

Original Research Article

A cross-sectional study on the impact of mobile medical units on hypertension awareness and management in rural Himachal Pradesh and Uttarakhand

Banoj Kumar Mahanta^{1*}, Narayan Rao Sameni¹, Sudeep Sinha², Retisha Sharma³,
Surabhi Pandey³, Sagar Kumar Jha³

¹Monitoring, Evaluation and Learning Department, The Hans Foundation, Gurugram, India

²Programme and Strategic Initiatives Department, The Hans Foundation, Gurugram, India

³Public Health Department, Integra Ventures Pvt Limited, Delhi, India

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*Correspondence:

Banoj Kumar Mahanta,
E-mail: banoj@thfmail.com

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ABSTRACT

Background: In India, the shift from communicable to non-communicable diseases such as hypertension is significant. Mobile medical units (MMUs) are among the new initiatives to improve hypertension treatment coverage in rural areas across many countries. The Hans Foundation has implemented Mobile Medical Unit intervention for over a year in the rural areas of Himachal Pradesh and Uttarakhand. This cross-sectional study aimed to investigate the factors affecting hypertension and to evaluate awareness, attitudes, and practices among rural communities, highlighting the effectiveness of MMUs.

Methods: In total, 418 randomly selected participants were recruited for this study. The respondents were adults (aged 18+ years) diagnosed with hypertension (systolic BP $\geq$ 130 and/or diastolic BP $\geq$ 90), on medication, and enrolled for over three months in Himachal Pradesh and Uttarakhand. Structured/semi-structured questionnaires were used in beneficiary interviews, key informant interviews (KIIs), and focus group discussions (FGDs) to examine the demographic, socioeconomic, and lifestyle factors influencing hypertension awareness and MMU effectiveness in the intervention areas.

Results: The study findings revealed a high awareness of hypertension risk factors, with stress being the most recognized (95%) and family history (46%). 54% of the study respondents lacked formal education, and respondents included homemakers (25%) and farmers (17%). Females demonstrated significantly higher awareness of alcohol consumption as a risk factor (64%, $p<0.033$) and unanimously believed in regular BP monitoring ($p<0.004$) for hypertension management compared to males.

Conclusions: The study emphasized the substantial impact of MMU on health outcomes and accessibility. Participants expressed high satisfaction with MMU services, highlighting their perceived effectiveness of healthcare delivery.

Keywords: Hypertension, Knowledge, Attitude, Practice, Hypertension risk factors, Mobile medical unit, The Hans Foundation

INTRODUCTION

Many developing countries, including India, are experiencing an epidemiological shift from

communicable to non-communicable diseases (NCDs), and hypertension has become a disease condition of great concern in these countries.¹ In an attempt to defeat this silent killer, the World Health Organization (WHO) has

reported that four out of five hypertensive individuals do not receive proper treatment, and 76 million deaths might be prevented from the catastrophic effect of high blood pressure between 2023 and 2050 if countries managed to increase coverage.² Worldwide, one in three adults suffer from hypertension.²

Stroke, heart attack, heart failure, renal damage, and other health issues are caused by this prevalent and fatal illness. The population with hypertension (blood pressure of 140/90 mmHg or above or on medication) increased from 650 million to 1.3 billion between 1990 and 2019.² More than 75% of adult hypertensive patients reside in low- and middle-income nations.

The risk of high blood pressure can be increased by heredity and advanced age, but it can also be increased by risk factors such as eating a diet heavy in salt, exercising rarely, and consuming excessive amounts of alcohol. Medications and lifestyle modifications are two popular ways to manage this disease. Lifestyle adjustments, such as eating a healthier diet, quitting smoking, and exercising regularly can help lower blood pressure. One of the most economical approaches for hypertension prevention is by early detection, promoting behavior change and cost-effective treatment.

