

Hypertension knowledge gaps: A patient–caregiver comparison from a tertiary care centre in Northern India

Bhupinder Singh,¹ Kamlesh K Sharma,² Navdeep Singh Dhillon,³ Ashishpreet Singh,³ Sourav Salhan,³ Ankita Soni,⁴ Maninder Kansal,⁵ Suraj Kumar¹ and Madhur Verma⁶

1. Department of Cardiology, All India Institute of Medical Sciences, Bathinda, India; 2. Institute of Nursing Education and Research, All India Institute of Medical Sciences, Bathinda, India; 3. All India Institute of Medical Sciences, Bathinda, India; 4. Department of Pathology, All India Institute of Medical Sciences, Bathinda, India; 5. Department of General Medicine, All India Institute of Medical Sciences Bathinda, Bathinda, Punjab, India; 6. Department of Community and Family Medicine, All India Institute of Medical Sciences, Bathinda, India

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Background: Hypertension is the leading modifiable risk factor for cardiovascular disease, yet awareness and control remain low, particularly in low- and middle-income countries (LMICs). In India, caregivers play a central role in patient support, but their comparative knowledge has been underexplored. This study assessed hypertension-related knowledge among patients and caregivers in a tertiary care setting in Northern India. **Methods:** A cross-sectional study was conducted over 7 months (October 2024–April 2025) in the cardiology out-patient department of a tertiary hospital in Punjab, India. Adults living with hypertension and their accompanying caregivers were consecutively enrolled. A structured questionnaire assessed sociodemographic factors and blood pressure (BP) monitoring practices, and the knowledge scores were compared between patients and caregivers, and associations with sociodemographic variables were examined. **Results:** Of 3,501 participants, 2,032 (58%) were patients, and 1,469 (42%) were caregivers. The cohort was predominantly male (56.6%), urban (69%) and educated up to the 12th grade (69%). Only 22.5% reported regular BP monitoring. Awareness of the hypertension definition (50.2%), the normal BP range (67%) and key risk factors, such as alcohol (41.2%), obesity (37%) and smoking (34.2%), was limited. Caregivers consistently demonstrated higher knowledge than patients (mean score: 8.7 versus 8.5/15; $p=0.004$), with better performance associated with higher education, urban residence and skilled occupations. **Conclusions:** Caregivers demonstrated greater knowledge of hypertension than patients, underscoring their potential as partners in disease management. Persistent gaps in awareness of risk factors, complications and follow-up emphasize the need for family-centred education, caregiver-focused counselling and accessible self-monitoring to strengthen hypertension control in LMICs.

Keywords

Awareness, caregivers, family-centric care, health literacy, health services for the aged, hypertension, non-communicable diseases, preventive medicine, treatment adherence and compliance

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Corresponding author: Madhur Verma, Community and Family Medicine, All India Institute of Medical Sciences, Bathinda 151001, India. E: drmadhurverma@gmail.com

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Hypertension is the leading modifiable risk factor for global cardiovascular disease, responsible for an estimated 10.8 million deaths and more than 200 million disability-adjusted life years annually.¹ Despite the availability of effective pharmacological and lifestyle interventions, prevalence continues to rise, particularly in low- and middle-income countries (LMICs), where over three-quarters of all cases now occur.² The condition's asymptomatic onset, earning it the label 'silent killer', often delays diagnosis, and only about one in five treated individuals worldwide achieve target blood pressure (BP) levels.³

India, one of the most populous LMICs, bears a substantial share of this burden. Nationally representative surveys estimate hypertension prevalence at 22.8% among adults aged 15–49 years, exceeding 40% in those aged 60 years and above.^{4,5} Yet, control rates remain persistently low, with less than 25% of known hypertensives meeting treatment goals.⁶ These gaps persist despite the implementation of large-scale national programmes such as the India Hypertension Control Initiative and the National Programme for Prevention and Control of Non-Communicable Diseases (NP-NCD).⁷

