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Barriers to Achieving Blood Pressure Control among Patients with Hypertension in the Community: A Community-Based Cross-Sectional Study.

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Abstract

Background: Hypertension is one of the major risk factors for cardiovascular disease. Despite the availability of effective treatment, many patients fail to achieve adequate blood pressure control. Patient-related, treatment-related and health-system-related factors may contribute to poor blood pressure control. Identifying these barriers is important for improving hypertension management at the community level. ***Objectives:*** To determine the proportion of hypertensive patients achieving blood pressure control and to identify patient-related, treatment-related and health-system-related barriers associated with uncontrolled hypertension. ***Methods:*** A community-based cross-sectional study was conducted among 400 adults with previously diagnosed hypertension in an urban community. Participants were selected using systematic random sampling. Sociodemographic details, lifestyle practices, medication adherence, treatment-related factors and health-system-related barriers were assessed using a structured questionnaire. Blood pressure was measured using a validated automated blood pressure monitor. Blood pressure control was defined as systolic blood pressure <140 mmHg and diastolic blood pressure <90 mmHg. Factors associated with uncontrolled hypertension were assessed using chi-square test and multivariable logistic regression. ***Results:*** Of the 400 participants, 168 (42.0%) had controlled blood pressure, while 232 (58.0%) had uncontrolled blood pressure. Poor medication adherence was reported by 38.8% of participants. High dietary salt intake (46.5%), inadequate physical activity (51.3%) and lack of regular blood pressure monitoring (40.5%) were commonly reported barriers. Among treatment-related factors, adverse effects of medication and difficulty following the prescribed regimen were reported by 18.5% and 22.0% of participants, respectively. Health-system-related barriers included irregular availability of medicines (27.5%), long waiting time at health facilities (24.0%) and inadequate counselling regarding lifestyle modification (31.8%). Poor medication adherence, high salt intake, inadequate physical activity and inadequate counselling were significantly associated with uncontrolled hypertension. On multivariable analysis, poor medication adherence and inadequate physical activity remained independently associated with uncontrolled blood pressure. ***Conclusion:*** A substantial proportion of hypertensive patients in the community did not achieve adequate blood pressure control. Patient-related barriers were the most commonly reported barriers, followed by health-system-related and treatment-related barriers. Improving medication adherence, lifestyle modification counselling and regular blood pressure monitoring may improve hypertension control at the community level.

Keywords: Hypertension; Blood Pressure Control; Medication Adherence; Barriers; Primary Health Care; Community Medicine; Lifestyle Modification.

INTRODUCTION

Hypertension is one of the most important modifiable risk factors for cardiovascular disease, stroke, chronic kidney disease and premature mortality.1 The burden of hypertension has increased considerably with population ageing, urbanisation, unhealthy dietary practices, physical inactivity and increasing prevalence of obesity. Although hypertension can be effectively managed with lifestyle modification and antihypertensive medications, adequate blood pressure control remains a major public health challenge.1,2

Blood pressure control depends on several factors. Patient-related factors such as poor medication adherence, high salt intake, physical inactivity, tobacco and alcohol use, inadequate knowledge and financial difficulties may interfere with effective management. Some patients may discontinue medication after their blood pressure becomes normal or may avoid regular treatment because of perceived adverse effects.3–5

Treatment-related factors may also contribute to poor blood pressure control. Patients receiving multiple medications may have difficulty following the prescribed regimen. Adverse effects, frequent dosing and lack of understanding regarding the importance of continued treatment can reduce adherence. Inadequate follow-up and delayed treatment modification may further contribute to persistent uncontrolled hypertension.

Health-system-related factors are particularly important from a Community Medicine perspective. Limited availability of medicines, inadequate counselling, long waiting time, difficulty accessing healthcare facilities and irregular blood pressure monitoring may affect long-term hypertension management. These factors can be especially important in primary healthcare settings, where regular follow-up and continuity of care are essential.

Most studies on hypertension have focused on prevalence, risk factors and treatment adherence. However, fewer studies have simultaneously examined patient-related, treatment-related and health-system-related barriers among patients with established hypertension. Understanding these barriers can help healthcare providers develop interventions that address the actual reasons for poor blood pressure control rather than focusing only on prescribing medication.

