National Board of Examination - Journal of Medical Sciences
Volume 2, Issue 4, Pages 350–362, April 2024
DOI 10.61770/NBEJMS.2024.v02.i04.007

ORIGINAL ARTICLE

Prevalence of hypertension in adult population and adherence to treatment among hypertensives in an urban area

Abhishek Pokkuluri,[1] Gudipally Monica[2,*] and Praveena Ganapa[3]

[1]*Assistant Professor, Department of Community Medicine, Malla Reddy Institute of Medical Sciences, Suraram, Medchal, Telangana, India.*
[2]*Assistant Professor, Department of Community Medicine, Government Medical College, Vikarabad, Telangana, India.*
[3]*Assistant Professor, Department of Community Medicine, Kurnool Medical College, Kurnool, Andhra Pradesh, India.*

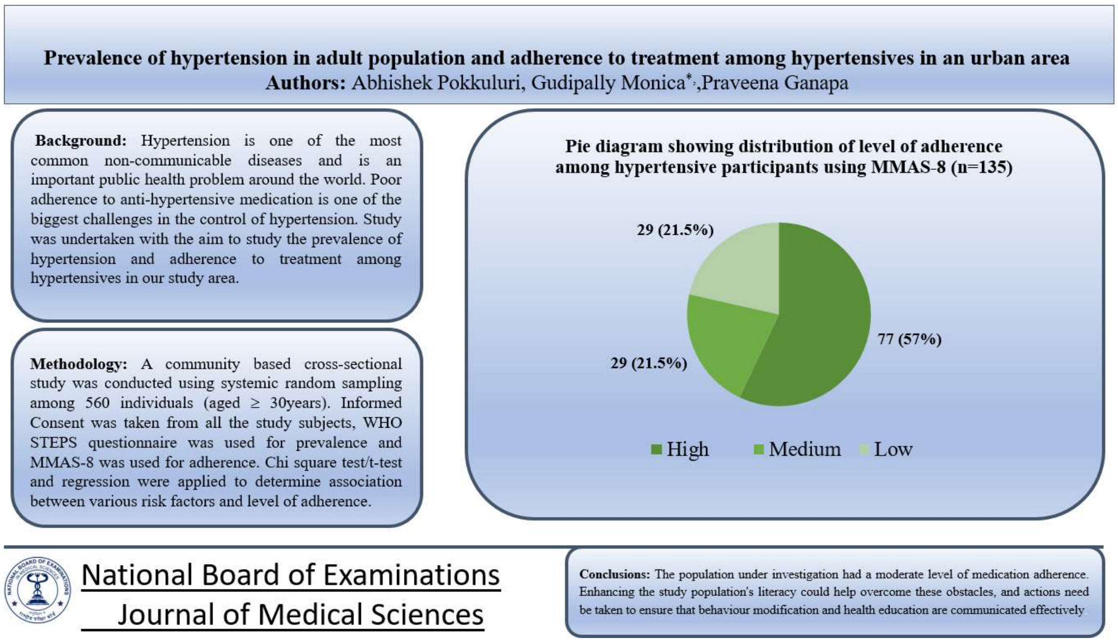
Accepted: 17-February-2024 / Published Online 31-March-2024

Abstract
Introduction / background: Hypertension is one of the most common non-communicable diseases and is an important public health problem around the world. Poor adherence to anti-hypertensive medication is one of the biggest challenges in the control of hypertension. Study was undertaken with the aim to study the prevalence of hypertension and adherence to treatment among hypertensives in our study area.
Methodology: A community based cross-sectional study was conducted using systemic random sampling among 560 individuals (aged ≥ 30years). Informed Consent was taken from all the study subjects, WHO STEPS questionnaire was used for prevalence and MMAS-8 was used for adherence. Chi square test/t-test and regression were applied to determine association between various risk factors and level of adherence.
Results: The present study concluded that 27.9% of the study population had hypertension**.** According to MMAS-8 scale the level of adherence among the participants with hypertension after ruling out the newly diagnosed hypertensive from the total hypertensive was high in 77 (57%), moderate in 29 (21.5%) and low in 29 (21.5%) Forgetfulness was the most common (21.9%) reasons for the poor adherence. On multivariate regression age <50 years and non-working status showed statistically significance with level of adherence with odds of 3.61 (1.29-10.13) and 3.296 (1.16-9.36) respectively.
Conclusions: The population under investigation had a moderate level of medication adherence. Enhancing the study population's literacy could help overcome these obstacles, and actions need be taken to ensure that behaviour modification and health education are communicated effectively.