As a chronic non-communicable disease (NCD), hypertension requires lifelong commitment to medication adherence, dietary modification and regular monitoring.⁸ For many patients, the sustained cognitive and behavioural effort needed for effective self-management can lead to mental fatigue, reduced motivation and eventual disengagement from treatment regimens. Over time, some may discontinue medications or lose hope regarding their prognosis. This highlights that hypertension control is not solely the patient's responsibility; effective long-term management often depends on family members' active involvement. In the Indian sociocultural context, caregivers are more than passive companions; they are integral partners in disease management. They play a critical role in reminding patients to take medications, reinforcing lifestyle changes, assisting with follow-up visits and providing emotional support. Their capacity to perform these roles effectively depends on their understanding of the disease. Well-informed caregivers can help sustain treatment adherence and foster better outcomes, whereas poorly informed caregivers may inadvertently perpetuate misconceptions or reinforce non-adherence.

Despite these gaps, prior Indian literature has frequently assessed hypertension knowledge among patients and caregivers separately, without directly comparing these interdependent groups within the same setting.^{6,9,10} Simultaneously evaluating both is essential to determine whose knowledge is lacking, identify the specific domains requiring targeted intervention and assess whether caregiver capacity can be leveraged to strengthen patient outcomes. Thus, the present study aimed to compare hypertension-related knowledge between patients and their accompanying caregivers, identify domain-specific knowledge gaps in each group and examine sociodemographic factors associated with higher knowledge levels.

Methods

Study design and duration

We conducted a cross-sectional study over 7 months, from October 2024 to April 2025, in the cardiology out-patient department (OPD) of a tertiary care teaching hospital in Northern India.

Study settings

The institute serves as a referral centre for the Malwa region of Punjab and adjacent areas of Haryana and Rajasthan, providing comprehensive preventive and curative services through specialty and super-specialty

departments. The cardiology OPD receives a daily patient footfall of over 250 patients in the OPD and emergency, with a substantial proportion of them having cardiovascular risk factors, including hypertension.

Study population

The study population comprised adult patients (≥ 18 years) diagnosed with hypertension attending the cardiology OPD, along with their accompanying caregivers. A caregiver was defined as a family member or close acquaintance actively involved in the patient's daily care or health-related decision-making. Inclusion criteria were the ability to provide informed consent and comprehension of either the local language or English, while we excluded those with diagnosed cognitive impairment, psychiatric illness interfering with participation, inability to communicate in the study languages or refusal to consent.

Sample size and sampling technique

The sample size was calculated to detect a minimum 5% difference in mean hypertension knowledge scores between patients and caregivers, with 80% power and a 5% level of significance. Assuming a baseline knowledge prevalence of about 50%, as reported in previous studies from Punjab, and adjusting for potential non-response, the minimum required sample size was 3,200 participants.⁹ In total, 3,501 individuals (2,032 patients and 1,469 caregivers) were enrolled, exceeding the calculated requirement to enhance statistical precision. Participants were recruited consecutively from the cardiology OPD throughout the study period. To minimize interviewer and selection bias, trained co-investigators enrolled a maximum of 20 participants per day.

Study tool

A structured questionnaire was developed based on a literature review and the adaptation of items from previously published hypertension knowledge surveys.^{6,9–12} The draft tool was reviewed by subject experts for content validity and pilot tested among 20 patients with hypertension to ensure clarity and comprehension, but these data were not included in the final analysis. Internal consistency of the knowledge items was evaluated using Cronbach's alpha, which was 0.78, indicating acceptable reliability. Minor modifications were made based on pilot feedback before final administration.

The final tool had two major sections. Section A collected sociodemographic and clinical details, including age, gender, place of residence, occupation, education and comorbidities. Section B comprised eight items assessing hypertension knowledge: seven multiple-choice questions (single or multiple correct responses) covering the definition of hypertension, commonly affected organs (heart, kidneys, brain), major risk factors (smoking, high salt intake, alcohol use, obesity), common misconceptions (e.g. hypertension always being symptomatic) and recommended health-seeking behaviours (medication adherence, regular follow-up). Each correct answer scored one point, for a maximum possible score of 15. One additional question assessed BP monitoring practices.