Therefore, the present study was undertaken to assess blood pressure control among patients with hypertension in the community and to identify the patient-related, treatment-related and health-system-related barriers associated with uncontrolled hypertension.

Rationale of the study

Hypertension control requires more than prescribing antihypertensive medication. Patients need to follow treatment regularly, adopt appropriate lifestyle practices and receive continuous support from the healthcare system. Identification of barriers at different levels can help in developing targeted interventions through primary healthcare services.
The findings of such a study may help community health workers and primary healthcare providers to identify patients at greater risk of uncontrolled hypertension and provide focused counselling, follow-up and treatment support.

Research question

What are the patient-related, treatment-related and health-system-related barriers associated with uncontrolled blood pressure among patients with hypertension in the community?

Hypothesis

Patients experiencing significant patient-related, treatment-related or health-system-related barriers are more likely to have uncontrolled blood pressure than patients without these barriers.

Objectives

The primary objective was to identify the barriers associated with uncontrolled blood pressure among patients with hypertension in the community. Secondary objectives were to determine the proportion of patients with hypertension who have controlled and uncontrolled blood pressure, to assess patient-related barriers to achieving blood pressure control, to assess treatment-related barriers to achieving blood pressure control, to assess health-system-related barriers to achieving blood pressure control, to determine the association between identified barriers and uncontrolled blood pressure and to identify independent predictors of uncontrolled blood pressure using multivariable analysis.

MATERIALS AND METHODS

Study design

A community-based cross-sectional study was conducted to assess barriers to blood pressure control among adults with previously diagnosed hypertension. The study was conducted in the field practice area of the Department of Community Medicine of a tertiary care teaching hospital in India. The field practice area consisted of both urban and peri-urban populations and was served by an urban primary health centre and community health workers. The study was conducted over a period of 12 months, from June 2025 to May 2026.

Study population comprised of adults aged ≥18 years with previously diagnosed hypertension were included in the study. Hypertension was considered to be present if the participant had been previously diagnosed with hypertension by a qualified healthcare professional, or was currently taking antihypertensive medication.

Inclusion criteria

Participants were included if they:

1. Were aged 18 years or above.
2. Had a previous diagnosis of hypertension.

3. Had been receiving antihypertensive treatment for at least 3 months.
4. Were residing in the study area for at least 6 months.
5. Provided written informed consent.

Exclusion criteria

Participants were excluded if they:

1. Were seriously ill at the time of data collection.
2. Were unable to participate in the interview because of severe cognitive or communication difficulties.
3. Were pregnant.
4. Had an acute medical condition requiring immediate referral.
5. Were unwilling to participate.

Sample size

The sample size was calculated using the formula for estimating a single proportion. Based on a previous study, the expected proportion of patients with uncontrolled hypertension was assumed to be 60%.

Using:

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

Where:

- Z = 1.96 at 95% confidence level
- p = 60%
- q = 40%
- d = 5% absolute precision

The calculated sample size was minimum 369 participants. After considering non-response rate, the required sample size was inflated to 400 participants.

Sampling technique

A list of patients with previously diagnosed hypertension was obtained from the records of the urban primary health centre and community health workers. Eligible participants were selected using systematic random sampling. The sampling interval was calculated based on the estimated number of eligible hypertensive patients in the study area and the required sample size. Participants were contacted at their homes and were invited to participate in the study.

Data collection

Data were collected using a pretested semi-structured questionnaire administered by trained investigators. The questionnaire consisted of five sections:

The questionnaire consisted of five sections. Section A assessed sociodemographic characteristics, including age, sex, education, occupation, socioeconomic status, marital status, residence, and family history of hypertension. Section B assessed clinical characteristics, including duration of hypertension, diabetes mellitus, cardiovascular disease, chronic kidney disease, number of antihypertensive medications, duration of treatment, and recent medical visits.

Section C assessed patient-related barriers such as medication forgetfulness or intentional discontinuation, high salt intake, inadequate physical activity, tobacco and alcohol use, difficulty following dietary advice, inadequate knowledge, financial difficulties, and the perception that medication was unnecessary when blood pressure was normal. Section D assessed treatment-related barriers, including adverse effects, medication burden, dosing frequency, difficulty following or understanding the prescribed regimen, frequent medication changes, difficulty obtaining medicines, and lack of perceived treatment benefit.

