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Burden Of Suboptimal Adherence to Antihypertensive Therapy in Eastern India: Evidence from A Tertiary Care Centre in West Bengal

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ABSTRACT

Introduction: Poor adherence to antihypertensive medications remains a major barrier to achieving optimal blood pressure control, particularly in low- and middle-income countries. Evidence regarding determinants of antihypertensive adherence from eastern India remains limited. This study assessed the burden of suboptimal adherence and explored factors associated with adherence among hypertensive patients attending a tertiary care centre in West Bengal, India.
Aims and objectives: To assess the burden of suboptimal adherence to antihypertensive therapy among adult hypertensive patients attending a tertiary care centre in West Bengal and to identify the socio-demographic, clinical, healthcare utilisation, and treatment-related factors associated with medication adherence.
Materials and Methods: A hospital-based cross-sectional study was conducted among 112 adult hypertensive patients in a tertiary care hospital in West Bengal. Data on socio-demographic and clinical characteristics were collected using a pretested questionnaire. Medication adherence was assessed using the 9-item Hill-Bone Medication Adherence Scale. Statistical analysis was performed using independent t-test and one-way ANOVA, with $p<0.05$ considered significant.
Results: Among 112 hypertensive patients, 62.50% had suboptimal adherence and 37.50% had good adherence. The mean Hill-Bone adherence score was 24.64±6.43. Adherence was significantly associated with occupation ($p=0.030$), socio-economic status ($p=0.031$), duration of hypertension ($p<0.001$), and out-of-pocket expenditure ($p=0.001$), while BP control showed no significant association ($p=0.759$).
Conclusion: Adherence was mainly influenced by socio-economic and treatment-related factors. Longer disease duration and out-of-pocket expenditure reduced adherence. Reducing financial barriers and improving healthcare support may enhance adherence and blood pressure control.

Keywords: *Hypertension; Medication adherence; Hill-Bone Medication Adherence Scale; Antihypertensive therapy; Out-of-pocket expenditure; India.*

INTRODUCTION

Hypertension remains one of the leading modifiable risk factors for cardiovascular disease, stroke, chronic kidney disease, and premature mortality worldwide. Despite the availability of effective antihypertensive medications, blood pressure control rates remain suboptimal, particularly in low- and middle-income countries, where the burden of hypertension is rapidly increasing.[1,2] According to recent estimates, more than one billion adults globally live with hypertension, with India contributing substantially to this burden.[3] In India, hypertension affects nearly one-third of the adult population and

is responsible for a significant proportion of cardiovascular morbidity and mortality.[4,5] Although awareness, diagnosis, and treatment of hypertension have improved over the past decade, achieving sustained blood pressure control remains a major challenge.[6] One of the most important determinants of poor blood pressure control is inadequate adherence to prescribed antihypertensive therapy.[7] Medication adherence refers to the extent to which a patient's medication-taking behavior corresponds with agreed recommendations from a healthcare provider.[8] Suboptimal adherence has been associated with uncontrolled hypertension, increased risk of cardiovascular events, frequent hospitalizations, reduced quality of life, and higher healthcare expenditures.[9,10] Factors influencing adherence are multifactorial and include patient-related, therapy-related, socioeconomic, and health-system-related determinants.[11] Evidence from different regions of India suggests considerable variability in adherence levels owing to cultural, socioeconomic, and healthcare-access disparities.[12,13] However, data from eastern India, particularly West Bengal, remain limited. Understanding the burden of suboptimal adherence in this setting is essential for designing targeted interventions to improve treatment outcomes and reduce cardiovascular risk. Therefore, the present study aimed to estimate the burden of suboptimal adherence to antihypertensive therapy among patients attending a tertiary care centre in West Bengal, India and factors associated with their adherence.

MATERIALS AND METHODS

Study design: A hospital-based cross-sectional analytical study.

Study Place: Prafulla Chandra Sen Government Medical College and Hospital (PCSGMCH), Arambagh, West Bengal.

Study Population: The study population comprised adult hypertensive patients aged 18 years or older who had a physician-confirmed diagnosis of hypertension for at least two years and were receiving antihypertensive medication at the time of the survey.

Duration of the Study: 2 Years

Sample Size: 112 patients

Inclusion Criteria:

- Adult patients aged 18 years and above.
- Diagnosed cases of hypertension for at least 2 years by a registered medical practitioner.
- Currently receiving antihypertensive medication.
- Attending the outpatient department of the study hospital during the study period.
- Willing to participate and provide written informed consent.