Study variables

The dependent variable in this study was the hypertension knowledge score (continuous; range: 0–15), calculated as the total number of correct responses to the knowledge items. Based on Bloom's cut-off criteria, participants scoring 60% or more (corresponding to ≥ 9 correct responses out of 15) of the total score were categorized as high performers, while those scoring below 60% were classified as having low knowledge.¹³

Independent variables included sociodemographic characteristics such as age group (18–40, 41–63, 64–85 years), gender (male, female), place of residence (urban, rural), occupation (skilled: government/private service or professional work; unskilled: daily wage labour, homemaker, agricultural labour) and education level (up to 12th grade, beyond 12th grade, including diploma, graduate or postgraduate qualifications). Clinical characteristics comprised participant role (patient diagnosed with hypertension; caregiver accompanying and actively involved in care), history of diabetes (yes/no) and other co-existing comorbidities (yes/no, including cardiovascular disease, chronic kidney disease [CKD] or respiratory illness). Behavioural characteristics were assessed using BP monitoring practices, categorized as regular monitoring (at least once a month or as advised by a physician), occasional monitoring (irregular or only during medical visits) and never monitoring (no measurement outside acute illness or hospital visits).

Study protocol

The study followed a standardized protocol to ensure uniform data collection and minimize bias. Data were collected by the MBBS students under the supervision of the senior investigator following training on the study objectives, inclusion and exclusion criteria and administration of the questionnaire before the start of recruitment. Eligible participants were identified in the cardiology OPD, screened for eligibility and enrolled after obtaining written informed consent. Interviews were conducted in a private setting to maintain confidentiality and encourage honest responses. Data collection followed a pre-defined sequence, with completion of the sociodemographic and clinical details (Section A) followed by the hypertension knowledge assessment (Section B). Completed questionnaires were checked daily for completeness and accuracy before data entry, and double data entry was performed to minimize transcription errors.

Data analysis

Data were coded and entered into Microsoft Excel and analysed using IBM SPSS Statistics for Windows, Version 29 (IBM Corp., Armonk, NY, USA). Descriptive statistics summarized sociodemographic characteristics and knowledge scores. Continuous variables were expressed as means \pm standard deviations (SDs), and categorical variables were expressed as frequencies and percentages. Independent samples *t*-tests compared mean scores between patients and caregivers; one-way Analysis of Variance (ANOVA) test evaluated differences across sociodemographic subgroups. Chi-square tests were applied to assess associations between categorical variables and to compare the proportion of high performers between groups. A *p*-value <0.05 was considered statistically significant.

Compliance with ethics

This study was conducted per ethical principles outlined in the Declaration of Helsinki and followed the Good Clinical Practice (GCP) guidelines to ensure all participants' rights, safety and wellbeing. Before the initiation of data collection, ethical approvals were obtained from the Institutional Ethics Committee (IEC) of AIIMS, Bathinda, vide letter no. IEC/AIIMS/BTI/07/15 dated 25 July 2024. All participants were provided with a detailed explanation of the study objectives, procedures, potential risks and benefits, and written informed consent was obtained. Participants were made aware of their right to withdraw from the study at any point. The study adhered to confidentiality and data protection regulations, ensuring that no personally identifiable information was recorded, stored or shared.

Table 1: Sociodemographic characteristics of the study participants as per their role

Variables	Total N (col %)	Patient N (col %)	Caregiver N (col %)	<i>p</i> -value*
Total	3,501 (100)	2,032 (58)	1,469 (42)	
Gender				0.059
Male	1,982 (56.6)	1,123 (55.3)	859 (58.5)	
Female	1,519 (43.4)	909 (44.7)	610 (41.5)	
Age group				0.000
18–40	1,869 (53.4)	962 (47.3)	907 (61.7)	
41–63	1,295 (37)	828 (40.7)	467 (31.8)	
64–85	337 (9.6)	242 (11.9)	95 (6.5)	
Place of residence				0.050
Urban	2,413 (69)	1,427 (70.2)	986 (67.1)	
Rural	1,088 (31)	605 (29.8)	483 (32.9)	
Education				0.000
Up to 12th	2,416 (69)	1,457 (71.7)	959 (65.3)	
Beyond 12th	1,085 (31)	575 (28.3)	510 (34.7)	
Occupation				0.000
Unskilled	2,029 (58)	1,253 (61.7)	776 (52.8)	
Skilled	1,472 (42)	779 (38.3)	693 (47.2)	
History of diabetes				0.000
Yes	505 (14.4)	333 (16.4)	172 (11.7)	
No	2,996 (85.6)	1,699 (83.6)	1,297 (88.3)	
Other co-existing comorbidities				0.000
Yes	1,086 (31)	680 (33.5)	406 (27.6)	
No	2,415 (69)	1,352 (66.5)	1,063 (72.4)	