Section E assessed health-system-related barriers, including distance to the health facility, waiting time, medicine availability, consultation costs, availability of healthcare personnel, regularity of BP monitoring, adequacy of counselling, follow-up appointment difficulties, and continuity of care.

Blood pressure measurement: It was measured using a validated automated digital blood pressure monitor. Participants were asked to avoid tea, coffee, smoking and vigorous physical activity for at least 30 minutes before measurement. The participant was seated comfortably for at least 5 minutes before measurement.

The arm was supported at heart level and an appropriately sized cuff was used. Two BP measurements were taken at an interval of approximately 1–2 minutes. The average of the two readings was used for analysis. If the difference between the two systolic BP measurements was more than 10 mmHg, a third measurement was taken and the average of the two closest readings was recorded.

Definition of blood pressure control: For this study, controlled blood pressure was defined as: SBP <140 mmHg and DBP <90 mmHg. Participants with: SBP ≥140 mmHg and/or DBP ≥90 mmHg were classified as having uncontrolled blood pressure.

Assessment of medication adherence: Medication adherence was assessed using a validated medication-adherence questionnaire. Participants were classified into, Good adherence, Moderate adherence and Poor adherence. For analysis, participants with moderate or poor adherence were considered to have suboptimal medication adherence.

Assessment of barriers: Each barrier was initially recorded as present or absent. For exploratory analysis, the barriers were grouped into three domains: Patient-related Forgetfulness, salt intake, inactivity, lack of knowledge; Treatment-related Adverse effects, multiple medicines, complex regimen; Health-system-related Medicine availability, waiting time, inadequate counselling. A barrier score was also calculated by assigning one point for each barrier reported. Higher scores indicated a greater number of perceived barriers.

Statistical analysis

Data were entered into Microsoft Excel and analysed using statistical package for social sciences V 26.0 (IBM, USA) software. Continuous variables were expressed as mean ± standard deviation or median with interquartile range, depending on the distribution of data. Categorical variables were expressed as frequency and percentage. The association between categorical variables and blood pressure control was assessed using the Chi-square test or Fisher's exact test, as appropriate.

Continuous variables were compared using the independent samples t-test or Mann–Whitney U test, depending on data distribution. Variables showing an association with uncontrolled hypertension in the univariable analysis were considered for multivariable logistic regression. Uncontrolled blood pressure was considered the dependent variable. Adjusted odds ratios (AOR) with 95% confidence intervals were reported. A p-value <0.05 was considered statistically significant.

Ethical considerations: Ethical approval was obtained from the Institutional Ethics Committee before commencement of the study. Written informed consent was obtained from all participants. Participants identified with markedly elevated blood pressure during the study were referred to the appropriate healthcare facility for further evaluation and management. Participant confidentiality was maintained throughout the study.

RESULTS

Table 1. Sociodemographic characteristics of study participants

Variable	Frequency (n=400)	Percentage
Age (years)		
18–39	24	6.0
40–59	166	41.5
≥60	210	52.5
Sex		
Male	218	54.5
Female	182	45.5
Residence		
Urban	248	62.0
Peri-urban	152	38.0
Education		
No formal education	72	18.0
Primary/secondary	194	48.5
Higher secondary	78	19.5
Graduate and above	56	14.0
Occupation		
Employed	132	33.0
Homemaker	118	29.5
Retired	84	21.0
Unemployed/other	66	16.5

The mean age of the participants was **61.4 ± 11.2 years**. More than half of the participants were aged ≥60 years.

Table 2. Clinical characteristics of participants (multiple responses)

Clinical characteristic	Frequency (n=400)	Percentage
Duration of hypertension ≥5 years	238	59.5
Diabetes mellitus	156	39.0
Dyslipidaemia	128	32.0
Previous cardiovascular disease	46	11.5
Chronic kidney disease	24	6.0
Family history of hypertension	286	71.5
Taking ≥2 antihypertensive drugs	214	53.5
Regular follow-up	268	67.0
Regular home BP monitoring	94	23.5

The majority of participants had hypertension for ≥5 years. More than half were receiving two or more antihypertensive medications.

Table 3. Blood pressure status among study participants

Blood pressure status	Frequency	Percentage
Controlled	168	42.0
Uncontrolled	232	58.0
Total	**400**	**100.0**

The mean systolic blood pressure was **146.8 ± 18.4 mmHg**, while the mean diastolic blood pressure was **86.9 ± 10.2 mmHg**. Overall, **58.0% of participants had uncontrolled blood pressure**.

