

Effectiveness of an Educational Intervention on Treatment Adherence Among Hypertensive Patients in Rural Delhi

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Abstract:

Introduction: Hypertension is a major public health challenge in low- and middle-income countries like India, with low awareness and control rates, especially in rural areas. Poor adherence to treatment remains a significant barrier. This study evaluated the effectiveness of an educational intervention in improving medication adherence among hypertensive patients in rural Delhi. **Objective:** To evaluate the effectiveness of a multifaceted educational intervention package in improving treatment adherence and blood pressure control among hypertensive patients in rural Delhi. **Methods:** A quasi-experimental, before-and-after study was conducted among 102 hypertensive patients at the Rural Health Training Centre, Najafgarh. The intervention included flipchart-based counselling, weekly voice and text messages, and follow-up visits conducted at 2,4,6 months. Data were collected using Hill Bone Medication Adherence Scale for medical adherence. Cochran's Q, McNemar, Chi square and logistic regression were used for statistical significance of adherence changes and associations. **Results:** Medication adherence increased significantly from 47 (53.9%) at baseline to 72 (70.5%) post-intervention ($p < 0.001$). The mean Hill Bone Scale score decreased from 31.4 ± 6.2 to 28.49 ± 4.46 , indicating better adherence. Significant associations were found between adherence and regular Blood Pressure checks ($p = 0.03$), weight loss ($p = 0.001$), and blood pressure control ($p = 0.02$). **Conclusion:** The study demonstrates that educational interventions significantly improve medication adherence and blood pressure control in rural settings. Regular monitoring and lifestyle changes, especially weight loss, further enhanced adherence, highlighting the need for scalable, sustainable hypertension management strategies.

Keywords: Blood pressure, Educational intervention, Hypertension, Medication adherence

Introduction:

Hypertension, commonly referred to as high blood pressure, is a chronic medical condition characterized by persistently elevated pressure in the blood vessels. It is a leading risk factor for cardiovascular diseases (CVDs), stroke, and renal complications, contributing significantly to global morbidity and mortality. Despite the availability of effective treatments, hypertension

remains poorly controlled, particularly in low- and middle-income countries (LMICs) like India, where awareness, treatment, and control rates are alarmingly low.^[1]

According to the National Family Health Survey (NFHS-5), the prevalence of hypertension in India has risen to 24% among men and 21% among women, with only 50% of individuals aware of their hypertensive

Quick Response Code	Access this article online	How to cite this article :
	Website : www.healthlinejournal.org	Mondal A, Kapoor R. Effectiveness of an Educational Intervention on Treatment Adherence Among Hypertensive Patients in Rural Delhi. Healthline. 2025;16(3): 195-200
	DOI : 10.51957/Healthline_742_2025	

Received : 04-06-2025

Accepted : 22-09-2025

Published : 30-09-2025

status.^[2] Rural areas face additional challenges, with awareness, treatment, and control rates significantly lower than in urban regions. For instance, a systematic review and meta-analysis conducted in 2014 found that in rural India, the rates of awareness, treatment, and control of hypertension were 25.1%, 24.9%, and 10.7%, respectively, compared to higher rates of 41.9%, 37.6%, and 20.2% in urban areas.^[3] This disparity underscores the urgent need for targeted interventions to address the growing burden of hypertension in rural and resource-limited settings.

Effective management of hypertension requires a combination of pharmacological and non-pharmacological interventions. However, poor adherence to treatment regimens and lifestyle modifications remains a major barrier to achieving blood pressure control. Studies have shown that adherence to antihypertensive medications is often suboptimal, with rates ranging from 30% to 50% in LMICs.^[4] Educational interventions have shown promise in improving patient outcomes by enhancing knowledge, self-management practices, and adherence to treatment.^[5] These interventions can empower patients to take an active role in managing their condition, leading to better blood pressure control and reduced risk of complications.

This study aimed to evaluate the effectiveness of a multifaceted educational intervention package in improving treatment adherence and blood pressure control among hypertensive patients in rural Delhi. The intervention package included flipchart-based counselling, weekly voice and text messages, and follow-up visits over six months. By addressing the specific needs and challenges faced by hypertensive patients in rural areas, the study sought to contribute valuable insights into more effective methods for managing hypertension and reducing its associated health risks.