Keywords: Adherence, Hypertensives, Risk factor, Morisky Medication Adherence scale-8.

*Corresponding author: Gudipally Monica
Email: monica.gudipally018@gmail.com

Graphical Abstract



Introduction

Hypertension is one of the most common non-communicable diseases and is an important public health problem around the world. It is one of the major risk factors of cardiovascular mortality which account for 20 to 50% of the deaths worldwide [1].

According to the Joint National Committee 7 (JNC-7), Hypertension is defined as systolic BP level of ≥140 mmHg and/or diastolic BP level ≥ 90 mmHg [2]. The area falling between 120–139 mmHg systolic BP and 80–89 mmHg diastolic BP is defined as "prehypertension". Although prehypertension is not a medical condition in itself, prehypertensive subjects are at more risk of developing hypertension.

In India, the prevalence of hypertension in males ranges from 3%–34.5% and from 5.8%–33.5% in females. Recent studies show a prevalence of 24-30 % in urban areas and 12-14% in rural areas [3]. Worldwide, 13.5% of premature deaths, 54% of strokes, and 47% of ischemic heart disease cases were attributed to hypertension [4]. An estimated 1.56 billion adults will be suffering from high blood pressure by 2025 [5].

Poor adherence to anti-hypertensive medication is one of the biggest challenges in the control of hypertension [1]. It also compromises the efforts of the health care system, policy makers and health care workers in improving the health of population. Failure to comply causes medical and psychological complications of the disease, reduces patients' quality of life, wastes health care resources and erodes public confidence in health systems [6]. This poses a greater responsibility on the health services especially in developing countries like India; where there is a greater strain on available health infrastructure and delivery systems.

Accurate estimate of hypertension prevalence and adherence are necessary to plan effective control measures. Very few studies have been done on similar lines. The present study was done to assess prevalence of hypertension and adherence to treatment among hypertensive in urban field practice area of a tertiary care teaching hospital in Nalgonda, Telangana.

Objectives: 1) To determine prevalence of hypertension in urban field practice area of a medical college. 2) To study the association between various risk factors (modifiable and non-modifiable) and hypertension. 3) To study the extent of adherence to anti- hypertensive medication. 4) To study the various socio demographic and other risk factors influencing adherence to anti- hypertensive medication

Materials and methods

This was a community based cross-sectional study done in urban field practice area of a tertiary care teaching hospital and medical college in Narketpally, Nalgonda, Telangana state. According to a study done by Ajeet Bhadoria et al. [7] the prevalence of hypertension was 25% in urban areas. So considering relative Precision as 15% and using the formula

$$n = \frac{Z_{1-\alpha/2}^{2}\, p(1-p)}{d^2}$$

Where, n = minimum sample required

Z = Standard normal deviate = 1.96 ≈ 2

p = prevalence of Hypertension which is 0. 25% = 25/100

q = 100 – p i.e. 100 – 25 i.e. 0.75%==75/100

L = Relative precision i.e. 15% =15/100x0. 25= 0.0375

Substituting the values, n = (4 x 0.25 x0. 75) / $(0.0375)^2$ = 533

By calculating 5% non-response rate it is rounded to **560**.

Study period: October 2017 to September 2019

Sampling Technique

Systematic random sampling was used for this study, wherein a sampling frame was formed. The urban field practice area covers the total of 3215 households.