Several patient-related barriers were identified. The most commonly reported barrier was **inadequate physical activity (51.3%)**, followed by **high salt intake (46.5%)** and **poor medication adherence (38.8%)**.

Table 4. Patient-related barriers to blood pressure control

Patient-related barrier	Frequency (n=400)	Percentage
Inadequate physical activity	205	51.3
High salt intake	186	46.5
Poor medication adherence	155	38.8
Difficulty following dietary advice	142	35.5
Lack of regular BP monitoring	162	40.5
Inadequate knowledge about hypertension	118	29.5
Forgetting medication doses	126	31.5
Stopping medication when BP becomes normal	96	24.0
Tobacco use	72	18.0
Alcohol consumption	84	21.0
Financial difficulties	68	17.0

Adverse effects and difficulty following the prescribed regimen were the most commonly reported treatment-related barriers.

Table 5. Treatment-related barriers

Treatment-related barrier	Frequency	Percentage
Difficulty following medication regimen	88	22.0
Adverse effects of medication	74	18.5
Multiple medications	68	17.0
Frequent dosing	62	15.5
Difficulty understanding instructions	52	13.0
Frequent medication changes	38	9.5
Perceived lack of benefit	44	11.0
Difficulty obtaining prescribed drugs	58	14.5

The most frequently reported health-system barrier was **inadequate counselling regarding lifestyle modification (31.8%)**.

Table 6. Health-system-related barriers

Health-system-related barrier	Frequency	Percentage
Inadequate counselling	127	31.8
Irregular availability of medicines	110	27.5
Long waiting time	96	24.0
Difficulty obtaining follow-up appointments	72	18.0
Distance from health facility	64	16.0
Inadequate BP monitoring facilities	58	14.5
Shortage of healthcare personnel	52	13.0
Cost of consultation	42	10.5

The presence of individual barriers was compared between participants with controlled and uncontrolled blood pressure.

Table 7. Selected barriers according to blood pressure control

Barrier	Controlled BP n (%)	Uncontrolled BP n (%)	p-value
Poor medication adherence	40 (23.8)	115 (49.6)	<0.001
High salt intake	62 (36.9)	124 (53.4)	0.001
Inadequate physical activity	67 (39.9)	138 (59.5)	<0.001
Lack of regular BP monitoring	48 (28.6)	114 (49.1)	<0.001
Inadequate knowledge	38 (22.6)	80 (34.5)	0.010
Adverse effects	25 (14.9)	49 (21.1)	0.100
Multiple medications	24 (14.3)	44 (19.0)	0.220
Inadequate counselling	38 (22.6)	89 (38.4)	0.001
Irregular medicine availability	34 (20.2)	76 (32.8)	0.006

Poor medication adherence, high salt intake, inadequate physical activity, lack of regular BP monitoring and inadequate counselling were significantly more common among participants with uncontrolled blood pressure.

For each participant, the number of reported barriers was calculated. Participants were categorised into: **Low barrier burden:** 0–2 barriers, **Moderate barrier burden:** 3–5 barriers, **High barrier burden:** ≥6 barriers.

Table 8. Barrier burden according to blood pressure control

Barrier burden	Controlled BP n (%)	Uncontrolled BP n (%)	p-value
Low (0–2)	82 (48.8)	48 (20.7)	
Moderate (3–5)	70 (41.7)	106 (45.7)	
High (≥6)	16 (9.5)	78 (33.6)	**<0.001**
Total	**168 (100)**	**232 (100)**	

A significantly higher proportion of participants with uncontrolled blood pressure had a **high barrier burden** compared with those who had controlled blood pressure.

Variables that showed a significant association with uncontrolled blood pressure in the univariable analysis were entered into a multivariable logistic regression model.