India has set a target to attain a 25% relative reduction in the prevalence of hypertension by 2025.³ The Indian government has launched numerous programs in an effort to accelerate progress. MMU (medical mobile unit) is one such initiative. One such initiative was launched by The Hans Foundation in 2021 in the states of Himachal Pradesh and Uttarakhand providing effective services to over 1.3 million beneficiaries. The Mobile Medical Unit's concurrent monitoring data on non-communicable diseases (NCD) statistics revealed that among the prevalent issues, 29% are related to anaemia, 26% to hypertension, and 20% to diabetes. Current cross-sectional study was conducted in the MMU intervention villages in the state of Himachal Pradesh and Uttarakhand with an aim of investigating the factors affecting hypertension and evaluating its awareness in the form of knowledge, attitude and practices among the rural communities.

Study objectives

To examine specific risk factors for hypertension, including dietary habits, physical inactivity, tobacco use, alcohol consumption, and genetic predispositions. To evaluate the level of awareness and knowledge about hypertension in rural communities. To assess the effectiveness of the MMU services in the Intervention areas.

METHODS

The current study was conducted in two MMU intervention states, namely Himachal Pradesh and

Uttarakhand, encompassing two districts each Kangra and Udham Singh Nagar. Known cases of hypertension who were already enrolled with the MMU and were receiving services from them were selected for the study. This study was conducted from January 2024-March 2024. Following the Institutional Review Board (IRB's) clearance, this research was conducted.

Those who visited MMU's services were randomly selected as respondents for the interviews. Line listing of the beneficiaries was shared by the MMU teams from both the states. The inclusion criteria involved adults above 18 years with known hypertension (systolic BP $\geq$ 130 and/or diastolic BP $\geq$ 90) diagnosed by a healthcare professional and was on medication, enrolled with MMUs at least for more than three months. Mentally challenged and below 18 years were excluded from the study. Two blocks (Bhawarna and Mahakal) of District Kangra (Himachal Pradesh) and 4 blocks (Gadarpur, Sitarganj, Khatima and Rudrapur) of District Udham Singh Nagar (Uttarakhand) with 418 beneficiaries all in total were selected for the study. Respondents from the line list were selected randomly for conducting interviews.

The study employed a mixed-method approach combining qualitative and quantitative methods to evaluate hypertension in MMU intervention areas. Using a cross-sectional research design, data was collected at a single point in time to deeply analyze hypertension associated risk factors and the knowledge and awareness of the condition among the rural communities of the two states.

Various data collection methods such as beneficiary interviews, key informant interviews (KIIs), and focus group discussions (FGDs) in the form of structured and semi-structured questionnaires were utilized to gather insights on demographic, socio-economic, and lifestyle factors contributing to hypertension, awareness levels. The structured and semi-structured interview schedules were designed by an expert group of public health specialist and by taking references from the WHO STEPS Instrument guide.⁴ Following a sociodemographic assessment the KAP questionnaire was administered to evaluate the awareness of hypertension among each research participant. KAP questionnaire consists of 53 questions (knowledge-17, attitude-13, practice-20). Six local doctors, six community leaders (Village Pradhan) and six frontline workers were also interviewed and ten FGDs were conducted during the study to get the insights of the hypertension related aspects and the effectiveness of the MMUs in the intervention areas. The surveys were originally written in English, and then translated and administered in Hindi. The "Kobo Toolbox software" was used to collect the data. The questionnaire was prepared in multiple sections like socio-demographic, hypertension information, behavioral, dietary details, alcohol and smoking, physical activity, stress management, KAP (knowledge, awareness and practice) sections to get

detailed insights on hypertension. Before making the required adjustments, a pre-test consisting of 10 participants who were not included in the sample was conducted to confirm that the questions were comprehended and are apparent.

The collected data was examined, collated, and converted into percentages and proportions. For statistical analysis Statistical Package for Social Sciences (SPSS) version (22.05) was used. The significance level was determined using the Chi-square test, with $p < 0.05$ considered as statistically significant.