Methods:

Study Design and Setting

A quasi-experimental, before-and-after study was conducted at the Rural Health Training Centre (RHTC). The study was conducted over 18 months, with patient

recruitment completed by October 2023. The RHTC provides healthcare services, including screening and management of non-communicable diseases (NCDs) such as hypertension.

Study Population

The study included 110 hypertensive patients aged above 30 years, diagnosed with hypertension, and currently on treatment. Patients residing in Najafgarh for at least six months were included. Exclusion criteria included patients without access to smartphones and those experiencing hypertensive crises.

Sample Size Calculation

The sample size was calculated based on a study by G.K. Mini et al.^[5], using a mean difference in systolic blood pressure of 8.0 mmHg and diastolic blood pressure of 4.4 mmHg. The formula used for sample size calculation, $n = (Z_{\alpha/2} + Z_{\beta})^2 * 2 * \sigma^2 / d^2$ where, $Z_{\alpha/2}$ is the critical value of the Normal distribution at $\alpha/2$ (e.g. for a confidence level of 95%, α is 0.05 and the critical value is 1.96), Z_{β} is the critical value of the Normal distribution at β (e.g. for a power of 80%, β is 0.2 and the critical value is 0.84), σ^2 is the population variance, and d is the mean difference. With a 95% confidence interval and 80% power and considering the mean difference of diastolic blood pressure (minimum of the two), the required sample size was 92. Accounting for a 20% loss to follow-up, the final sample size was 110. The study participants were selected from the hypertensive patients attending the NCD clinic, employing purposive sampling.

Intervention

The intervention package included:

- **Flipchart-Based Counselling:** A 20-minute session on hypertension, risk factors, lifestyle modifications, and medication adherence, conducted every 2 months, till 6 months.
- **Voice and Text Messages:** Weekly reminders on diet, physical activity, salt reduction, and medication adherence, for 6 months.
- **Follow-Up Visits:** Participants were followed up at 2-, 4-, and 6-months post-intervention.

Operational Definition:

Controlled hypertension: Systolic Blood Pressure <140 mmHg and Diastolic Blood Pressure <90 mmHg, among people with high blood pressure.

Regular Blood Pressure Measurement: Weekly once getting the blood pressure checked.

Regular Eye check-up: Eye check-up done by ophthalmologist once in 6 months

Regular Blood Tests: Getting the blood tests advised by the doctor by 2 weeks.

Data Collection

Data were collected using, structured, validated questionnaires which included a socio-demographic profile to capture participant characteristics. Medication adherence was assessed using the Hill-Bone Medication Adherence Scale. The Hill Bone scale based on patients self-report was designed in the form of a rating scale for use by health care professionals to assess patients adherence to anti-hypertensive therapy in three main domains: i) medication-taking ii) salt intake restriction, and iii) appointment keeping.^[6] Scores above the mean value of the scale was taken as adherent and below, as non-adherent. Additionally, anthropometric and clinical measurements such as blood pressure, height, weight, and BMI were recorded to evaluate the participants' health status. Further, BG Prasad Scale 2022 was used to derive the socioeconomic classification.

Ethics: Ethical clearance was taken from the Institutional Ethics Committee, VMMC and SJH (IEC/VMMC/SJH/ THESIS/2023/CC-77). Informed consent was taken from the participants before including them in the study.

Statistical Analysis

Data were analysed using SPSS version 21. Descriptive statistics, Cochran Q test, and McNemar test were used to assess changes in medication adherence over time. A p-value < 0.05 was considered statistically significant. Chi square test and further, multivariate logistic regression was used for testing association.

Results:

A total of 110 participants were recruited at the first visit at the RHTC from June to October 2023 and were subsequently followed up for 6 months.

Table 1: Distribution of study participants according to sociodemographic details (N=110)

Variables	Frequency, n (%)
Age (Years)	
<40	14 (12.7%)
41-50	29 (26.4%)
51-60	36 (32.7%)
61-70	21 (19.1%)
>70	10 (9.1%)
Gender	
Male	38 (34.5%)
Female	72 (65.5%)
Religion	
Hindu	102 (92.7%)
Muslim	5 (4.6%)
Sikh	3 (2.7%)
Educational Status	
Illiterate	17 (15.6%)
Primary School	23 (21%)
Middle School	29 (26.5%)
Secondary School	19 (17.4%)
Intermediate School	9 (8.4%)
Graduate	9 (8.4%)
Postgraduate	3 (2.7%)
Occupation Category	
Unskilled	14 (12.7%)
Semi-Skilled	10 (9.1%)
Skilled	18 (16.4%)
Clerical	1 (0.9%)
Semi-Professional	0 (0%)
Professional	11 (10%)
Home Makers	56 (50.9%)
Family Type	
Nuclear	57 (51.8%)
Joint Family	53 (48.2%)
Socioeconomic Status	
Lower Class	37 (33.6%)
Lower Middle Class	48 (43.6%)
Middle Class	17 (15.5%)
Upper Middle Class	7 (6.4%)
Upper Class	1 (0.9%)