Sample interval (SI) = total population /sample size

= 3215 / 560 = 5.74 = 6

Every household is given number and the required sample is obtained by dividing total households with the sample size and the number 6 obtained as sample interval. A number is chosen randomly between 1 to 6 which becomes the first household. Here number 2 is chosen. From there every 6^{th} household will be visited, ex : 2, 8, 14, 20, 26…..

Eligible individual above 30 years were taken into study. If the selected family has more than one available eligible person, then one was chosen randomly by using lottery method. In case of nonavailability of eligible person in a selected household, at the time of survey, the adjacent household was selected.

Inclusion Criteria

- Subjects above 30 years of age both male and female.
- Should be residing in urban field area for 6 months.
- Ability to provide information about medication in use.

Exclusion Criteria

- Subjects not giving consent and those not willing to participate will be excluded
- Seriously ill, pregnant women. Congenital cardiac disorders.

Study tool and data collection

A pretested and semi structured questionnaire was used for data collection. WHO stepwise approach to chronic disease risk factor surveillance (STEPS) was used for hypertension risk factors and disease prevalence and Morisky medication adherence scale (MMAS)-8 was used to assess adherence. Omron Blood pressure device, Libra weighing machine, anthropometry rod and measuring tape were used to measure blood pressure and anthropometry respectively.

All the subjects were personally contacted in their house, examined and interviewed.

Blood pressure measurement

Blood pressure was measured using the Omron BP apparatus and stethoscope in the sitting position on the right arm. Three readings were taken in an interval of 3 to 5 min and the average of the readings was taken.

Anthropometry

All the anthropometric measurements were done by the following standardized technique. Weight was measured by Libra weighing machine having an accuracy of 0.1 kg and height was measured by using a steel anthropometry rod with accuracy of 0.1 cm using standard techniques. Body Mass Index was calculated using the following formula: BMI = weight (kg)/height (mt)^2. Based on BMI obtained, the subjects were classified into different categories according to the WHO global classification.

Adherence

The extent to which a person's behaviour-taking medication, following a diet, and /or executing lifestyle changes, corresponds with agreed recommendations from a health care provider. In the present study adherence was measured using Morisky Medication Adherence Scale -8 (MMAS-8). Highly adherent were given a score of 8, medium were given a score of 6 to<8, Low adherence < 6.

Ethical considerations

All methods were carried out in accordance with relevant guidelines and regulations, The study was approved by Institutional Ethics Committee (Ref No: ETHICS COMMITTEE/KIMS/NKP/2017). The participants were briefed about the purpose of the study and prior informed consent was taken.

Data management and analysis

Data was entered in Microsoft Excel. Data analysis was done using SPSS Version 20. Appropriate like Chi Square test were applied.

Results

Among the 560 study participants in our study majority of the participants were in the age group of 30-60 years (69.8%) followed by 45-60 years (28.1%) and least (2.1%) above 75 years age group. Males were comparatively more than females (55.4% Vs 44.6%). More than half were not having any formal education (52.3%) and self-employed (61.4%). About 99

(17.7%), 153 (27.3%) and 03 (0.5%) were in prehypertension, stage 1 hypertension and stage 2 hypertension respectively according to JNC 7 classification. Most of the participants were in age group of 46-60 in hypertensive group whereas in normative group 30-45years age group was more. Mean age of the participants was more in hypertensive group compared to normotensive group (51.41 ± 12.69 Vs 58.33 ± 11.29) was showing a statistically significant association with $p<0.05$. Gender-wise difference was not seen with the hypertensive status in our study. Level of education was showing a statistically significant association with level of hypertensive with majority of them with no formal education. Socio-economic status, amount of salt intake, vegetables & fruits servings and BMI didn't show any association with the hypertensive status. Family history of hypertension was more in hypertensive group than in normotensive group and was showing significant association (61.9% Vs 38.1%). Marital status, alcohol consumption and tobacco consumption were showing statistically significant association with hypertensive status with $P<0.05$.