RESULTS

Out of the total 418 participants, 67% (279) were female, while 33% (139) were male collectively from Himachal and Uttarakhand. Majority 66% (275) of the respondents were in the above >60 years age group. In both Himachal Pradesh and Uttarakhand, higher percentage of males (87%, 88%) were married compared to female (57%, 64%). Uttarakhand exhibits a higher concentration (54%) of individuals with no formal education.

Table 1: Characteristics of study participants.

Social demographic background			
Characteristics	Himachal Pradesh	Uttarakhand	Overall
Gender			
Male	77 (38)	62 (29)	139 (33)
Female	125 (62)	154 (71)	279 (67)
Age (in years)			
18-35	.	3 (1)	3 (1)
36-45	10 (5)	17 (8)	27 (6)
46-59	53 (26)	60 (28)	113 (27)
60+	139 (69)	136 (63)	275 (66)
Marital status			
Married	135 (67)	157 (73)	292 (70)
Unmarried	2 (1)	1 (0)	3 (1)
Widowed	64 (32)	56 (26)	120 (29)
Separated	-	1 (0)	1 (0)
Divorced	-	1 (0)	1 (0)
Level of education			
Primary (up to class 5)	56 (28)	49 (23)	105 (25)
Middle school (up to class 8)	39 (19)	27 (13)	66 (16)
High school (up to class 10)	44 (22)	8 (4)	52 (12)
Intermediate (up to class 12)/diploma	12 (6)	6 (3)	18 (4)
Graduate	6 (3)	7 (3)	13 (3)
Post graduate	1 (0)	1 (0)	2 (0)
Illiterate (no school)	44 (22)	117 (54)	161 (39)
Others	0	1 (0)	1 (0)
Occupation			
Agricultural labors	12 (6)	7 (3)	19 (5)
Agriculture farming (own farm)	36 (18)	34 (16)	70 (17)
Business	1 (0)	4 (2)	5 (1)
Daily wage laborer	11 (5)	21 (10)	32 (8)
Govt. employee	14 (7)	9 (4)	23 (6)
Home maker	59 (29)	45 (21)	104 (25)
Not working/unemployed	32 (16)	34 (16)	66 (16)
Other	47 (23)	35 (16)	82 (20)
Private employee	4 (2)	6 (3)	10 (2)
Self employed	-	7 (3)	7 (2)
Type of family			
Lone individuals or single person households	-	2 (1)	2 (0.5)
Joint	162 (80)	97 (45)	259 (62)
Nuclear	38 (19)	117 (54)	155 (37)
Extended family	2 (1)	0	2 (0.5)
Total	202	216	418

A significant proportion, 25%, were home makers, while 17% were engaged in agriculture farming on their own farms. Majority 62% (259) were having joint families (Table 1). Table 2 represents the distribution of the lifestyle and risk factors among the study population.

Family history of hypertension was present in 29% (120) cases while 31% (130) has agreed to have comorbidities. Among the studies participants 40% (167) had BMI $\geq$ 25. Table 3 represents the knowledge of the awareness of hypertension and its associated risk factors among the study participants.

Table 2: Distribution of life style and risk factors among study participants.

S. no.	Life style and risk factor assessment		
	Factors	Yes (%)	No (%)
1	Family history of hypertension	120 (29)	298 (71)
2	Comorbidities	130 (31)	288 (69)
3	BMI ($\geq$ 25)	167 (40)	242 (60)
4	Reliability on traditional healing	162 (39)	256 (61)
5	Engaged in physical activity	249 (60)	169 (40)
6	Perception of stress as a risk factor	396 (95)	23 (5)
7	Alcohol use	49 (12)	369 (88)
8	Tobacco use	55 (13)	363 (87)
9	Additional salt intake	62 (15)	356 (85)

Table 3: Knowledge of hypertension among study participants.