The majority of participants (32.7%) were aged 51-60 years, with a mean age of 54.5 ± 11.6 years. Females constituted the larger proportion of the study population (65.5%), and Hindus formed the predominant religious group (92.7%). In terms of education, most participants (26.5%) had attended middle school, while only 2.7% were postgraduates. Occupation-wise, homemakers

represented the largest group (50.9%). More participants lived in nuclear families (51.8%) compared to joint families (48.2%), and the majority (43.6%) belonged to the lower-middle socioeconomic class. Regarding hypertension duration, most participants (35.4%) had been diagnosed with the condition for 1-5 years, with a mean duration of 5.19 ± 5.55 years. Overweight/obesity (87.3%) and diabetes (50.4%) were the most common comorbidities. In terms of health monitoring, 76.4% of participants regularly monitored their blood pressure, but only 8.2% underwent regular eye checkups, and a mere 2.7% regularly followed up with blood tests as advised by their doctor. (Table 1,2)

A total of 8 patients (7.2%) were lost to follow-up, leaving 102 patients who completed the follow-up and were included in the final analysis.

The proportion of participants who were adherent to medications increased from 53.9% at baseline to 58.8% at the first follow up. It further increased to 65.7% in the

Table 2: Distribution of study participants according to clinical history (N=110)

Category	Frequency, n (%)
Duration of Hypertension	
<1 Year	33 (30%)
1-5 Years	39 (35.4%)
5-10 Years	17 (15.5%)
>10 Years	21 (19.1%)
Comorbidities*	
Overweight/Obesity	96 (87.3%)
Diabetes	57 (50.4%)
Overweight/Obesity + Diabetes	52 (47.2%)
Stroke	1 (0.9%)
Hypothyroidism	2 (1.8%)
Regular BP Monitoring	
Yes	84 (76.4%)
No	26 (23.6%)
Regular Eye Checkup	
Yes	9 (8.2%)
No	101 (91.8%)
Regular Blood Tests	
Yes	3 (2.7%)
No	107 (97.3%)

*Categories are not mutually exclusive

second follow up and to 70.5% the last follow up. This difference in proportion, over subsequent visits was found to be statistically significant, ($p=0.046$) on applying Cochran Q test.

The proportion of participants who were adherent to medications increased from 53.9% at baseline to 70.5% at the last follow up. This difference was found to be statistically significant ($p=0.002$), on applying McNemar test. (Table 3) (Figure 1)

The mean score also decreased (indicating better adherence) from 31.4 ± 6.2 at the baseline, to 30 ± 5.3 at 2 months, to 29.4 ± 4.5 at 4 months, and to 28.49 ± 4.46 at 6 months. Significant associations were observed between medication adherence and regular BP checks ($\chi^2 = 3.36$, $p = 0.047$), weight loss ($\chi^2 = 10.64$, $p = 0.001$), and blood

Table 3: Distribution of study participants according to medication adherence by Hill Bone Scale Before and after interventions (N=102)

Hill Bone Scale Scoring	Adherent (%)	Non adherent (%)
Baseline (First visit)	55 (53.9)	47 (46.1)
Follow up (first) at 2 months	60 (58.8)	42 (41.2)
Follow up (second) at 4 months	67 (65.7)	35 (34.3)
Follow up (third) at 6 months	72 (70.5)	30 (29.5)
<i>Cochran Q</i>	17.79 ($p < 0.001$)	
<i>McNemar χ^2</i>	9.97 ($p = 0.002$)	

Statistical analysis done by Cochran Q test and McNemar test

Figure 1: Distribution of study participants according to medication adherence by Hill Bone Scale at baseline and subsequent follow up visits after interventions.(N=102)