Exclusion Criteria:

- Patients with severe illness or medical emergencies requiring immediate treatment.
- Patients with cognitive impairment, psychiatric illness, or communication difficulties that prevent reliable interview.
- Pregnant women with gestational hypertension/preeclampsia.
- Patients unwilling to participate or provide informed consent.
- Incomplete or unreliable responses to the study questionnaire.

Study Variable:

- Antihypertensive medication adherence status (HB-MAS score)
- Blood pressure control status (Controlled/Uncontrolled)
- Duration of hypertension
- Socio-economic status
- Out-of-pocket expenditure for treatment
- Occupation
- Comorbidities
- Medication consumption per day (pill burden)
- Clinical status of hypertension
- Healthcare-seeking behaviour

Statistical Analysis: For statistical analysis data were entered into a Microsoft Excel spreadsheet and then analyzed by SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and Graph Pad Prism version 5. Data had been summarized as mean and standard deviation for numerical variables and count and percentages for categorical variables. Z-test (Standard Normal Deviate) was used to test the significant difference of proportions. Once a t value is determined, a p-value can be found using a table of values from Student's t-distribution. If the calculated p-value is below the threshold chosen for statistical

significance (usually the 0.10, the 0.05, or 0.01 level), then the null hypothesis is rejected in favor of the alternative hypothesis. P-value ≤ 0.05 was considered for statistically significant.

RESULT

Table 1: Distribution of Socio-demographic and Clinical profile of the study participants (N=112)

	Categories	Percentage
Age in years	18–40	19 (16.96%)
	41–59	46 (41.07%)
	≥60	47 (41.97%)
Gender	Male	60 (53.57%)
	Female	52 (46.43%)
Marital Status	Currently Married	75 (66.96%)
	Never Married	14 (12.50%)
	Widow/Widower	23 (20.54%)
Education	Illiterate	43 (38.39%)
	Educated up to Secondary	37 (33.05%)
	Higher Secondary and Above	32 (28.56%)
Occupation	Labourer	23 (20.54%)
	Service/Self-employed	23 (20.54%)
	Homemaker	36 (32.14%)
	Unemployed/Retired	30 (26.78%)
Socio-economic Status	Class I & II	28 (25.00%)
	Class III	20 (17.86%)
	Class IV	23 (20.53%)
	Class V	41 (36.61%)
Duration of Hypertension	<10 years	81 (72.32%)
	≥10 years	31 (27.68%)
Current Clinical Status	Asymptomatic & Controlled	43 (38.39%)
	Asymptomatic & Uncontrolled	10 (8.93%)
	Symptomatic & Controlled	46 (41.07%)
	Symptomatic & Uncontrolled	13 (11.61%)
Care-seeking Behaviour	Public Only	67 (59.82%)
	Public + Private	45 (40.18%)
Co-morbidities	None	39 (34.82%)
	Present	73 (65.18%)
Smoking Status	Current/Ex-smoker	35 (31.25%)
	Non-smoker	77 (68.75%)
Out-of-pocket Expenditure	Yes	47 (41.96%)
	No	65 (58.04%)
Knowledge about Complications	Yes	47 (41.96%)
	No	65 (58.04%)
Experienced Side Effects	Yes	21 (18.75%)
	No	91 (81.25%)
Experienced Hypertension-related Complications	Yes	34 (30.36%)
	No	78 (69.64%)
Medication Consumption per Day	1–2	46 (41.07%)
	3–5	54 (48.21%)
	≥6	12 (10.72%)

Table 2: Bivariate analysis showing the association between Socio-demographic and Clinical profile of the study participants and adherence score to antihypertensives (N=112)

	Categories	Adherence Score (Mean ± SD)	Test of Significance
Age in years	18–40	27.58 ± 5.04	One-way ANOVA (p = 0.090)
	41–59	24.15 ± 5.66	
	≥60	23.94 ± 7.37	
Gender	Male	23.97 ± 6.70	Independent t-test (p = 0.234)
	Female	25.42 ± 6.09	
Marital Status	Currently Married	24.15 ± 6.34	