Knowledge	Female (Yes%)	Male (Yes%)	Total (%)	P value
1. Are you aware of the condition high B.P/Hypertensio	222 (80)	115 (83)	337 (81)	0.441
2. Are you aware that having a family history of hypertension increases your chance of developing hypertension?	134 (70)	58 (30)	192 (46)	0.223
3. Are you aware that having a sedentary (less physically active) lifestyle increases your chance of developing hypertension?	196 (65)	108 (36)	304 (73)	0.107
4. Are you aware that smoking is a risk factor for hypertension?	220 (65)	120 (35)	340 (81)	0.064
5. Are you aware that drinking alcohol is a risk factor for hypertension?	214 (64)	119 (36)	333 (80)	0.033
6. Are you aware that overweight/obesity is a risk factor for hypertension?	245 (66)	125 (34)	370 (89)	0.523
7. Are you aware that diabetes is a risk factor for hypertension?	243 (68)	117 (33)	360 (86)	0.415
8. Are you aware that stress is a risk factor for hypertension?	266 (67)	129 (33)	395 (94)	0.284

Overall, awareness levels were consistently high across various risk factors, with the highest awareness observed for stress 95% (395) and the lowest for family history 46% (192). Gender differences in awareness were observed for alcohol consumption as a risk factor, where females 64% (214) showed significantly ($p<0.033$) higher awareness compared to males 36% (119). In contrast, other risk factors showed no significant gender differences in awareness levels. Findings in the Table 4 indicates a strong positive attitude among study participants towards hypertension management and preventive measures. Participants believe preventive actions such as reducing salt intake, regular BP

monitoring, accessing healthcare services, and adhering to medication. Variations in attitudes between genders, was present and statistically significant ($p<0.004$) regarding the importance of regular BP monitoring, where 100% (279) females believed in regular monitoring compared to men. Positive health practices among the study participants regarding hypertension management is indicated in Table 5. Most participants reported engaging in recommended behaviors such as dietary modifications, regular exercise, and adherence to medication. There were high levels of compliance with healthcare advice, including attending follow-up appointments and making lifestyle changes. These findings are further supported by

the findings of the focus group discussion (FGD), which demonstrated that the majority of participants understood the significance of medication adherence and followed their doctor's instructions. Some people, though, were ignorant of the negative effects of frequently missing doses of medication and also reported that they consume almost regularly pickles (achaar) and papads which, are major sources of extra salt intake. Overall practices related to hypertension management did not significantly vary by gender. The study participants' ratings in Figure 1 indicates a predominantly positive perception of the mobile medical unit (MMU) across multiple dimensions.

The MMU is widely viewed as positively impacting health outcomes, with a significant majority acknowledging its beneficial effects on personal health and healthcare accessibility in the community. Participants also reported feeling more knowledgeable about health management and expressed high satisfaction with the professionalism of MMU staff and overall healthcare services. Overall, the findings underscore the MMU's effectiveness in delivering essential healthcare services and educating communities, while highlighting opportunities for further enhancing its impact and reach.

Table 4: Attitude about hypertension among study participants.

Attitudes	Female (Yes%)	Male (Yes%)	Total (%)	P value
1. Do you believe hypertension can be managed or controlled?	274 (98)	135 (97)	418 (100)	0.471
2. Should we reduce salt intake to prevent hypertension?	277 (99)	137 (99)	414 (99)	0.474
3. Do you think regular checking of BP is important?	279 (100)	135 (97)	414 (99)	0.004
4. Should we access healthcare services regularly?	278 (100)	138 (99)	416 (100)	0.614
5. Do you think regular medication is important in hypertension?	278 (100)	136 (98)	414 (99)	0.075
6. Should we exercise regularly for a healthy life?	265 (95)	133 (96)	398 (95)	0.075
7. Do you think it is important to avoid adding extra salt to cooked food?	265 (95)	133 (96)	398 (95)	0.075
8. Do you think it is important to avoid eating foods outside of the house?	265 (95)	133 (96)	398 (95)	0.075
9. Do you think it is important to limit the consumption of processed foods such as: chips, fried foods, achar etc?	265 (95)	133 (96)	398 (95)	0.075

Table 5: Practices followed by study participants.

