0.683
No Regular exercise (Ref doing it)	3.724 (1.033-13.427)	0.045	2.363 (0.611-9.135)	0.213
Age group >60 years				
No Awareness about complications (Ref Aware)	2.077 (0.430-10.035)	0.363	1.708 (0.325-8.967)	0.527
OD Frequency of drug intake (Ref BD/TID/QID)	2.430 (0.298-19.480)	0.407	2.665 (0.300-23.65)	0.379
≤1 year of treatment (Ref>1 year of treatment)	1.562 (0.177-13.772)	0.688	1.257 (0.113-13.92)	0.852
Smoking or chewing tobacco (Ref No)	6.556 (1.782-24.121)	0.005	6.495 (1.694-24.90)	0.006
No Regular exercise (Ref doing it)	2.225 (0.461-10.738)	0.319	2.386 (0.465-12.24)	0.298

COR: Crude Odds ratio, AOR: Adjusted Odds ratio, 95% CI: 95% Confidence intervals
*There was no non-adherent in one of the groups. Hence, Regression could not be performed

Table 8: Subgroup Analysis of Factors Associated with Non-Adherence among Participants with Treatment Duration ≤1 year and >1 year

Variable	COR (95% CI)	P value	AOR (95% CI)	P value
No. of years of treatment ≤1 year				
≤60 years of Age (Ref >60 years)	3.200 (0.326-31.42)	0.318	3.395 (0.187-61.72)	0.409
No Awareness about complications (Ref Aware)	-		-	
OD Frequency of drug intake (Ref BD/TID/QID)	-		-	
Smoking or chewing tobacco (Ref No)	2.667 (0.347-25.50)	0.346	5.048 (0.259-98.57)	0.286
No Regular exercise (Ref doing it)	3.857 (0.396-37.58)	0.245	1.337 (0.082-21.80)	0.839
No. of years of treatment >1 year				
≤60 years of Age (Ref >60 years)	1.733 (0.738-4.065)	0.206	2.039 (0.817-5.086)	0.127
No Awareness about complications (Ref Aware)	3.762 (1.088-13.00)	0.036	3.355 (0.937-12.01)	0.063
OD Frequency of drug intake (Ref BD/TID/QID)	4.073 (0.532-31.16)	0.176	3.277 (0.402-26.69)	0.267
Smoking or chewing tobacco (Ref No)	2.440 (0.830-7.177)	0.105	3.651 (1.125-11.84)	0.031
No Regular exercise (Ref doing it)	2.793 (0.923-8.453)	0.069	3.019 (0.943-9.669)	0.063

COR: Crude Odds ratio, AOR: Adjusted Odds ratio, 95% CI: 95% Confidence intervals
*There was no non-adherent in one of the groups. Hence, Regression could not be performed

Among patients receiving antihypertensive treatment for ≤1 year, none of the variables demonstrated a statistically significant association with non-adherence after adjustment. Regression analysis could not be performed for awareness regarding complications and frequency of drug intake because no non-adherent individuals in one category.

Among participants on treatment for >1 year, smoking or chewing tobacco was significantly associated with non-adherence (AOR: 3.651; 95% CI: 1.125–11.84). No significant association was observed with age group, awareness regarding complications, frequency of drug intake, or regular exercise. (Table 8)

Discussion

In this study, 11.1% (95% CI: 7.4-14.8) were non-adherent to medication. In a similar study done in Warangal population, the medication non-adherence rate in hypertensive population was 8.6%.[16] A similar study done in urban slums of Hyderabad found the non-adherence rate to be 38.3%.[17] The lower non-adherence rate observed in the present study compared to the Hyderabad urban slum study may be attributable to several contextual differences. The Hyderabad study was conducted in urban slum populations characterized by poorer socioeconomic conditions, lower health literacy, unstable employment and greater barriers to healthcare access, all of which may negatively influence medication adherence. In contrast, the present study population had comparatively better access to urban healthcare facilities and antihypertensive medications through government services. A study from Malaysia among patients attending primary health clinics showed non-adherence rate of 46.6%.[18] Differences in educational profile, continuity of care, and awareness regarding hypertension may explain the variation. Methodological differences, including categorization of adherence, sampling characteristics, and participant inclusion criteria, could additionally contribute to the disparity.