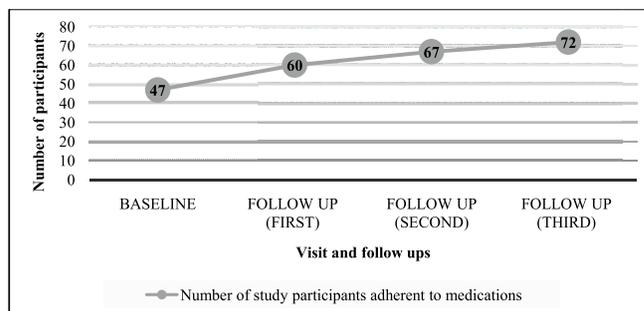


Table 4: Multivariate logistic regression of medication adherence with variables (N=102)

Variable	OR	95% CI (OR)	p-value	AOR	95% CI (AOR)	Adjusted p-value
Regular BP Check						
Yes	3.36	1.02 11.07	0.047	2.86	1.12 7.31	0.03
No	Reference					
Weight Loss						
Yes	10.64	3.45 32.82	0.001	9.48	3.45 26.05	0.001
No	Reference					
BP Control						
Controlled	6.56	1.56 27.58	0.010	4.98	1.29 19.23	0.02
Uncontrolled	Reference					

Note. OR: Odds Ratio, AOR: Adjusted Odds Ratio

pressure control ($x^2 = 6.56, p = 0.010$). However, no significant associations were found between medication adherence and age groups, gender, religion, profession, education, family type, or obesity status. Further, on conducting multivariate logistic regression. Regular BP checks, weight loss and BP control remained significant. (Table 4)

Discussion:

This study demonstrated the effectiveness of a comprehensive educational intervention in enhancing treatment adherence among hypertensive patients in rural Delhi. The intervention led to a significant improvement in medication adherence, increasing from 46.1% to 70.5%. These findings underscore the potential of structured educational programs to address the challenges of hypertension management in resource-limited settings.

The results align with existing literature, reinforcing the efficacy of similar interventions. For example, G.K. Mini et al.^[5] reported a 15.9% increase in medication adherence following a comparable intervention, while Suza et al.^[7] documented a 2.68-point reduction in the Hill Bone Scale score post-intervention, which is consistent with the 2.91-point reduction observed in this study. The significant increase in adherence underscores the potential of scalable, low-cost interventions to address the challenges of hypertension management in similar settings.

In current study significant associations were observed between medication adherence and regular blood pressure checks, weight loss, and blood pressure

control. Patients who regularly monitored their blood pressure had a significantly higher likelihood of adherence, with an adjusted odds ratio (AOR) of 2.86 (95% CI: 1.127.31, $p = 0.03$). This finding aligns with the study by Kim et al.^[8], who demonstrated that regular blood pressure monitoring significantly enhances adherence, and is further supported by Burnier et al.^[9] who emphasized the critical role of medical adherence in achieving optimal blood pressure control.

Similarly, weight loss showed a significant association with adherence, with an adjusted OR of 9.48 (95% CI: 3.4526.05, $p = 0.001$). This is consistent with Schroeder et al.^[10], who highlighted the importance of lifestyle modifications, including weight loss, in improving medical adherence, and corroborates the findings of Appel et al.^[11], who demonstrated that comprehensive lifestyle changes significantly enhance blood pressure control and adherence.

Furthermore, controlled blood pressure was significantly associated with adherence, with an adjusted OR of 4.98 (95% CI: 1.2919.23, $p = 0.02$). Similar association was reported by Ozumba et al.^[12]

Conclusion:

The study highlights the effectiveness of a multifaceted educational intervention in improving treatment adherence (53.9% to 70.5%) among hypertensive patients in rural Delhi. The intervention package, which included flipchart-based counselling, voice and text messages, and follow-up visits, led to significant improvements in medication adherence and

self-care practices. These findings underscore the need for scalable and sustainable educational interventions to address the growing burden of hypertension in resource-limited settings.

Limitations:

While the study demonstrated significant improvements in medication adherence, it is important to acknowledge its limitations. The quasi-experimental design restricts the ability to establish causality, and the reliance on self-reported data may introduce potential biases, such as recall or social desirability bias. Additionally, the intervention was administered alongside existing standard care, and the absence of a comparison group limits the ability to attribute the observed improvements in adherence solely to the intervention. These factors highlight the need for further large-scale randomized controlled trials to validate the effectiveness of the intervention and to isolate its impact from other confounding variables. Such studies would provide more robust evidence and strengthen the generalizability of the findings.