According to MMAS-8 scale the level of adherence among the participants with hypertension after ruling out the newly diagnosed hypertensive from the total hypertensive was high in 77(57%), moderate in 29(21.5%) and low in 29(21.5%). On univariate regression marital status of being single and non-working status were showing significant association with low level of adherence. Whereas in multivariate regression marital status of being single lost its significance and age <50 years and non-working status were statistically significant with odds of 3.61 (1.29-10.13) and 3.296 (1.16-9.36) respectively. "Forgetfulness" was the most common (21.9%) reasons for the poor adherence followed by "felt better so stopped" (18.5%) and "no money buy to buy medicines". (17.2%) (Tables 1-3 and Figures 1-2).

Table 1. Distribution of the study population according to JNC 7 Classification (N=560)

Classification	**Frequency (%)**
Normal	305 (54.5)
Pre-hypertensive	99 (17.7)
Stage 1 Hypertension	153 (27.3)
Stage 2 Hypertension	03 (0.5)

Table 2. Distribution of socio-demographic profiles among Hypertensive and Normotensive participants (N=560)

Variable	Category	Normotensive n=404 (72.1)	Hypertensive N=156 (27.9)	P-value
Age	30-45	163 (84.9)	29 (15.1)	0.00
	45-60	139 (69.8)	60 (30.2)	
	60-75	98 (62.4)	59 (37.6)	
	75-90	04 (33.3)	08 (66.7)	
	Mean ± SD	51.41 ± 12.69	58.33 ± 11.29	0.00
Gender	Male	228 (73.5)	82 (26.5)	0.41
	Female	176 (70.4)	74 (29.6)	
Education	No formal schooling	195 (66.6)	98 (33.4)	0.01
	Less than primary	22 (81.5)	05 (18.5)	
	Primary	41 (69.5)	18 (30.5)	
	Secondary	23 (79.3)	06 (20.7)	
	High school	90 (77.6)	26 (22.4)	
	College	33 (91.7)	03 (8.3)	
Occupation	Government employee	06 (100)	0 (0)	0.03
	Non-government employee	08 (66.7)	04 (33.3)	
	Self-employed	258 (75)	86 (25)	
	Home-maker	71 (73.2)	26 (26.8)	
	Retired	61 (60.4)	40 (39.6)	
SES	I (Upper)	26 (68.4)	12 (31.6)	0.92
	II (Upper middle)	247 (71.8)	97 (28.2)	
	III (Middle)	101 (72.7)	38 (27.3)	
	IV (Lower Middle)	21 (75)	07 (25)	
	V (Lower)	09 (81.8)	02 (18.2)	
Marital status	Never married	09 (90)	01 (10)	0.00
	Currently Married	359 (74.3)	124 (25.7)	
	Separated/Divorced	04 (100)	0 (0)	
	Widowed	32 (50.8)	31 (49.2)	

Family history	Present	53 (38.1)	86 (61.9)	0.00
	Absent	351 (83.4)	70 (16.6)	
Alcohol Consumption	Yes	97 (61.8)	60 (38.2)	0.00
	No	307 (76.2)	96 (23.8)	
Smoking Consumption	Yes	93 (58.9)	65 (41.1)	0.00
	No	311 (77.4)	91 (22.6)	
Salt intake	≤5g	55 (82.1)	12 (17.9)	0.05
	>5g	349 (70.8)	144 (29.2)	
Vegetable	≤5 servings	137 (77.4)	40 (22.6)	0.06
	>5 servings	267 (69.7)	116 (30.3)	
Physical activity	Yes	94 (76.4)	29 (23.6)	0.23
	No	310 (70.9)	127 (29.1)	
BMI	Underweight	22 (66.7)	11 (33.3)	0.33
	Normal	147 (70)	63 (30)	
	Overweight	204 (75.6)	66 (24.4)	
	Obese	31 (66)	16 (34)	