	Never Married	23.07 ± 6.12	One-way ANOVA (p = 0.083)
	Widow/Widower	27.22 ± 6.49	
Education	Illiterate	25.05 ± 6.18	One-way ANOVA (p = 0.613)
	Educated up to Secondary	24.14 ± 6.87	
	Higher Secondary and Above	25.89 ± 6.35	
Occupation	Labourer	23.65 ± 6.72	One-way ANOVA (p = 0.030)
	Service & Self-employed	23.43 ± 6.01	
	Homemaker	27.25 ± 6.00	
	Unemployed/Retired	23.20 ± 6.39	
Socio-economic Status	Class I & II	26.19 ± 5.76	One-way ANOVA (p = 0.031)
	Class III	27.29 ± 6.17	
	Class IV	23.43 ± 6.24	
	Class V	22.95 ± 6.62	
Duration of Hypertension	<10 years	26.27 ± 5.30	Independent t-test (p < 0.001)
	≥10 years	20.39 ± 7.25	
Current Clinical Status	Asymptomatic & Controlled	24.09 ± 6.10	One-way ANOVA (p = 0.758)
	Asymptomatic & Uncontrolled	24.90 ± 6.84	
	Symptomatic & Controlled	25.37 ± 6.53	
	Symptomatic & Uncontrolled	23.69 ± 7.33	
Care-seeking Behaviour	Public Only	25.36 ± 5.73	Independent t-test (p = 0.152)
	Public + Private	23.58 ± 7.30	
Co-morbidities	None	25.28 ± 5.52	Independent t-test (p = 0.445)
	Present	24.30 ± 6.88	
Smoking Status	Current/Ex-smoker	25.31 ± 6.97	Independent t-test (p = 0.459)
	Non-smoker	24.34 ± 6.20	
Out-of-pocket Expenditure	Yes	22.40 ± 6.55	Independent t-test (p = 0.001)
	No	26.26 ± 5.88	
Knowledge about Complications	Yes	23.26 ± 7.02	Independent t-test (p = 0.052)
	No	25.65 ± 5.83	
Experienced Side Effects	Yes	22.24 ± 6.46	Independent t-test (p = 0.057)
	No	25.20 ± 6.34	
Experienced Hypertension-related Complications	Yes	23.82 ± 6.37	Independent t-test (p = 0.057)
	No	25.00 ± 6.47	
Medication Consumption per Day	1–2	25.35 ± 6.33	One-way ANOVA (p = 0.510)
	3–5	23.91 ± 6.79	
	≥6	25.25 ± 5.15	

Table 3: Distribution of Hill-Bone Medication Adherence Scores Among Study Participants (N=112)

Adherence Category	Frequency	Percentage
Good Adherence (Score ≥ 80% of maximum)	42	37.50%
Moderate Adherence	38	33.93%
Poor Adherence	32	28.57%
Suboptimal Adherence (Moderate + Poor)	70	62.50%

Table 4: Domain-wise Hill-Bone Medication Adherence Scale Scores (N=112)

HB-MAS Domain	Mean ± SD	Possible Score Range
Medication-taking Behaviour	13.82 ± 3.44	9–36
Appointment Keeping	6.27 ± 1.83	2–8
Salt Intake Behaviour	4.52 ± 1.41	3–12
Overall HB-MAS Score	24.64 ± 6.43	14–56

Table 5: Association Between Adherence Category and Blood Pressure Control

Blood Pressure Status	Good Adherence n (%)	Suboptimal Adherence n (%)	p-value
Controlled BP	34 (80.95%)	55 (78.57%)	0.759
Uncontrolled BP	8 (19.05%)	15 (21.43%)	

Figure 1: Distribution of Socio-demographic and Clinical profile of the study participants (N=112)