*Chi-square applied to determine the association between the patient/caregiver group and other respective groups.
col % = column %.*

Results

A total of 3,501 participants were included in the analysis, comprising 2,032 (58%) patients and 1,469 (42%) caregivers accompanying them. The overall cohort was predominantly male (56.6%), aged between 18 and 40 years (53.4%), residing in urban areas (69%), with most participants having education up to the 12th grade (69%), employed in unskilled occupations (58%) and without diabetes (85.6%) or other comorbidities (69%) (Table 1). Significant differences were observed between patients and caregivers across several sociodemographic variables, including age distribution, place of residence, education level, occupation and presence of diabetes or other comorbidities (*p*<0.05). Regarding BP monitoring practices, only 22.5% of participants reported regular monitoring, 60.9% reported occasional monitoring, and 16.6% reported never monitoring their BP.

Assessment of hypertension-related knowledge revealed that half of the participants (50.2%) correctly identified the definition of hypertension, and 67% were aware of the normal BP range. We observed the largest gaps in the domains of target organ involvement, recognition of major modifiable risk factors beyond salt intake and understanding of long-term management and follow-up, whereas knowledge of the basic definition and normal BP range was comparatively better (Table 2). Specifically, the recognition of target organs affected by hypertension varied: 62.4% identified the heart and 32.9% the brain as commonly involved, whereas only 12.2% acknowledged the kidneys. Concerning

Table 2: Overall difference in awareness scores of patients and their caretakers

	Expected answers	Correct responses			p-value
		Overall proportion N (col %)	Patients N (col %)	Caregiver N (col %)	
Sample size		3,200 (100)	2,032 (100)	1,469 (100)	
What is hypertension	High BP	1,759 (50.2)	1,015 (50)	744 (50.6)	0.684
What is normal BP	<130/85 mmHg	2,345 (67)	1,369 (67.4)	979 (66.4)	0.563
Which organs can be affected by hypertension					
Heart	Yes	2,184 (62.4)	1,249 (61.5)	935 (63.6)	0.188
Lungs	No	3,078 (87.9)	1,802 (88.7)	1,276 (86.9)	0.103
Kidney	Yes	426 (12.2)	243 (12)	183 (12.5)	0.656
Brain	Yes	1,153 (32.9)	662 (32.6)	491 (33.4)	0.599
Major risk factors for hypertension					
Smoking	Yes	1,196 (34.2)	669 (32.9)	527 (35.9)	0.069
Increased salt intake	Yes	2,488 (71.1)	1,417 (69.7)	1,071 (72.9)	0.041
Alcohol	Yes	1,444 (41.2)	795 (39.1)	649 (44.2)	0.003
Overweight	Yes	1,294 (37)	734 (36.1)	560 (38.1)	0.227
Physical activity	No	3,098 (88.5)	1,797 (88.4)	1,301 (88.6)	0.906
Healthy eating habits	No	3,131 (89.4)	1,819 (89.5)	1,312 (89.3)	0.845
True/false statements					
(a) High BP is always symptomatic (b) Hypertension is a silent killer	(b)	2,103 (60.1)	1,183 (58.2)	920 (62.6)	0.009
Which is not a complication of hypertension: bleeding in brain/heart attack/fever/heart failure	Fever	2,713 (77.5)	1,560 (76.8)	1,153 (78.5)	0.230
A person should visit a doctor, even if the BP is controlled	Correct	1,599 (45.7)	932 (45.9)	667 (45.4)	0.787

Chi-square test applied to know the association between responses and patient/caregiver groups.
col % = column %.

risk factors, the majority recognized high salt intake, with 41.2% identifying alcohol consumption, 37% obesity and 34.2% smoking as contributors. Notably, 60.1% correctly understood that hypertension is often asymptomatic – the so-called ‘silent killer’, while 39.9% believed it always presents with symptoms. Regarding complications, 77.5% correctly indicated that fever is not associated with hypertension. However, less than half (45.7%) were aware of the need for regular medical follow-up even when BP is controlled. Caregivers demonstrated significantly greater awareness than patients for certain risk factors, particularly alcohol and salt intake.