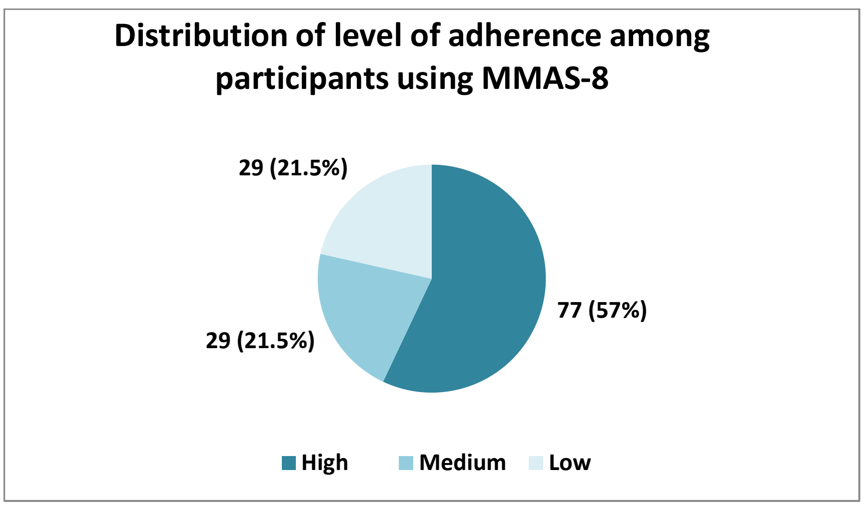


Figure 1. Pie diagram showing distribution of level of adherence among hypertensive participants using MMAS-8 (n=135)

Table 3. Association between level of adherence and risk factors among hypertensive participants (n=135)

Variable	Univariate regression		Multivariate regression	
	p-value	OR (CL)	p-value	OR (CL)
Age				
≥50 years		1		
<50 years	0.38	1.44 (0.64-3.26)	0.02	3.61 (1.29-10.13)
Gender				
Male				
Female	0.75	1.12 (0.57-2.22)	0.16	0.49 (0.18-1.33)
Marital status				
Married				
Unmarraied/divorce/window	0.04	2.44 (1.06-5.59)	0.199	1.95 (0.70-5.43)
Alcohol				
No		1		
Yes	0.08	0.52 (0.26-1.08)	0.27	0.58 (0.22-1.53)
Smoking				
No		1		
Yes	0.64	0.85 (0.43-1.69)	0.497	1.37 (0.55-3.38)
Occupation				
Working		1		
Non-working	0.02	2.37 (1.17-4.79)	0.03	3.296 (1.16-9.36)
SES				
Upper				
Lower	0.44	0.51 (0.09-2.75)	0.71	0.69 (0.097-4.88)
BMI				
Underweight	0.75	1.25 (0.32-4.83)	0.69	0.73 (0.16-3.39)
Normal		1		
Overweigh	0.90	1.05 (0.49-2.22)	0.77	1.15 (0.45-2.96)
Obese	0.13	0.34 (0.09-1.36)	0.24	0.37 (0.07-1.94)
Salt				
≤5g		1		
>5g	0.61	0.73 (0.22-2.40)	0.61	0.71(0.18-2.72)
Vegetable serving				
≤5		1		
>5	0.63	1.22 (0.55-2.70)	0.34	1.58 (0.61-4.07)
Fruit servings				
≤5		1		
>5	0.995	1.01 (0.22-4.67)	0.73	1.42 (0.20-10.03)
Sedentary behavior				
≤1hr		1		
>1hr	0.22	1.59 (0.76-3.32)	0.46	1.45 (0.55-3.83)
Family history				
Absent		1		
Present	0.67	1.16 (0.58-2.30)	0.299	1.53 (0.69-3.41)