Practices	Female (%)	Male (%)	Total (%)	P value
1. Have you ever got your blood cholesterol checked?	129 (46)	61 (44)	190 (46)	0.649
2. Do you follow a specific diet or dietary restrictions to manage hypertension?	199 (71)	102 (73)	301 (72)	0.659
3. Do you exercise regularly to control hypertension?	145 (52)	77 (55)	222 (53)	0.509
4. Do you often eat processed foods such as: chips, fried foods, achar, papad etc.?	13 (5)	6 (4)	19 (5)	0.874
5. Do you smoke?	17 (6)	12 (8)	29 (7)	0.336
6. Do you take your prescribed hypertension medication as instructed by the healthcare provider?	252 (90)	122 (88)	374 (90)	0.423
7. Do you attend follow-up appointments for hypertension check-ups at the Mobile Medical Unit?	272 (98)	137 (99)	409 (98)	0.478
8. Have you made any lifestyle changes to control hypertension, as advised by the healthcare provider?	265 (95)	135 (97)	400 (96)	0.31

DISCUSSION

The results of the present study reveal critical insights into the demographic distribution, lifestyle factors,

awareness, attitudes, and practices related to hypertension among the population in Himachal Pradesh and Uttarakhand. These findings contribute to a broader understanding of hypertension management and prevention in rural India.

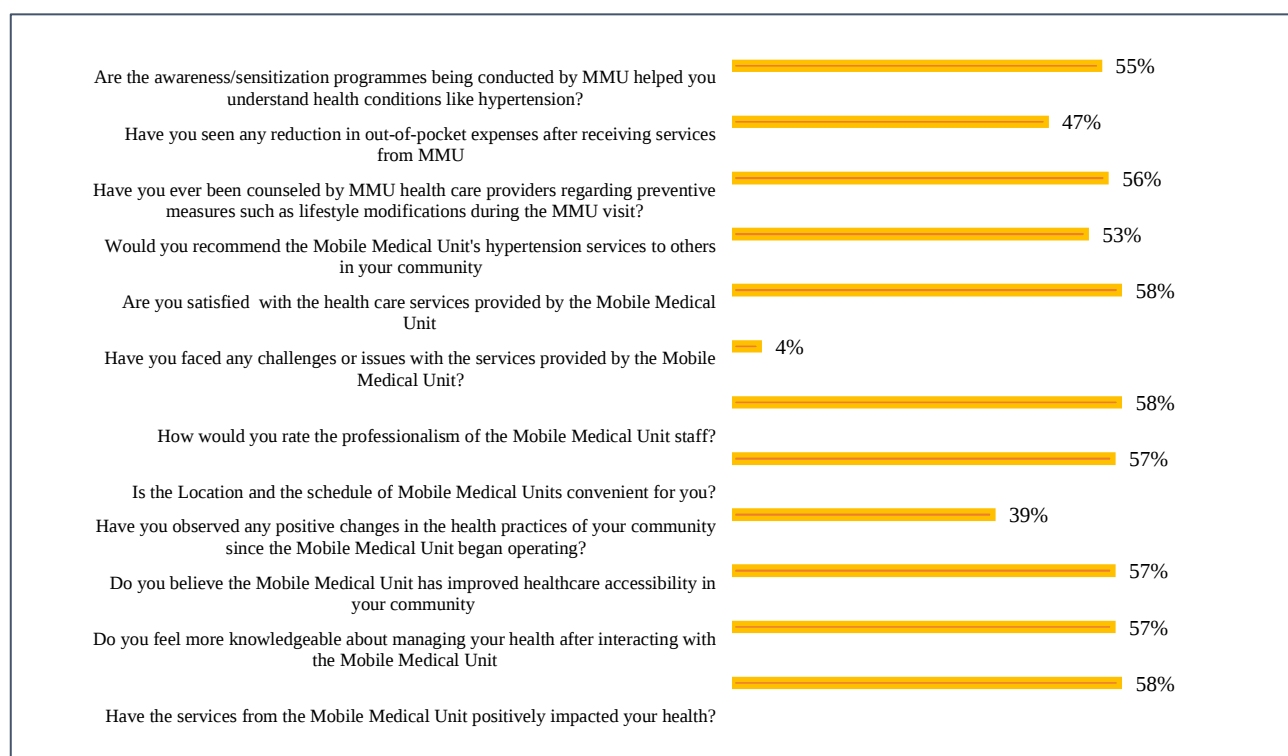


Figure 1: Perceived effectiveness of MMU across different aspects: study participant rating.