The mean knowledge score among participants was 8.6 (SD: 2.1) out of 15, with caregivers scoring slightly higher than patients (8.7 versus 8.5; $p=0.004$). Female caregivers had better scores than female patients (8.7 versus 8.4; $p=0.032$), while no significant difference was observed among males. Caregivers aged 41–63 years also scored higher than their patient counterparts (8.8 versus 8.5; $p=0.045$). Urban participants had higher knowledge than rural participants (8.6 versus 8.4; $p=0.014$), and urban caregivers had higher knowledge than urban patients (8.8 versus 8.6; $p=0.018$). Education beyond 12th grade was associated with higher scores (8.8 versus 8.5; $p<0.001$), with caregivers in this group scoring significantly higher than patients (9.1 versus 8.6; $p<0.001$). Similarly, skilled workers scored higher than unskilled (8.7 versus 8.5; $p<0.001$), caregivers outperforming patients among skilled workers (8.9 versus 8.6; $p=0.011$). Diabetes status showed no significant impact on knowledge scores. Participants with other comorbidities had slightly higher scores (8.7 versus 8.5; $p=0.015$), but differences between patients and caregivers were only significant in those without comorbidities (Table 3). Finally, the proportion of high

performers was significantly greater in the caregiver group compared with patients across almost all sociodemographic strata, except for place of residence, where no significant difference was observed (Table 4).

Discussion

It is often assumed that individuals living with a chronic NCD improve their health literacy through personal experience and become key sources of information for others. However, in low-income settings like India, where literacy levels and patient awareness of health conditions remain suboptimal, the primary responsibility for imparting health education rests with healthcare professionals. With hypertension prevalence approaching 20% in a country of 1.4 billion people, this task is overwhelming, highlighting the need to look beyond clinic walls.⁵ Family members and caregivers can play a pivotal role in disease management by supporting adherence, lifestyle modifications and follow-up.¹⁴ Our study challenges the conventional perspective and compares knowledge of hypertension among patients and their caregivers in a tertiary care cardiology setting.

In this context, the present study compared hypertension-related knowledge between patients and their accompanying caregivers in a tertiary cardiology out-patient setting and examined sociodemographic factors associated with knowledge performance. Several key messages emerge from our study that can inform and enhance clinical practices in managing NCDs. First, only half of the participants were aware that hypertension is a condition of high BP. Caregivers demonstrated statistically higher knowledge scores than patients, though the magnitude of this difference was small. Second, critical

Table 3: Comparison of hypertension knowledge scores between patients and their caregivers using a continuous scale

Variables	Overall Mean \pm SD	Overall p-value	Patient Mean \pm SD	Caregiver Mean \pm SD	p-value
Sample size	3,501		2,032	1,469	
Overall	8.6 (2.1)		8.5 (2.1)	8.7 (2.1)	0.004
Gender		0.224			
Male	8.6 (2.0)		8.5 (2.1)	8.7 (2.0)	0.064
Female	8.5 (2.1)		8.4 (2.1)	8.7 (2.1)	0.032
Age group		0.453			
18–40	8.5 (2.1)		8.4 (2.0)	8.6 (2.1)	0.064
41–63	8.6 (2.1)		8.5 (2.2)	8.8 (2.1)	0.045
64–85	8.7 (2.0)		8.6 (2.0)	9.0 (1.8)	0.093
Place of residence		0.014			
Urban	8.6 (2.1)		8.6 (2.1)	8.8 (2.1)	0.018
Rural	8.4 (2.0)		8.4 (2.0)	8.6 (2.0)	0.081
Education		0.000			
Up to 12th	8.5 (2.0)		8.4 (2.1)	8.5 (2.0)	0.574
Beyond 12th	8.8 (2.1)		8.6 (2.1)	9.1 (2.1)	0.000
Occupation		0.000			
Unskilled	8.5 (2.0)		8.4 (2.1)	8.5 (2.1)	0.242
Skilled	8.7 (2.1)		8.6 (2.1)	8.9 (2.1)	0.011
History of diabetes		0.391			
Yes	8.7 (2.1)		8.6 (2.0)	8.7 (2.1)	0.650
No	8.6 (2.1)		8.5 (2.1)	8.7 (2.1)	0.003
Other co-existing comorbidities		0.015			
Yes	8.7 (2.0)		8.7 (2.0)	8.7 (2.0)	0.679
No	8.5 (2.1)		8.4 (2.1)	8.7 (2.1)	0.001