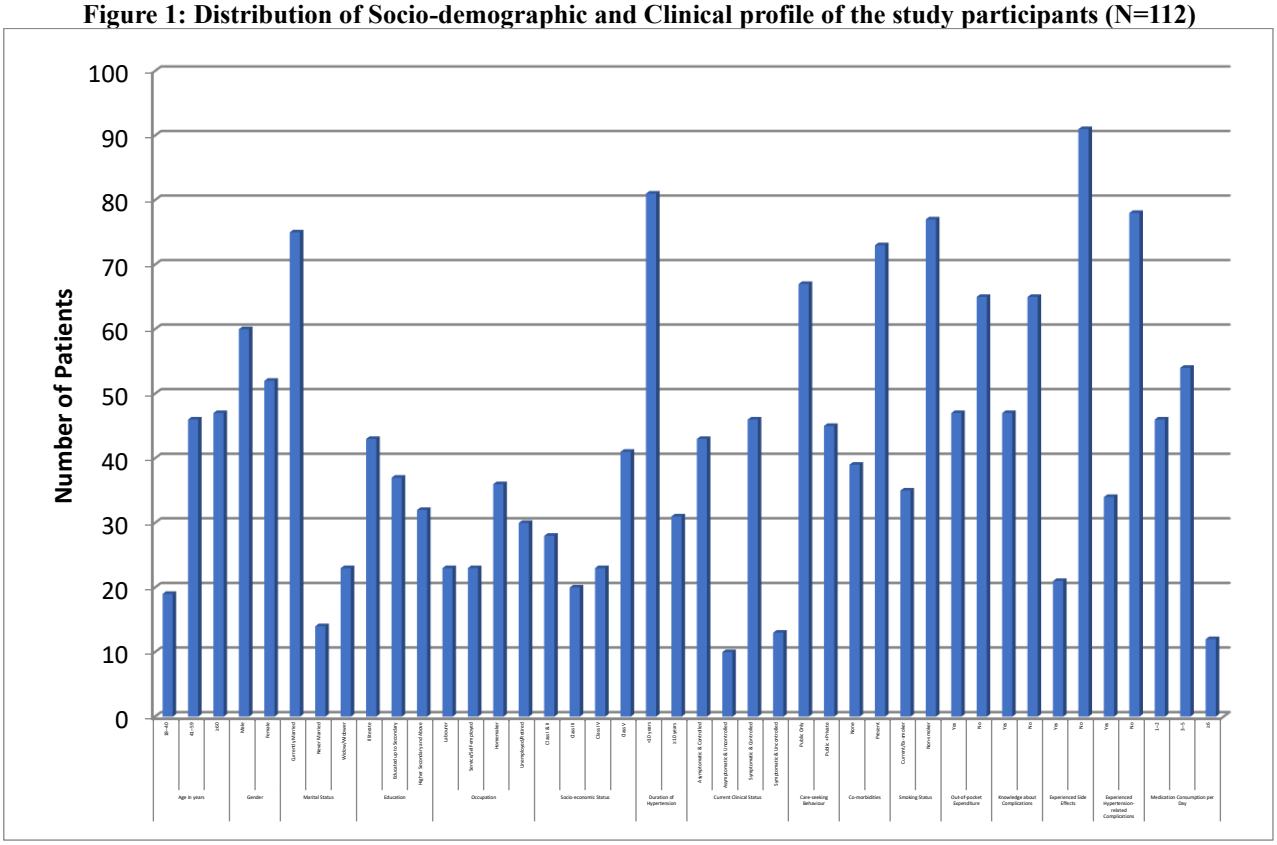
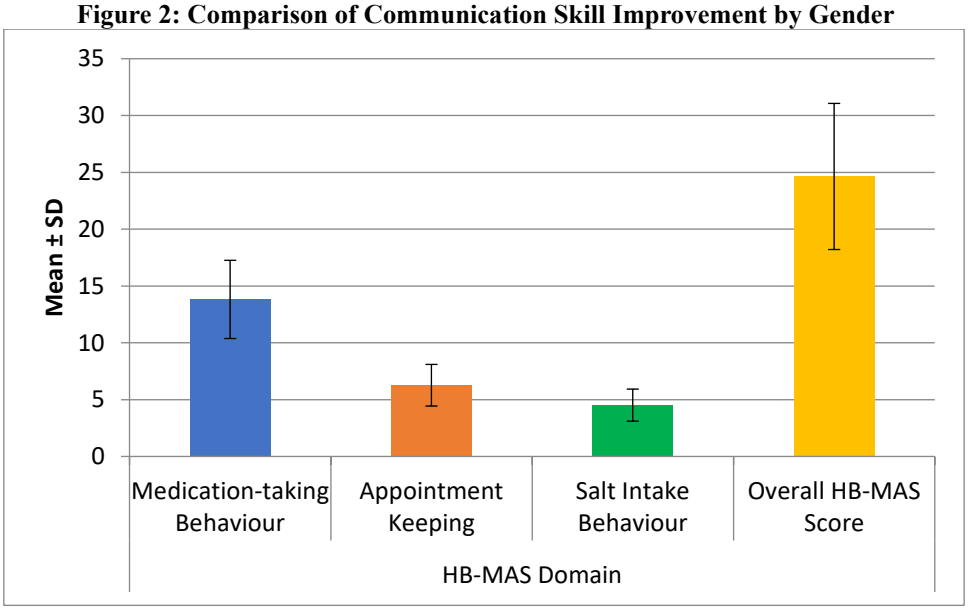