Table 9. Multivariable logistic regression for predictors of uncontrolled blood pressure

Variable	Adjusted OR	95% CI	p-value
Age ≥60 years	1.42	0.91–2.22	0.118
Diabetes mellitus	1.36	0.88–2.10	0.164
Hypertension ≥5 years	1.51	0.98–2.33	0.062
Poor medication adherence	**2.48**	**1.55–3.96**	**<0.001**
High salt intake	**1.76**	**1.14–2.71**	**0.010**
Inadequate physical activity	**1.89**	**1.23–2.91**	**0.004**
Lack of regular BP monitoring	**1.71**	**1.10–2.66**	**0.017**
Inadequate counselling	**1.68**	**1.07–2.64**	**0.024**
Irregular medicine availability	1.44	0.89–2.33	0.137

Poor medication adherence showed the strongest independent association with uncontrolled blood pressure. Participants with poor medication adherence had approximately **2.5 times higher odds of uncontrolled blood pressure** compared with those with adequate adherence. Inadequate physical activity, high salt intake, lack of regular BP monitoring and inadequate counselling also remained independently associated with uncontrolled blood pressure.

DISCUSSION

The present community-based study assessed barriers to achieving blood pressure (BP) control among 400 adults with previously diagnosed hypertension. The study examined barriers at three levels, namely patient-related, treatment-related and health-system-related factors. Overall, 58.0% of participants had uncontrolled BP, while only 42.0% had controlled BP. This finding indicates that a substantial proportion of patients continue to have inadequate BP control despite being diagnosed and receiving antihypertensive treatment.

The high proportion of uncontrolled BP observed in the present study is consistent with the persistent challenges in hypertension management reported from India. However, the control rate should be interpreted in relation to the study population. The present study included only individuals with previously diagnosed hypertension who had been receiving antihypertensive treatment for at least three months. In contrast, several large population-based studies have included both diagnosed and undiagnosed individuals. Therefore, direct comparison of control rates between studies should be made cautiously.

Basu et al. reported that the hypertension care cascade in India remained suboptimal despite improvements in screening and treatment.6 They found that increasing age, higher BMI and greater waist-to-hip ratio were associated with uncontrolled hypertension among individuals receiving antihypertensive treatment. Similarly, the National Non-communicable Disease Monitoring Survey reported important gaps in hypertension control and behavioural counselling across India. Among individuals receiving treatment, good medication adherence was reported by 70.6%, but counselling regarding physical activity, salt reduction and other lifestyle modifications remained limited.7 These findings support the observation in our study that treatment alone may not be sufficient to achieve sustained BP control.

Mills et al. reported that hypertension control in India remained low despite gradual improvement over time.1 Their findings highlight the persistent gap between diagnosis, treatment and effective control. The present study adds to this evidence by demonstrating that even among patients who are already diagnosed and receiving treatment, multiple patient-level and health-system barriers remain relevant.

A recent study by Anaswara et al. from Kerala also reported low rates of BP control and identified several behavioural and health-system barriers.5 Their findings highlighted the importance of diet, physical activity, medication-related factors and access to healthcare. These observations are broadly consistent with the present study, although the proportion of controlled BP differed between the two studies. The difference may be explained by variations in the study population, healthcare setting, treatment status and methods used to assess BP control.

Patient-related factors were the most frequently reported barriers in the present study. Inadequate physical activity was reported by 51.3% of participants, high salt intake by 46.5%, poor medication adherence by 38.8% and lack of regular BP monitoring by 40.5%. These findings suggest that behavioural factors continue to influence hypertension control even after diagnosis and initiation of treatment.

Physical inactivity was independently associated with uncontrolled BP in the present study, with an adjusted odds ratio of 1.89. This finding is consistent with evidence from previous studies showing that regular physical activity contributes to BP reduction. Islam et al. reported that moderate-intensity leisure-time physical activity was associated with clinically meaningful reductions in systolic and diastolic BP.8 Their findings support the importance of incorporating physical activity into routine hypertension management rather than treating it as an optional lifestyle recommendation.

Similar findings have been reported from India. The National Noncommunicable Disease Monitoring Survey showed that counselling regarding physical activity was relatively limited, with only about one-third of treated hypertensive individuals reporting such advice. This may partly explain why physical inactivity remains common among patients with established hypertension.

The findings from Puducherry also support the importance of self-care behaviour. In a community-based study, poor self-care practices were significantly more common among participants with uncontrolled hypertension.9 Participants with poor self-care practices had a substantially higher prevalence of uncontrolled BP compared with those with better self-care practices. These findings are consistent with the present study, where several behavioural barriers were significantly more common among participants with uncontrolled BP.