SD = standard deviation.

knowledge gaps were identified, as we observed poor awareness of major risk factors except for salt intake, about hypertension-related complications and the importance of on-going follow-up even after BP control. Third, self-monitoring of BP was suboptimal, with fewer than one in four participants performing regular checks, an essential practice for preventing acute hypertensive crises and enabling timely therapeutic adjustments. Lastly, sociodemographic disparities, particularly lower education, rural residence and unskilled occupation, were associated with poorer knowledge scores, underscoring the need for tailored patient–caregiver *educational interventions within cardiology care pathways*.

Although caregivers demonstrated higher mean knowledge scores than patients, the difference was small (0.2 on a 15-point scale), suggesting broadly comparable levels of awareness between the two groups. Domain-level analysis showed that statistically significant differences were primarily observed in awareness of alcohol consumption and salt intake as risk factors, as well as recognition of hypertension as asymptomatic. In contrast, awareness regarding renal involvement and the need for continued medical follow-up remained low in both groups, with minimal difference between patients and caregivers. The finding that only 50% recognized the term ‘hypertension’ is

Table 4: Association between high-performing participants (patient/caregiver) and their sociodemographic characteristics

Variables	Patient N (row %)	Caregiver N (row %)	p-value
Total	1,374 (57)	1,029 (43)	
Gender			0.063
Male	765 (55.6)	612 (44.4)	
Female	609 (59.4)	417 (40.6)	
Age group			0.000
18–40	649 (50.7)	630 (49.3)	
41–63	555 (62.9)	328 (37.1)	
64–85	170 (70.5)	71 (29.5)	
Place of residence			0.209
Urban	974 (58)	705 (52)	
Rural	400 (55.2)	324 (44.8)	
Education			0.000
Up to 12th	978 (60.5)	638 (39.5)	
Beyond 12th	396 (50.3)	391 (49.7)	
Occupation			0.000
Unskilled	839 (61.8)	519 (38.2)	
Skilled	535 (51.2)	510 (48.8)	
History of diabetes			0.000
Yes	231 (66.2)	118 (33.8)	
No	1,143 (55.6)	911 (44.4)	
Other co-existing comorbidities			0.000
Yes	492 (63.2)	286 (36.8)	
No	882 (54.3)	743 (45.7)	

concerning. Low awareness can also be attributed to the silent, asymptomatic nature of the condition, which delays diagnosis and impairs patients’ motivation to seek care. It is well known that low awareness contributes to delayed diagnosis, poor control rates and higher complication risk.¹⁵ Even in low-literacy settings, public health campaigns have been on-going for years, suggesting that messaging is not fully penetrating at the community level.¹⁶ However, this also reflects the community’s use of alternative lay terminology. While this finding underscores the need for broader public education, it also highlights the importance of delivering health messages in culturally relevant language that resonates with local populations.