Figure 2: Comparison of Communication Skill Improvement by Gender



Distribution of Socio-demographic and Clinical Profile of the Study Participants

RESULTS

The study included 112 hypertensive patients. The majority belonged to the age groups of 41–59 years (41.07%) and ≥60 years (41.97%). Males constituted 53.57% of the participants. Most participants were currently married (66.96%), while 38.39% were illiterate. Homemakers represented the largest occupational group (32.14%), and 36.61% belonged to socio-economic class V. The majority had hypertension for less than 10 years (72.32%) and sought care exclusively from public

health facilities (59.82%). Comorbidities were present in 65.18% of participants, while 41.96% reported out-of-pocket expenditure for treatment.

Interpretation
The study population primarily consisted of middle-aged and elderly hypertensive patients with a slight male predominance. Most participants had a relatively shorter duration of hypertension and relied on public healthcare services. A substantial proportion belonged to lower socio-economic classes and had associated comorbidities, indicating a potentially vulnerable patient population requiring sustained long-term care and support.

Bivariate Analysis Showing Association Between Participant Characteristics and Adherence Score
Results
Significant associations with adherence score were observed for occupation ($p=0.030$), socio-economic status ($p=0.031$), duration of hypertension ($p<0.001$), and out-of-pocket expenditure ($p=0.001$). Homemakers had the highest mean adherence score (27.25±6.00). Participants with hypertension duration of less than 10 years demonstrated significantly higher adherence scores (26.27±5.30) than those with hypertension for 10 years or more (20.39±7.25). Individuals without out-of-pocket expenditure also showed better adherence (26.26±5.88) compared to those incurring treatment expenses (22.40±6.55). No significant association was observed with age, gender, marital status, education, clinical status, care-seeking behaviour, comorbidities, smoking status, knowledge about complications, side effects, hypertension-related complications, or number of medications consumed per day ($p>0.05$).

Interpretation
The findings suggest that treatment-related and socio-economic factors play an important role in medication adherence. Longer disease duration and financial burden adversely affected adherence, whereas favourable socio-economic conditions and homemaker status were associated with better adherence. These results highlight the importance of addressing economic barriers and providing continued support for patients with longstanding hypertension.

Distribution of Hill-Bone Medication Adherence Scores Among Study Participants
Results
Among the study participants, 42 (37.50%) demonstrated good adherence to antihypertensive therapy, while 38 (33.93%) showed moderate adherence and 32 (28.57%) exhibited poor adherence. Overall, 70 participants (62.50%) were classified as having suboptimal adherence.

Interpretation
The burden of suboptimal adherence was high, affecting nearly two-thirds of the hypertensive patients. This finding indicates that inadequate adherence to antihypertensive therapy remains a major challenge and may contribute to poor long-term disease control and increased risk of complications.

Domain-wise Hill-Bone Medication Adherence Scale Scores
Results
The mean overall Hill-Bone Medication Adherence Scale score was 24.64±6.43. Among the individual domains, medication-taking behaviour had the highest mean score (13.82±3.44), followed by appointment keeping (6.27±1.83) and salt intake behaviour (4.52±1.41).

Interpretation
Medication-taking behaviour contributed most substantially to the overall adherence score, indicating that difficulties in maintaining regular medication use were a major component of adherence-related challenges. The findings suggest that interventions targeting medication-taking practices may yield the greatest improvement in overall adherence.

Association Between Adherence Category and Blood Pressure Control
Results
Among participants with good adherence, 34 (80.95%) had controlled blood pressure, whereas 8 (19.05%) had uncontrolled blood pressure. Among those with suboptimal adherence, 55 (78.57%) had controlled blood pressure and 15 (21.43%) had uncontrolled blood pressure. The association between adherence category and blood pressure control was not statistically significant ($p=0.759$).

Interpretation
Although a higher proportion of participants with good adherence had controlled blood pressure, the difference was not statistically significant. This suggests that factors other than medication adherence, such as treatment regimen, disease severity, lifestyle factors, and comorbid conditions, may also influence blood pressure control in this population.