The study involved 418 participants, with a higher representation of females (67%) compared to males (33%). Most of the respondents (66%) were aged above 60 years. This demographic skew towards older individuals is consistent with the increased prevalence of hypertension in older populations, as reported in the study by the Department of Community Medicine at Kerala's Government Medical College, which found that hypertension is prevalent among 47% of the urban population, with significant representation of older age groups.⁴ This is consistent with findings from the study in Sri Lanka, where the majority of participants were also older adults.⁵

In both Himachal Pradesh and Uttarakhand, a higher percentage of males (87% and 88%, respectively) were married compared to females (57% and 64%). Additionally, Uttarakhand exhibited a higher concentration (54%) of individuals with no formal education. These socio-demographic factors are crucial as they influence health-seeking behavior and adherence to medical advice. For instance, a study from Sri Lanka highlighted that individuals with higher education levels were more likely to adhere to hypertension management practices.⁵ This is consistent with previous studies, such as the one conducted in urban Kerala, where educational standards were also found to be a significant factor in health awareness and management.⁴ Occupationally, 25% were homemakers, and 17% were engaged in agriculture, which are common occupations in these regions, potentially affecting their lifestyle and access to healthcare.

The high percentage of individuals with no formal education in Uttarakhand (54%) suggests barriers in health literacy and healthcare access. Lower education levels often correlate with reduced health literacy, impacting health management. Improving health literacy in regions with high illiteracy is crucial. The study from Akatsi South District in Ghana underscores the importance of health literacy in managing conditions like hypertension and diabetes.³ The significant proportion of homemakers (25%) and those engaged in agriculture (17%) underscores the rural occupational landscape of the study areas. The prevalence of joint families (62%) indicates a social structure that can influence health behaviors through collective decision-making. The Gandhinagar study showed that family support plays a vital role in managing chronic diseases like hypertension.

Participants reported high compliance with recommended health practices, such as dietary modifications, regular exercise, and adherence to medication. These findings are in line with virtual-based nutritional intervention studies that showed a significant improvement in knowledge, attitude, and practice scores post-intervention. Similarly, the study from Ghana found that good attitudes towards hypertension were strong predictors of health practice compliance. The distribution of lifestyle and risk factors among the study population highlighted that 40% had a BMI of ≥ 25 , indicating a high prevalence of overweight and obesity. Family history of hypertension was present in 29% of cases, and 31% had comorbidities. These factors align with findings from a study conducted in

Kerala, where high salt intake and diabetes mellitus were significantly associated with hypertension.

The awareness of hypertension risk factors was generally high, particularly regarding stress (95%), though awareness of family history as a risk factor was lower (46%). The high prevalence of BMI ≥ 25 among the participants points to the necessity for nutritional education and physical activity promotion to combat obesity, a significant risk factor for hypertension.

The prevalence of comorbidities (31%) among the study participants also indicates a substantial burden of chronic diseases, which can complicate hypertension management. Joint family structures (62%) could provide both a support system and a potential barrier to individual health management practices. This dual role of family structures in health management has been observed in other studies as well, suggesting that public health interventions should consider family dynamics when designing hypertension management programs. Significant gender differences in awareness were observed for alcohol consumption as a risk factor, with females (64%) showing higher awareness compared to males (36%). This difference was statistically significant ($p < 0.033$). These findings are in line with a study from North India that reported males had higher knowledge about normal BP levels, but females were more aware of lifestyle modifications necessary for hypertension management. The study participants exhibited a strong positive attitude towards hypertension management, with significant gender differences noted in the belief in regular BP monitoring ($p < 0.004$), (100% females vs. males). This is consistent with a hospital-based study from North India that found significant positive attitudes towards regular intake of antihypertensive drugs and lifestyle changes.

