

Treatment Adherence, Lifestyle Behaviour, and Complication Profile Among Urban Hypertensive Patients: A Community-Based Cross-Sectional Study

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Abstract

Background: Cardiovascular complication largely attributed to the combination of poor adherence to therapy, unhealthy lifestyle habits and presence of end organs is one of the greatest preventable causes of cardiovascular mortality and morbidity worldwide, but the same triad of therapy adherence, lifestyle behaviour, and end organ complication remains inadequately described in urban Indian community settings. The aim of the study was to identify the prevalence and profile of complications associated with hypertension in an urban field practice setting in adults and test associations between medication adherence, dietary and physical activity behaviour and the presence of these complications. **Material and Methods:** A community based cross sectional study was done amongst 330 confirmed hypertensive adults by simple random sampling from a hypertension register in a field practice area in the urban area. The Morisky Medication Adherence Scale (MMAS) was used as a tool to evaluate medication adherence. Blood pressure and anthropometric Indices were recorded using calibrated instruments according to the standard procedure. Chi-square and logistic regression ($p < .05$ significance level) were used to test associations. **Results:** Hypertension-related complications were identified in 58 participants (17.6%). Cardiovascular disease was the most prevalent complication (3.9%), followed by nephropathy and neuropathy (each 2.4%), stroke (1.8%), and retinopathy (1.5%). High medication adherence was documented in 69.1% of participants. Forgetfulness was the principal barrier to non-adherence (56.9%). Overall adherence category did not differ significantly between those with and without complications ($\chi^2 = 0.673$, $p > 0.05$); however, adherence type was significantly associated with complication pattern ($p = 0.022$), with low adherence over-represented among cardiovascular disease (9.7%) and stroke (6.5%) cases. Healthy dietary practice was strongly protective against complications ($\chi^2 = 12.73$, $p < 0.001$). **Conclusion:** Despite high adherence rates, complications remain common, showing that medicines alone are not enough. Improving diet quality and addressing specific adherence-complication links should be priority targets for comprehensive, community based interventions.

Keywords: Hypertension; medication adherence; lifestyle modification; cardiovascular complications; urban community; MMAS; India.

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INTRODUCTION

Hypertension is one of the primary non-communicable diseases of today, impacting more than 1.13 billion individuals globally and accounting for substantial early deaths among those that die from cardiovascular diseases and stroke.^[1] South Asia is particularly affected. According to the statistics; India has more than 220 million adults with hypertension and the figure is increasing tremendously with urbanisation, changing demographics.^[1,2]

Over time, high blood pressure can cause damage to blood vessels and organs, causing heart disease, stroke, kidney disease and eye disease. In fact, the prevalence of hypertension in urban India has increased by nearly three decades in last 30 years whereas the prevalence in rural areas doubled.^[1,3,4] It is found that 14.6-32.9% of urban dwellers are hypertensive depending on age and survey methods, with males consistently being the more affected.^[5,6] than women, partly due to stress, tobacco and alcohol use, and differences

in health seeking behaviour.^[7,8]

Urbanisation increases health risk through sedentary occupation, high-sodium and processed-food consumption, ambient environmental pollution, and disrupted sleep architecture.^[5,9,10]

The lifestyle profile of urban hypertensive patients shows multiple overlapping behavioural risks. Almost 90% are working in sedentary jobs. Nearly half are overweight and 14% are obese, which is much higher than the percentage of overweight or obese

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people in rural areas. Besides, psychological tension is reported significantly more often in urban than in rural areas (27.6% versus 7.1%).^[12] These factors do not operate in isolation, but act in concert to promote the onset and aggravate the severity of hypertension.^[12,13]

Though the urban centres have relatively better health infrastructure, the control rate of blood pressure is still poor. Multidimensional strategies, including regimen simplification and patient education, monitoring and psychosocial support, have been increasingly supported by evidence as the most promising way to enhance the ability of treated urban hypertensives to reach and maintain the BP control targets set by guidelines.^[18,20]

To overcome this, this study sought to examine: (i) the prevalence and distribution of hypertension-related complications; (ii) the medication adherence and key barriers to non-adherence; and (iii) the association of medication adherence, dietary and physical activity behaviour, and hypertension-related complication occurrence.

MATERIALS AND METHODS

Study Design and Setting: This community-based cross-sectional study was conducted within the urban field practice area of a Department of Community Medicine at a medical institution in Hyderabad Telangana. The area is served by an Urban Health Training Centre (UHTC) that maintains a periodically updated hypertension registry.