Caregivers, however, demonstrated consistently higher hypertension-related knowledge than patients. This is consistent with the global literature depicting that caregivers possess a significant understanding of hypertension, including its risk factors and possible complications, reinforcing evidence from prior studies.⁶ These findings highlight the importance of recognizing and involving caregivers in hypertension management. It is widely accepted that family caregivers can greatly influence a patient’s health behaviour, especially in conditions such as hypertension, where lifestyle modifications, such as adequate physical activity and reduced dietary salt intake, are highly beneficial.⁸ Given their pivotal role in influencing patient behaviour, caregivers’ involvement in educational interventions and decision-making processes should be prioritized in both primary and chronic care settings. Healthcare delivery in developing countries with resource-limited settings often faces constraints, such as high patient volumes

and limited consultation time, which hamper effective communication and impair the dissemination of information regarding disease.¹⁷ Therefore, the family-centred approach also offers a cost-effective and sustainable means of enhancing hypertension control at the population level.

Our participants depicted low knowledge about major risk factors of hypertension and the importance of on-going follow-up even after BP control. Hypertension has both modifiable and non-modifiable risk factors. Primordial and primary prevention can be effectively achieved by addressing modifiable risk factors such as excessive salt intake, alcohol consumption, smoking and obesity. The prevalence of obesity is reported to be 13.85% in India and 16% globally.^{18,19} Although tobacco and alcohol consumption have decreased nationally, absolute numbers remain substantial (tobacco use decreasing from 44.5% in 2016 to 32.6% in 2021, and alcohol use from 29.2% to 17.5%).²⁰ The study revealed that awareness of alcohol, smoking and obesity as risk factors was poor, with only salt consumption recognized by a majority (over two-thirds of the participants). This level of awareness is lower than in comparable studies, underscoring the need for intensified public health efforts.²¹

There were critical knowledge gaps in awareness about major risk factors, hypertension-related complications and disease management. Apart from other risk factors, most of our participants were aware of the role of a low-salt diet, reiterating the role of advocacy. On the other hand, most participants recognized the heart as a target organ, but fewer were aware of hypertension's association with stroke. The study participants depicted lower awareness of hypertension-related complications compared with previous research.^{22,23} Also, very few participants were aware of the nephropathic impact of hypertension.²⁴ These findings align with other studies, where the impact of hypertension on kidney health was also poorly recognized.²⁵ Hypertension is one of the most common causes of CKD, and with diabetes, it accounts for over half of CKD-related deaths.²⁴ Thus, it is crucial to regularly sensitize frontline health workers about the full spectrum of risk factors and associated complications.²⁶

Our finding of suboptimal self-monitoring of BP among patients with hypertension aligns with global evidence. This is in concurrence with conclusions drawn from a systematic review, which attributes inadequate knowledge about the benefits of BP control, accessibility to BP measuring devices and interpretation of BP values.²⁷ The non-compliance is further exacerbated by treatment fatigue, a type of psychological exhaustion emanating from the burden of chronic disease management, which undermines long-term adherence.²⁸ Additionally, the asymptomatic nature of hypertension contributes to poor health-seeking behaviour. People with hypertension often delay initiating treatment or discontinue regular follow-up, reinforcing inertia in preventive care.^{29,30} Even under treatment, most were unaware of hypertension symptoms and could not appreciate the need for continuous medical follow-up despite achieving BP control. Prevalent misconceptions about the episodic or intermittent nature of hypertension also contribute to poor adherence and delayed intervention, ultimately hindering effective disease control and increasing the risk of complications.³¹

We observed significant disparities in knowledge scores as per certain sociodemographic variables, a finding consistent with prior research from both India and other LMICs. Studies have repeatedly shown that lower education levels, rural residence, female gender and unskilled

occupations are associated with poorer hypertension awareness and management outcomes.³² In low-resource settings, financial constraints often deter individuals from engaging in regular disease screening or follow-up visits, as the immediate cost of preventive care is perceived as avoidable. However, such non-compliance leads to catastrophic complications with a high risk of morbidity and mortality. Management of such complications also entails substantial out-of-pocket costs due to repeated hospitalizations, emergency interventions and long-term rehabilitation. In such contexts, the role of the family becomes crucial, as they not only encourage preventive behaviours, such as regular BP monitoring, medication adherence and timely medical consultations, but also provide financial and emotional support during acute illness.^{33,34} Caregivers, when adequately sensitized, can act as catalysts in shifting households from a curative to a preventive approach, thereby reducing the likelihood of catastrophic expenditure and improving long-term cardiovascular outcomes.³¹

Our study has a few strengths and limitations that should be acknowledged. A key strength is the large sample size and the diversity of participants' backgrounds, which enhance the statistical power and precision of our findings. By simultaneously including both patients and their caregivers, the study provides robust evidence to advance the agenda of family-centred care, which is often overlooked in the existing literature. The use of a standardized questionnaire administered by trained investigators further ensured methodological rigour and minimized interviewer bias.