Positive health practices were prevalent among the study participants, with high levels of compliance with dietary modifications, regular exercise, and adherence to medication. The results align with a study in Sri Lanka where 74% of hypertensive patients adhered to prescribed medications, and 95% regularly checked their BP. However, the overall practices related to hypertension management did not significantly vary by gender, indicating a general awareness and commitment to managing hypertension across both genders.

When compared with other studies, our study findings offer a nuanced understanding of hypertension awareness and management in a rural and semi-urban context. The findings of this study are comparable to several other studies in different regions of India and beyond. For instance, the urban Kerala study reported high prevalence but low awareness of hypertension, like our finding of high awareness of specific risk factors but variable awareness of others like family history. The study on the efficacy of virtual-based nutritional interventions further supports the positive impact of targeted health education

on improving knowledge, attitudes, and practices regarding hypertension management. Similarly, the study on diabetes and hypertension knowledge indicated higher awareness among diabetics, suggesting that comorbid conditions might drive better health literacy. Our findings align with the positive correlation between knowledge, attitude, and practice observed in virtual-based intervention studies, reinforcing the importance of educational interventions.

One of the strengths of this study is its large sample size and representation of both Himachal Pradesh and Uttarakhand, providing a comprehensive view of the hypertension-related knowledge, attitudes, and practices in these regions. However, the study has limitations, including its cross-sectional design, which limits the ability to infer causality. Future research should focus on longitudinal studies to assess the long-term impact of educational interventions on hypertension management outcomes.

The current study highlights the importance of targeted health education and community-based interventions to enhance awareness, attitudes, and practices related to hypertension management in rural India. Overall, the findings underscore the MMU's effectiveness in delivering essential healthcare services and educating communities, while highlighting opportunities for further enhancing its impact and reach. Addressing gender-specific needs and focusing on high-risk groups such as the elderly and those with lower education levels will be critical in improving health outcomes. Future research should focus on longitudinal studies to assess the long-term impact of educational interventions on hypertension management outcomes.

CONCLUSION

This study provides comprehensive insights into the demographic profile, health awareness, attitudes towards hypertension management, and perceptions of healthcare services among participants from Himachal Pradesh and Uttarakhand. Most participants were elderly, married males engaged in agriculture or homemaking, residing in joint families with limited formal education. Despite these demographic specifics, awareness levels regarding hypertension and associated risk factors were generally high, with notable gender differences observed for alcohol consumption awareness. Participants exhibited a strong positive attitude towards hypertension management, emphasizing preventive measures such as dietary adjustments and regular blood pressure monitoring. The study highlighted the MMU's significant role in improving health outcomes and accessibility, with participants expressing high satisfaction and perceived effectiveness of MMU services. These findings underscore the MMU's vital role in healthcare delivery and health education within the community, while also identifying areas for potential improvement in enhancing

health practices and further tailoring services to meet specific demographic needs.

Recommendations

The importance of MMUs is filling in healthcare gaps among rural people in Uttarakhand and Himachal Pradesh. The study highlights the MMUs success in improving health outcomes, particularly among elderly individuals with limited education and access to healthcare facilities. Positive attitudes and high levels of understanding regarding the management of hypertension indicate that MMUs are effectively empowering and educating communities. Policy going ahead should prioritize increasing MMU coverage, adjusting services to meet the needs of specific demographic groups, improving community involvement, and including gender-sensitive health education. By taking these actions, MMUs may guarantee long-lasting gains in the health and wellbeing of their communities by enhancing their ability to provide affordable, high-quality healthcare.

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10089/IRB/23-24. IRB gave its approval for the study on dated 23-02-2024

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