Study Population and Eligibility: The study population comprised adults aged 18 years or above with a confirmed diagnosis of primary hypertension who had resided in the study area for a minimum of six months and provided written informed consent. Pregnant women and those unwilling or unable to participate were excluded.

Sample Size and Sampling: Sample size was determined using the formula $n = 4pq/d^2$, with a prevalence estimate (p) of 0.2875 derived from regional epidemiological data, yielding a minimum of 327.5, rounded to 330 participants. Participants were recruited by simple random sampling from the UHTC hypertension registry using a random number table.

Data Collection: Structured interviews were conducted at participants' residences or during clinic visits. The schedule captured sociodemographic characteristics, hypertension

duration and treatment history, medication adherence, and lifestyle factors including dietary practices, habitual physical activity, tobacco and alcohol use, and self-reported psychological stress. Hypertension-related complications were ascertained from documented medical histories and available investigation reports.

Medication adherence was measured using the Morisky Medication Adherence Scale (MMAS), a validated self-report instrument that classifies adherence as high (score 8), moderate (score 6–7), or low (score < 6).

Clinical and Anthropometric Measurements: Blood pressure was recorded following WHO recommendations: participants were seated for five minutes, and two readings were taken five minutes apart using calibrated electronic digital sphygmomanometers; the mean was taken as the final value. Height, weight, and waist circumference were measured using standardised techniques. BMI was computed as weight (kg) divided by height squared (m²).

Ethical Considerations: Ethical clearance was obtained from the Institutional Ethics Committee prior to study initiation. Written informed consent was obtained from every participant. Data confidentiality and anonymity were maintained throughout.

Statistical Analysis: Data were entered in Microsoft Excel and analysed using IBM SPSS version 26. Categorical variables are presented as frequencies and percentages; continuous variables as mean $\pm$ standard deviation. Chi-square test assessed associations between categorical variables; independent samples t-test compared continuous measures between groups. Binary logistic regression identified independent predictors of complication occurrence. A two-tailed p-value of less than 0.05 was considered statistically significant.

RESULTS

Sociodemographic and Clinical Characteristics: A total of 330 hypertensive patients participated. The largest age group was 41–50 years (29.7%), followed by 51–60 years (26.7%). Women constituted 58.2% of the sample. The overwhelming majority (86.6%) belonged to the upper-lower socioeconomic stratum; 61.8% resided in nuclear families. Family history of hypertension was present in 42.7%. Hypertension duration exceeded five years in 50.3% of participants. Regular medication use was reported by 95.5% and regular healthcare attendance by 93.6%, whereas only 33.3% engaged in regular physical activity [Table 1].

Table 1: Sociodemographic and Clinical Characteristics of Study Participants (N = 330)

Characteristic	Category	n	%
Age (years)	<40	42	12.7
	41–50	98	29.7
	51–60	88	26.7
	61–70	75	22.7
	>70	27	8.2
Sex	Female	192	58.2
	Male	138	41.8
Socioeconomic class	Upper middle	10	3.1
	Lower middle	34	10.3
	Upper lower	286	86.6
Family history of HTN	Yes	141	42.7
	No	189	57.3
Family type	Nuclear	204	61.8
	Joint	126	38.2
HTN duration	>5 years	166	50.3

	≤5 years	164	49.7
Regular physical activity	Yes	110	33.3
	No	220	66.7
Regular medication use	Yes	315	95.5
	No	15	4.5
Regular healthcare visits	Yes	309	93.6
	No	21	6.4

Prevalence and Distribution of Complications: Fifty-eight participants (17.6%) had at least one documented hypertension-related complication; 295 (89.4%) reported none. Cardiovascular disease was the most frequent

complication (3.9%; n = 13), followed by nephropathy and neuropathy (each 2.4%; n = 8), stroke (1.8%; n = 6), and retinopathy (1.5%; n = 5) [Table 2].

Table 2: Distribution of Hypertension-Related Complications (N = 330)

Complication	Frequency (n)	Percentage (%)
Cardiovascular disease	13	3.9
Nephropathy	8	2.4
Neuropathy	8	2.4
Stroke	6	1.8
Retinopathy	5	1.5
No complication	295	89.4

Medication Adherence Levels and Barriers: High adherence was observed in 228 participants (69.1%), moderate adherence in 71 (21.5%), and low adherence in 31 (9.4%). Among the 58 participants with complications, 38 (65.5%) were classified as high adherers, 15 (25.9%) as

moderate, and five (8.6%) as low adherers. The distribution of adherence levels did not differ significantly between those with and without complications ($\chi^2 = 0.673$, $p > 0.05$) [Table 3].