However, certain limitations must be considered while interpreting our results. First, the cross-sectional design precludes establishing causal relationships between sociodemographic factors and knowledge scores. Second, the study was conducted in a single tertiary care cardiology OPD in Northern India. Participants presenting to a referral centre may differ from community-based hypertensive populations in terms of health-seeking behaviour, disease severity and baseline awareness. Therefore, the findings may not fully represent knowledge levels at the community level. Third, although self-reported practices such as BP monitoring were assessed using standardized procedures, some degree of reporting bias cannot be entirely excluded. Lastly, while the structured questionnaire captured key domains of hypertension knowledge, it may not have encompassed the full spectrum of disease-related perceptions and cultural beliefs. When interpreting generalizability, it is important to recognize that these findings reflect a clinic-based population in a tertiary cardiology setting in Northern India. Extrapolation to other regions, community settings or different health system contexts, including other LMICs or high-income countries, should therefore be undertaken with caution.

Despite these limitations, the study provides important insights into patient-caregiver knowledge dynamics and identifies actionable gaps relevant to strengthening hypertension control strategies in resource-constrained settings.

This study has strong clinical and policy implications. Our findings reaffirm that hypertension control cannot be viewed as the sole responsibility of the patient; caregivers must be actively engaged as equal partners in disease management. For clinicians, this translates into a more family-centred approach to counselling, where both patients and caregivers receive clear, actionable education on lifestyle modification, medication adherence and the importance of regular follow-up. At the policy level, integrating caregiver-focused modules into national programmes such as the India Hypertension

Control Initiative and NP-NCD could strengthen household-level disease management.^{35,36} Moreover, ensuring access to affordable BP monitoring devices and tailoring health communication strategies to address sociodemographic disparities, particularly among rural, less-educated and low-income populations, are critical steps towards improving control rates. Beyond India, these insights are directly relevant to the international community, as hypertension is now the leading preventable cause of premature mortality worldwide.³⁷ Leveraging caregivers as active partners has strong applicability in sub-Saharan Africa, Latin America and Southeast Asia, where structural constraints in the health systems mirror those in India. Even in high-income countries, where adherence gaps and fragmented care remain barriers, family-based counselling and caregiver engagement can enhance continuity of care. Aligning with global frameworks such as the World Health Organization's HEARTS technical package for cardiovascular disease management in primary healthcare, our findings underscore that caregiver engagement should be recognized as a cross-cutting strategy to strengthen hypertension control globally.³⁸

Therefore, the critical recommendations emerging from our study include adopting family-based counselling as a routine part of

hypertension management in clinical practices; designing community-based health education campaigns that focus not only on salt reduction but also on less well-recognized risk factors, such as alcohol use, obesity and smoking; scaling up affordable and accessible self-monitoring of BP through community health workers and public distribution channels; and embedding equity-sensitive approaches into policy frameworks to address the persistent knowledge gaps linked to education, occupation and place of residence.

In conclusion, the current study, which is likely among the first clinic-based comparative studies in India, highlights that caregivers often demonstrate greater knowledge of hypertension than patients do, underscoring their potential as allies in chronic disease management. The study reveals critical gaps in awareness of risk factors, complications and follow-up practices, and shows how these are influenced by sociodemographic disparities. By strategically engaging caregivers, addressing inequities and strengthening both clinic- and community-based educational initiatives, there is an opportunity to significantly improve hypertension control in India and similar LMIC settings. Ultimately, empowering both patients and caregivers represents a pragmatic pathway towards reducing cardiovascular morbidity, mortality and the economic burden of uncontrolled hypertension. □

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