The high prevalence of physical inactivity observed in our study may be particularly relevant because more than half of the participants were aged ≥60 years. Older adults may experience physical limitations, chronic disease, lack of motivation or environmental barriers that make regular physical activity difficult. Therefore, counselling should focus on achievable activities such as walking and age-appropriate daily physical activity rather than recommending unrealistic exercise targets.

High salt intake was reported by 46.5% of participants and was independently associated with uncontrolled BP (AOR 1.76). This finding is consistent with both Indian observational and intervention studies.

Bae et al. demonstrated a positive association between dietary salt intake and hypertension in an urban South Indian population. Increasing dietary salt intake was associated with progressively higher BP and hypertension prevalence.10 Their findings highlight the relevance of dietary salt reduction in the Indian context.

More recent intervention evidence also supports this association. In a randomised controlled trial involving 502 hypertensive adults from rural India, Yu J et al. reported that replacing regular salt with a reduced-sodium, potassium-enriched salt substitute resulted in a significant reduction in systolic BP.11 This is particularly relevant to community-based hypertension management because salt substitution represents a practical intervention that can be implemented at the household level.

Similarly, dietary assessment among rural Indian patients with hypertension demonstrated relatively high sodium intake and poor overall diet quality, particularly low consumption of fruits, vegetables and whole grains. These findings suggest that dietary counselling should extend beyond simply advising patients to "reduce salt".

A recent intervention from Puducherry also evaluated a practical low-salt food preparation demonstration.9 The study specifically targeted household food preparation and compared it with routine health education. Such approaches may be more effective than generic dietary advice because they translate recommendations into practical household behaviour.

In the present study, 35.5% of participants reported difficulty following dietary advice. Therefore, counselling should include specific instructions regarding household salt use, pickles, papad, processed foods and other commonly consumed high-salt foods. Practical demonstrations and repeated reinforcement may be more useful than one-time verbal advice.
Poor medication adherence was reported by 38.8% of participants and was significantly more common among those with uncontrolled BP. More importantly, poor adherence remained the strongest independent predictor of uncontrolled BP in the multivariable analysis, with an AOR of 2.48.

This finding is supported by several previous studies. Basu et al., in a qualitative study from a primary care clinic in Delhi, identified forgetfulness, carelessness and running out of medicines as important reasons for non-adherence.6 They also reported suboptimal BP control among participants. These findings are particularly similar to our study because both studies were conducted in primary-care/community-oriented settings and identified patient behaviour as well as medicine availability as barriers.

A recent systematic review and meta-analysis also demonstrated that medication adherence remains a major challenge.12 The review identified older age, treatment complexity, low socioeconomic status, low educational level, uncontrolled BP and comorbidities among factors associated with non-adherence. These findings support our observation that adherence should be assessed routinely rather than assuming that a prescription translates into regular medication use.

The National Noncommunicable Disease Monitoring Survey reported a higher proportion of good medication adherence than that observed in our study. However, the methods used to define adherence differed, and the survey assessed medication intake over the preceding two weeks. The lower adherence observed in our study may therefore reflect differences in measurement method as well as differences in the study population.

The present study also found that 31.5% of participants reported forgetting medication doses and 24.0% reported stopping medication when BP became normal. These findings are clinically important because hypertension is usually asymptomatic. Patients may therefore incorrectly interpret the absence of symptoms or a temporary normal BP reading as evidence that treatment is no longer necessary.

A recent Indian trial protocol by Longkumer et al. is also relevant.13 Their ongoing SMS4BP study is evaluating medication reminders and BP-related health education through text messages among patients with uncontrolled hypertension in India. Although outcome data are not yet available, this approach reflects the growing importance of simple digital interventions to address forgetfulness and improve treatment adherence.

Treatment-related barriers were less frequently reported than patient-related barriers. Difficulty following the prescribed medication regimen was reported by 22.0% of participants, while adverse effects were reported by 18.5%. Multiple medications were reported by 17.0%, and frequent dosing by 15.5%.

These findings are important because 53.5% of our participants were taking two or more antihypertensive drugs. Older patients may also be receiving medication for diabetes, dyslipidaemia and other chronic diseases. Increasing treatment complexity can therefore increase the risk of missed doses.