Table 3: Treatment Adherence Level by Complication Status (N = 330)

Adherence Level	With Complications	Without Complications	Total
Low	5 (8.6%)	26 (9.6%)	31
Moderate	15 (25.9%)	56 (20.6%)	71
High	38 (65.5%)	190 (69.9%)	228
Total	58	272	330

Forgetfulness was the predominant barrier to non-adherence (56.9%), followed by insufficient understanding of the need

for ongoing treatment (29.4%) and cost-related constraints (13.7%) [Table 4].

Table 4: Reasons for Non-Adherence to Antihypertensive Therapy

Reason for Non-Adherence	Frequency (n)	Percentage (%)
Forgetfulness	188	56.9
Lack of understanding of treatment necessity	97	29.4
Cost-related barriers	45	13.7

Adherence Category and Type of Complication: Stratification by complication type revealed a statistically significant association with adherence category ($p = 0.022$). The proportion of cardiovascular disease was highest among low adherers (9.7%) relative to moderate (3.5%) and high

adherers (3.3%). Stroke followed a similar gradient: 6.5% in the low adherence group versus 2.4% in moderate and 0.9% in the high adherence group. Neuropathy was confined to the high adherence group in this sample [Table 5].

Table 5: Association Between Adherence Category and Complication Type

Adherence	CVD	Nephropathy	Neuropathy	Stroke	None	Total
High (n=214)	7 (3.3%)	3 (1.4%)	8 (3.7%)	2 (0.9%)	194 (90.7%)	214
Moderate (n=85)	3 (3.5%)	5 (5.9%)	0 (0%)	2 (2.4%)	75 (88.2%)	85
Low (n=31)	3 (9.7%)	0 (0%)	0 (0%)	2 (6.5%)	26 (83.9%)	31

Lifestyle Behaviour and Complication Status: Dietary pattern was significantly associated with complication occurrence. Among participants maintaining a healthy diet, 8.9% had complications compared with 27.1% of those with non-healthy dietary practices ($\chi^2 = 12.73$, $p < 0.001$) [Table 6]. Behavioural profiling of participants with

complications identified high salt intake in 70.7% (41/58), physical inactivity in 74.1% (43/58), and poor medication adherence in 94.8% (55/58). Conversely, healthy dietary behaviour and adequate physical activity were more prevalent among those without complications.

Table 6: Dietary Pattern and Complication Status

Dietary Pattern	Complications Present	No Complications	χ^2	p-value
Healthy diet	25 (8.9%)	256 (91.1%)	12.73	<0.001
Non-healthy diet	13 (27.1%)	35 (72.9%)	—	—

DISCUSSION

This study examined three significant factors when it comes to managing hypertension: patient compliance in taking prescriptions, lifestyle and the complications patients can experience. There was a clear paradox revealed by the findings. Despite the majority patients taking the drugs regularly, many still experienced complications. It also indicates that no harm will happen if you only take medicines. If a patient does not make healthy changes and rarely checks them, then they are going to continue to be at risk. Both adherence to antihypertensive therapy and lifestyle change are important to the management of hypertension.

In this study, the adherence of patients was high in 69.1% of cases. This result is comparable to previous studies in urban centres of India. As an example, in the national Hypertension Diagnosis, Treatment, and Control survey, 83.2% of treated urban hypertensives had good adherence. Improved adherence has been attributed to increased access to health care, more frequent health care visits, and increased availability of generic drugs²¹ and to structured primary care and higher level of health literacy in urban areas.^[22]

However, the overall adherence to medication was not significantly associated with the presence of complications ($\chi^2 = 0.673$; $p > 0.05$). This doesn't imply that adherence is not crucial. This study was a cross sectional study which was the only measurement; one single time. Years of poorly managed blood pressure cause damage to the heart, kidneys and blood vessels to occur slowly. The patients with existing problems may have done some improvement in their adherence later, after their diagnosis or counselling. Another study also showed that patients' awareness of the disease often leads to greater attention to the use of medicines, and in turn decreases differences observed in cross sectional data.^[23]

But dichotomous comparison of complications by adherence was significant ($p = 0.022$). Low adherence patients had a higher prevalence of cardiovascular disease (9.7%) and stroke (6.5%) than did high adherence patients (3.3% and 0.9%). This indicates that over time, those who don't follow the advice may be more likely to have complications, particularly related to the damage to blood vessels.