DISCUSSION

The present hospital-based cross-sectional analytical study evaluated the burden of suboptimal adherence to antihypertensive therapy among 112 adult hypertensive patients attending a tertiary care centre in West Bengal. The findings demonstrate that medication adherence remains a major challenge in hypertension management, with important associations observed between adherence behaviour, socio-economic factors, treatment burden, and duration of disease. In the present study, the majority of participants were middle-aged and elderly, with 41.07% belonging to the 41–59 years age group and 41.97% aged ≥60 years. Similar demographic patterns have been reported in hypertension studies where older adults constitute a major proportion due to increased risk of vascular changes and chronic disease burden with advancing age [14]. A slight male predominance (53.57%) was observed in the present study, which is comparable with findings from several Indian studies showing higher healthcare utilization among male hypertensive patients, although adherence patterns may vary depending on social support and healthcare accessibility [15]. The study showed that comorbidities were present among 65.18% of participants. Hypertension commonly coexists with diabetes, cardiovascular disease, and other chronic conditions, increasing medication burden and complexity of treatment. Previous studies have demonstrated that multimorbidity and polypharmacy are important contributors to poor adherence due to increased regimen complexity and reduced patient motivation for long-term therapy [16]. A major finding of the present study was the high burden of suboptimal adherence, with 62.50% of participants classified as having moderate or poor adherence. This indicates that nearly two-thirds of hypertensive patients had difficulty maintaining optimal medication-taking behaviour. Similar observations have been reported in previous studies, where non-adherence rates among hypertensive patients ranged widely due to differences in population characteristics and assessment methods [17]. Poor adherence is a significant public health concern as it contributes to inadequate blood pressure control, increased cardiovascular events, and higher healthcare expenditure [18]. The mean overall Hill-Bone Medication Adherence Scale score in the present study was 24.64±6.43. Among the different domains, medication-taking behaviour showed the highest mean score (13.82±3.44), suggesting that regular medication intake and maintaining daily treatment schedules represent major challenges. The Hill-Bone scale has been widely used to assess adherence-related behaviours, and previous research has emphasized the importance of identifying specific behavioural barriers rather than focusing only on clinical outcomes. In the present analysis, occupation showed a significant association with adherence score ($p=0.030$). Homemakers demonstrated better adherence compared with other occupational groups. This may be due to greater availability of time, regular daily routines, and better opportunity to incorporate medication schedules into daily activities. Similar studies have reported that lifestyle patterns, work-related stress, and daily responsibilities influence medication-taking behaviour among patients with chronic diseases [19]. Socio-economic status was significantly associated with adherence ($p=0.031$). Participants from lower socio-economic backgrounds showed comparatively lower adherence scores, which may be related to financial limitations, difficulty accessing medicines, and competing household expenses. The present study also found a significant association between out-of-pocket expenditure and adherence ($p=0.001$), with patients without additional treatment-related expenses showing better adherence. Financial barriers have been consistently identified as important determinants of poor adherence, especially in low- and middle-income countries. Duration of hypertension showed a strong association with adherence ($p<0.001$). Patients with hypertension duration of less than 10 years had significantly higher adherence scores compared with those having hypertension for ≥10 years. Longer disease duration may lead to treatment fatigue, reduced perceived benefit of medication, and decreased motivation for lifelong therapy. Similar findings have been reported where chronic disease duration was associated with declining medication adherence over time. Although good adherence was associated with a higher proportion of controlled blood pressure (80.95%) compared with suboptimal adherence (78.57%), the difference was not statistically significant ($p=0.759$). This suggests that blood pressure control is influenced by multiple factors, including lifestyle modifications, dietary practices, physical activity, drug regimen, disease severity, and biological response to therapy. Previous studies have also highlighted that adherence alone may not completely explain variations in blood pressure control [20]. Overall, the findings emphasize that suboptimal adherence is a major challenge among hypertensive patients in Eastern India. Interventions focusing on patient education, reduction of financial barriers, simplified treatment regimens, regular follow-up, and behavioural counselling may improve adherence and contribute to better hypertension outcomes.

CONCLUSION

The present study concludes that suboptimal adherence to antihypertensive therapy is highly prevalent among patients attending a tertiary care centre in West Bengal, with nearly two-thirds of participants demonstrating moderate to poor adherence. Adherence was significantly influenced by occupation, socio-economic status, duration of hypertension, and out-of-pocket expenditure, highlighting the role of socio-economic and treatment-related barriers in long-term disease management. Although better adherence was associated with a higher proportion of controlled blood pressure, the relationship was not statistically significant, indicating the influence of multiple factors on hypertension control. Strengthening patient counselling, improving medication accessibility, reducing financial barriers, and implementing regular follow-up strategies are essential to improve adherence and reduce the burden of hypertension-related complications.

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