The systematic review by the Indian researchers on medication adherence also identified medication regimen complexity as an important factor associated with non-adherence.12 The findings support the need to simplify treatment regimens whenever clinically appropriate.

Adverse effects were not independently associated with uncontrolled BP in our study. However, they remain clinically relevant because patients may reduce or stop medication without discussing symptoms with their healthcare provider. Regular enquiry regarding adverse effects may therefore prevent unnecessary treatment interruption. Health-system-related factors were also important. Inadequate counselling was reported by 31.8% of participants, irregular medicine availability by 27.5%, and long waiting time by 24.0%. Inadequate counselling remained independently associated with uncontrolled BP after adjustment (AOR 1.68).

The National Noncommunicable Disease Monitoring Survey reported similar deficiencies in behavioural counselling. Only 41.6% of individuals receiving treatment reported advice regarding salt reduction and 32.5% reported advice regarding increased physical activity. The similarity between these findings and the present study suggests that counselling remains an important but insufficiently addressed component of hypertension care.

Medicine availability is another important health-system issue. Basu et al. reported running out of drug stocks as an important reason for non-adherence among patients attending a primary care clinic in Delhi.6 This supports our finding that 27.5% of participants experienced irregular availability of antihypertensive medicines. Evidence from the India Hypertension Control Initiative further demonstrates the importance of reliable drug supply and standardised treatment. Kaur et al. reported substantial improvement in BP control when simple drug- and dose-specific treatment protocols were implemented in public-sector facilities.14 Similarly, Kaur et al. reported improvement in BP control following decentralisation of hypertension care to Health and Wellness Centres. BP control increased from 20% in 2019 to 58% in 2022, while missed visits decreased substantially.15

These findings are particularly relevant to our study because they demonstrate that health-system interventions can directly influence BP control. Our study identified inadequate counselling and irregular medicine availability as important barriers, while the IHCI experience demonstrates that protocol-based treatment, decentralised care, medicine availability and systematic follow-up can improve outcomes.

The early IHCI experience also showed that protocol-based hypertension management supported by reliable drug supply and information systems was feasible across multiple Indian states. Clinic-level BP control averaged 43% during the initial implementation period. More recent IHCI data reported by Kaur et al. demonstrated even higher control among patients retained in care under programme conditions.16 These differences highlight the importance of continuity of care and retention in treatment.

Lack of regular BP monitoring was reported by 40.5% of participants and remained independently associated with uncontrolled BP (AOR 1.71). Only 23.5% of participants reported regular home BP monitoring.

Regular monitoring provides an opportunity to detect persistent uncontrolled BP and allows timely modification of treatment. The IHCI experience supports this approach. Chavan et al. demonstrated that decentralised hypertension care, regular follow-up and monitoring were associated with improved BP control and reduced missed visits.17

Community health workers may have an important role in this process. An ASHA-led community-based intervention evaluated by Riddell et al. incorporated BP measurement, medication adherence assessment, dietary counselling and physical activity advice into repeated community sessions. Such approaches demonstrate the feasibility of shifting some components of hypertension management closer to the community.18

The present study therefore supports greater involvement of community health workers in identifying patients with uncontrolled BP, reinforcing adherence, encouraging regular monitoring and ensuring follow-up.

An important finding of the present study was the association between the total barrier burden and BP control. Participants reporting six or more barriers had a substantially higher proportion of uncontrolled BP than those reporting fewer barriers. This suggests that uncontrolled hypertension is usually multifactorial rather than being caused by a single patient behaviour.

A patient may simultaneously experience poor medication adherence, high salt intake, physical inactivity, inadequate BP monitoring and difficulty obtaining medicines. These factors may also interact. For example, inadequate counselling may contribute to poor understanding of the need for continued treatment, while medicine shortages may directly interrupt treatment.

This multilevel interpretation is supported by Jariyasakulwong et al., who demonstrated that self-care and BP among patients with uncontrolled hypertension are influenced by multiple behavioural and contextual factors.4 Similarly, the Kerala study by Anaswara et al. identified patient, treatment and healthcare-access factors as important contributors to hypertension control.5

Therefore, interventions directed at only one barrier may have limited effectiveness. Patients with multiple barriers may require a structured assessment followed by individualised interventions.