Forgetfulness was the main reason for not taking medicines, reported by 56.9% of patients. This finding is similar to other studies. For example, a hospital based cross sectional study in North India found that forgetfulness was the most common reason for missing doses, more frequent than financial problems or lack of awareness. The study noted that patients had fair knowledge of hypertension, but behavioural barriers like forgetfulness still limited adherence.³⁰ Other studies in South Asia also reported high rates of forgetfulness (around 48%), which were much higher than financial problems (18%) or the belief of being healthy without symptoms (12%).²⁴ In another study, Sharif et al. found that forgetfulness was the leading cause of irregular medicine use

(20.3%) in Bangladesh, with work stress as another factor.^[25]

In this study, cost was the least common reason for non adherence (13.7%). This may be because patients in urban areas often have access to subsidised generic medicines and primary care through urban health centres reducing out of pocket expenses. The important point is that forgetfulness is a behavioural issue. This means it can be improved with simple, low cost solutions like pill boxes, mobile reminders. Community health workers can also support patients by giving reminders during home visits.

This study found a strong protective effect of healthy dietary practices against complications ($\chi^2 = 12.73$, $p < 0.001$). In a randomised clinical trial showed that following the DASH diet, along with exercise and weight management, reduced blood pressure in patients with resistant hypertension.^[26] The benefits of the DASH diet go beyond lowering blood pressure. It reduces sodium intake, increases potassium and magnesium, and boosts antioxidants. These changes help protect blood vessels and slow down harmful structural changes.

In this study, high salt intake was common among patients with complications (70.7%).^[27] Excess sodium leads to water retention, increased blood volume, and left ventricular hypertrophy. Physical inactivity was also a significant problem.²⁸ 33.3% of every participant was active and 74.1% of the people with complications were not active. Poor diets and insufficient physical activity make a team player that needs to be tackled through community initiatives. These programs should aim at both diet and physical activity, and should not be broken down into these two components.

Complications occurred in 17.6% of patients in this study, less than the typical complication rate reported by hospital based studies. Most patients in our study were compliant with their medications (95.5%) and this may be due to the fact that the study was community based. The most common complication was due to heart disease (3.9%), as would be expected, because hypertension most often affects the heart.

1.5% of patients had eye related complications (retinopathy). Although this number is small, it's important. We found a low prevalence compared to large studies that reported an increased risk of heart disease within the next 5-13 years even in mild cases of hypertensive retinopathy.^[29] This may be due to the community-based nature of this study, most of whom were regular drug users and had good healthcare follow-up. The results highlight the need to include a regular eye screening component in the community-based hypertension care provided to prompt detection and prevention of chronic complications.

In this study, the majority of participants indicated taking regular medicine (95.5%) and making frequent visits to health care (93.6%). However, 17.6% of participants still experienced complications, and the levels of physical activity were still low. This mirrors the 'paradox of hypertension' common in urban India of giving the medicines and failing to get them under good control. The pattern has been the same in national survey data, as well – even with high adherence, less than half of treated patients

achieve the target blood pressure.^[12] Similarly, Choudhry et al., in their American Heart Association scientific statement on medication adherence and blood pressure control, state that adherence alone is not enough – other co-components of effective blood pressure control, such as lifestyle modification, evidence-based regimen selection, home blood pressure monitoring and psychosocial support, are all necessary.^[20]

There are some strengths and limitations in this study. One of its great advantages is that it employed a community-based sample, instead of the selection that is typical in hospital-study settings. Adherence was assessed with a well-validated instrument (MMAS), and type of complications assessed in large enough sample to do the primary objective of the main study.

Meanwhile, there are crucial restraints. The study is cross sectional so that it cannot demonstrate a cause and effect relationship between adherence, blood pressure control and complications. Information on adherence and lifestyle was based on self report, which may be influenced by social desirability bias. Complications were not screened for by standard methods, and were detected from medical records and self-reported by participants; this means that early complications were likely to be missed from medical records, particularly cases of retinopathy and kidney disease. Lastly, the study was limited to one urban field practice area, which might not be representative of the other urban areas in India, which may have varying socioeconomic and healthcare access statuses.

CONCLUSION

The findings from this community-based study indicate that a high proportion of the urban hypertensive patients stated a good adherence to therapy and to seeking care; however, complications were still observed. Stylish habits (specifically, low physical activity and unhealthy eating habits) had been strongly associated with these complications, and healthy diet was protective. The most frequently reported lack of adherence factors were related to forgetfulness, stressing the importance of behavioural support strategies.

The results highlight the importance of addressing hypertension not just with medication but also through several other approaches in urban India. Simplification of treatment, structured diets, supervised exercise, reminders to combat forgetfulness, and periodic blood pressure measurement should be incorporated into programmes. Mobile deployment of these services via Community Health Workers and digital platforms presents a realistic approach to enhancing preventability and a means of keeping complications low in city dwellers.

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Conflicts of interest

There are no conflicts of interest.

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