Recommendations:

To address hypertension management in rural areas, educational interventions such as flipchart-based counselling and digital reminders should be integrated into primary healthcare services. Scaling up voice and text messaging systems can serve as a cost-effective strategy to reinforce health behaviours. Training community health workers (CHWs) to deliver these interventions can enhance their reach and effectiveness. Regular follow-up visits and blood pressure monitoring should be emphasized to ensure sustained adherence. Educational programs must prioritize lifestyle modifications, such as diet and physical activity. Policymakers should prioritize hypertension control in national health programs, while further research evaluates the long-term impact and cost-effectiveness of these interventions. Collaboration with NGOs can amplify reach and sustainability. By implementing these recommendations, healthcare systems can improve hypertension management and patient outcomes, particularly in resource-limited settings.

Declaration:

Funding: Nil

Conflict of Interest: Nil

References:

1. Forouzanfar MH, Liu P, Roth GA, Ng M, Biryukov S, Marczak L, et al. Global Burden of Hypertension and Systolic Blood Pressure of at Least 110 to 115 mm Hg, 1990-2015. *JAMA*. 2017 Jan 10;317(2):165–82. doi: 10.1001/jama.2016.19043
2. International Institute for Population Sciences (IIPS). NFHS Data Portal [Internet]. Mumbai: IIPS; [cited 2025 Aug 1]. Available from: <https://www.nfhsiips.in/nfhsuser/index.php>
3. Anchala R, Kannuri NK, Pant H, Khan H, Franco OH, Di Angelantonio E, et al. Hypertension in India: a systematic review and meta-analysis of prevalence, awareness, and control of hypertension. *J Hypertens*. 2014 Jun;32(6):1170–7. doi: 10.1097/HJH.000000000000146
4. Mills, K. T., Bundy, J. D., Kelly, T. N., Reed, J. E., Kearney, P. M., Reynolds, K., Chen, J., & He, J. (2016). Global disparities of hypertension prevalence and control: A systematic analysis of population-based studies from 90 countries. *Circulation*, 134(6), 441–450. doi: 10.1161/CIRCULATIONAHA.115.018912
5. Mini GK, Sathish T, Sarma PS, Thankappan KR. Effectiveness of a School-Based Educational Intervention to Improve Hypertension Control Among Schoolteachers: A Cluster-Randomized Controlled Trial. *J Am Heart Assoc*. 2022 Jan 13;11(2):e023145. doi: 10.1161/JAHA.121.023145
6. Johns Hopkins School of Nursing. Hill-Bone Scales [Internet]. Baltimore: Johns Hopkins University; [cited 2025 Aug 1]. Available from: <https://nursing.jhu.edu/faculty-research/research/projects/hill-bone-scales/>
7. Souza AC, Borges JW, Moreira TM. Quality of life and treatment adherence in hypertensive patients: systematic review with meta-analysis. *Rev Saude Publica*. 2016 Dec 22;50:71. doi: 10.1590/S1518-8787.2016050006415. PMID: 28099657; PMCID: PMC5152803.
8. Kim S, Shin DW, Yun JM, Hwang Y, Park SK, Ko YJ, et al. Medication adherence and the risk of cardiovascular mortality and hospitalization among patients with newly prescribed antihypertensive medications. *Hypertens Res*. 2016 Nov;39(11):734–41. doi: 10.1038/hr.2016.72
9. Burnier M, Egan BM. Adherence in hypertension: a review of prevalence, risk factors, impact, and management. *Circ Res*. 2019 Apr 12;124(7):1124–40. doi: 10.1161/CIRCRESAHA.118.313220
10. Schroeder K, Fahey T, Ebrahim S. How can we improve adherence to blood pressure-lowering medication in ambulatory care? Systematic review of randomized controlled trials. *Arch Intern Med*. 2004 Apr 12;164(7):722–32. doi: 10.1001/archinte.164.7.722
11. Appel LJ, Champagne CM, Harsha DW, Cooper LS, Obarzanek E, Elmer PJ, et al. Effects of comprehensive lifestyle modification on blood pressure control: main results of the PREMIER clinical trial. *JAMA*. 2003 Apr 23;289(16):2083–93. doi: 10.1001/jama.289.16.2083
12. Ozumba LN, Ndukwu GU. The association between medication adherence and blood pressure control among hypertensive patients attending a tertiary hospital in south-south Nigeria. *Int J Res Med Sci* 2021;9:965-9. doi: 10.18203/2320-6012.ijrms20211338