The findings have several implications for community and primary healthcare services. First, every hypertension follow-up visit should include assessment of BP control and medication adherence rather than focusing only on prescription renewal. Second, lifestyle counselling should be specific and repeated. Third, healthcare workers should identify patients who frequently miss medications, BP measurements or follow-up visits.

Fourth, primary healthcare facilities should ensure uninterrupted availability of essential antihypertensive medicines. Fifth, treatment regimens should be simplified wherever clinically appropriate. Sixth, patients with persistent uncontrolled BP should be identified for closer follow-up and treatment review.

The IHCI provides strong evidence that systematic primary-care interventions can improve BP control in India. Kaur et al. demonstrated high BP control among patients retained in care using simple treatment protocols, while Chavan et al. showed that decentralisation to Health and Wellness Centres was associated with improved control and fewer missed visits.15,17 The present study complements this programme-level evidence by demonstrating that important barriers remain at the patient level even among individuals who are already receiving treatment. Therefore, an effective community hypertension programme should combine reliable drug supply and protocol-based treatment with adherence assessment, lifestyle counselling, regular BP monitoring and community follow-up.

The present study has several strengths. It was conducted at the community level and included patients with established hypertension rather than only apparently healthy adults identified through screening. It assessed patient-related, treatment-related and health-system-related barriers simultaneously. BP was measured using a standardised procedure, and multivariable logistic regression was used to identify independent predictors.

However, several limitations should be considered. First, the cross-sectional design prevents establishment of a temporal relationship between the identified barriers and uncontrolled BP. Second, medication adherence and lifestyle practices were partly self-reported and may therefore be affected by recall and social desirability bias. Third, BP was measured during a single study visit and may not represent usual BP. Fourth, the study was conducted in a defined geographical area, limiting generalisability. Finally, health-system barriers were based on participant perceptions and may not completely reflect actual health-system performance.

The present study demonstrates that achieving BP control among treated hypertensive patients remains a significant community health challenge. More than half of the participants had uncontrolled BP. Poor medication adherence was the strongest independent predictor of uncontrolled BP, while inadequate physical activity, high salt intake, lack of regular BP monitoring and inadequate counselling were also independently associated with poor control.

The findings are broadly consistent with evidence from Indian community studies, primary-care studies and large-scale hypertension programmes. Basu et al. highlighted the role of forgetfulness and medicine availability in non-adherence. The National Noncommunicable Disease Monitoring Survey demonstrated gaps in behavioural counselling. Anaswara et al. identified multiple patient and health-system barriers in Kerala. Kaur et al. and Chavan et al. demonstrated that protocol-based treatment, reliable medicine availability, decentralised care and systematic follow-up can substantially improve BP control.5,12,14,17,19

Thus, hypertension management at the community level should move beyond prescription-based care. A patient-centred, multilevel approach integrating medication adherence assessment, practical lifestyle counselling, regular BP monitoring, reliable medicine availability, treatment simplification and community-based follow-up is more likely to achieve sustained BP control.

The findings also suggest that patients should not be considered solely responsible for poor BP control. Non-adherence may reflect forgetfulness, inadequate counselling, adverse effects, treatment complexity or medicine shortages. Identifying the specific barrier experienced by each patient may therefore be more useful than simply labelling the patient as "non-compliant".

In practical terms, a community-based hypertension programme may follow the sequence:
BP measurement → identification of uncontrolled BP → adherence assessment → barrier assessment → lifestyle counselling → medicine availability check → treatment review → community follow-up → repeat BP monitoring.
Such an integrated approach could strengthen hypertension control within existing primary healthcare and NCD services and may help reduce the long-term cardiovascular and renal complications associated with uncontrolled hypertension.

CONCLUSION

In this community-based study, 58.0% of patients with hypertension had uncontrolled blood pressure despite receiving treatment. Patient-related barriers were the most frequently reported, with inadequate physical activity, high salt intake, poor medication adherence and lack of regular BP monitoring being the major barriers. Treatment-related barriers included difficulty following the prescribed medication regimen and adverse effects, while inadequate counselling and irregular availability of medicines were the major health-system-related barriers. Poor medication adherence, high salt intake, inadequate physical activity, lack of regular BP monitoring and inadequate counselling were independently associated with uncontrolled blood pressure. These findings suggest that effective hypertension control requires a comprehensive approach addressing patient behaviour, treatment-related difficulties and gaps in primary healthcare services.

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