A systematic review conducted by Nielsen JØ et al. showed that the pooled percentage of non-adherence among hypertensives in low-and middle-income countries is 63.35%.[19] The substantially high non-adherence reported in global systematic reviews may reflect heterogeneity in healthcare systems, medication affordability, cultural beliefs, and adherence measurement methods across countries. 8.6% patients who participated in the study conducted by Bandi H et al[16] were non-adherent to antihypertensive medications. This finding is similar to this study.

Patients without comorbidities were found to have higher rates of non-adherence in this study. It could be because using multiple medications could be making them perceive themselves as sicker and adhere better to medications.[16,21] In this study, it was observed that the majority of non-adherent hypertensives have been under treatment for less than 1 year (23.3%). Similarly, in the study conducted by Bandi H et al[16] lower medication adherence was reported in patients with ≤1year (24.6%) and in another study by Nair et al states that patients with 1-5 years of hypertension exhibited the lowest adherence (53.6%) compared to those with >10 years.[21]

The majority of nonadherent participants had habit of smoking or chewing tobacco (21.9%), which is similar to the findings of Bandi H et al.[16], non-adherence among smokers was 10.6% and among alcoholics was 12.6%. Nair et al[21] found that lower adherence in those using both alcohol and tobacco (15.9%).

In this study, those who lacked awareness regarding complications were 4.7 times more non-adherent compared to their counterparts and hypertensives with habit of smoking or chewing tobacco had 3.5 times higher odds of being non-adherent to treatment compared to non-tobacco users. Patients lacking awareness about complications were more than four times more likely to be non-adherent, suggesting that inadequate understanding of disease consequences may substantially reduce perceived necessity for long-term treatment adherence. This finding highlights the need for structured patient education programs focusing on stroke, cardiovascular disease, renal complications, and long-term disability associated with uncontrolled hypertension. Similarly, tobacco users were more than three times likely to be non-adherent, indicating that unhealthy behavioural practices may coexist with poor treatment-seeking and medication-taking behaviours. Integrating tobacco cessation counselling into hypertension clinics and community-based NCD programs may therefore improve both adherence and cardiovascular risk reduction.

Future studies should consider longitudinal designs to better understand temporal relationships between behavioural factors and medication adherence. Interventional studies evaluating structured patient education, behavioural counselling, and tobacco cessation strategies may help identify effective approaches for improving adherence. Further research in rural settings and other sociocultural contexts would also be useful to validate and generalize the present findings.

Strengths and Limitations

The strength of the study was that it was a community-based study and was done in urban hypertensives; most of the previous studies were conducted in hospital patients. The questionnaire included not only medical factors but also social, demographic, knowledge and psychological factors. This study has several limitations. Because of the cross-sectional study design, causal relationships between identified determinants and medication non-adherence cannot be established. Since it was conducted in an urban area, the results may not accurately reflect the rural

population and patients in healthcare facilities. Additionally, the use of self-reported adherence measures such as MMAS-8 may have introduced social desirability bias, with participants potentially over-reporting adherence behaviours. The multivariable logistic regression showed wide confidence intervals for some variables, likely due to the relatively small number of non-adherence events, which may have limited the precision of effect estimates. Although a high proportion of participants demonstrated adherence to antihypertensive medications, the findings should be interpreted cautiously because adherence assessment was based on self-reported responses, which may overestimate true adherence behaviour because of possible social desirability bias in self-reporting.

Conclusion

Medication non-adherence was observed in 11.1% of hypertensive patients. Lack of awareness regarding complications of uncontrolled hypertension and tobacco use were associated with non-adherence independently. The findings emphasize the importance of sustained patient education and counseling on disease complications, behavioural modification, and lifestyle measures to improve adherence among hypertensive patients. Health-care providers should emphasize continuous motivation, reinforcement of knowledge, and cessation of tobacco use as key strategies to ensure better long-term blood pressure control and prevention of complications. Targeted educational interventions and integration of tobacco cessation services into hypertension management programs may improve medication adherence and long-term blood pressure control.

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Availability of Data: The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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