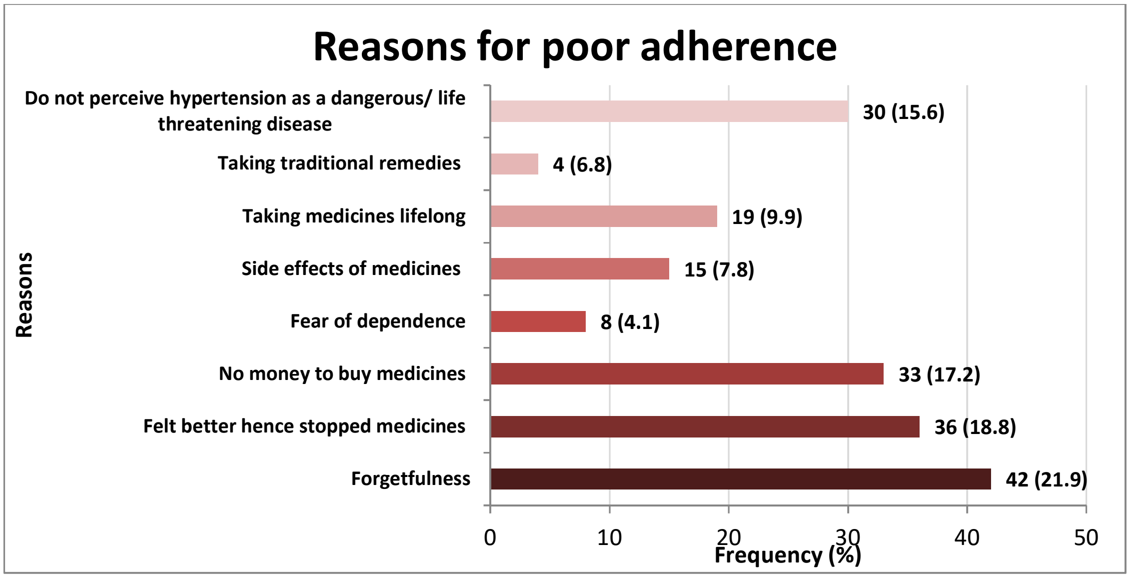


Figure 2. Reasons for poor adherence among Hypertensive participants

Discussion

In chronic and frequently asymptomatic diseases like hypertension, medication adherence is a critical concern. Medication non-adherence can lead to life-threatening consequences. The present study conducted to fill the gaps in data in our study setting. According to JNC VII standards, 27.9% of participants in the current study had hypertension. Studies by Shukla et al. [8] Prabhakaran et al. [9], Anand et al. [10] and Shymalkumar et al. [11] reported results that were similar. Nonetheless, the frequency in this investigation was lower than that of investigations conducted in Trivandrum by Joseph et al. [12] (~36%) and Gupta et al. [13] (~32%). But the prevalence was higher than in a study by Mohan et al. [14] (14%) conducted in Chennai among persons aged 20 to 60 years.

The present study found that increasing age is an important risk factor for hypertension. The prevalence of hypertension increased from 15.1% in 30 to 45 years age group to 66.7% in 75 to 90 age. Similar increase with age were observed in studies by Shukla et al. [8] Gupta et al. [13], Rao et al. [15] and Mohan et al. [14]. Hypertension was showing statistically significant association with age in our study similar to finding by Laxmaiah et al. [16] which might be due to age related atherosclerotic changes.

Our study's findings on female predominance and hypertension were in line with those of Mahmood et al. [17] and different from those of Kumar et al. [18] and Rao et al. [15]. The current investigation revealed a significant association with schooling. These findings were consistent with the study conducted by Sathya Prakash Manimunda et al. [19] where prevalence of hypertension was greater in illiterates. A study by Rao et al. [15] shown that as educational status increased, prevalence decreased. Similar to results from a study conducted in Ahmedabad, Gujarat, by Parikh et al. [20]

our study also demonstrated a statistically significant variation in prevalence based on marital status.

Studies by Deswal et al. [21], Madhumitha et al. [22], Chandwani et al. [23] and Singh et al. [24] found a significant association between family history and an increased prevalence of hypertension. Contradiction to Shanthirani et al. [25] statistically significant connection was established between hypertension prevalence and alcohol intake in our study although Saunders [26] exhibited comparable findings. 41.1% of smokers were found to have hypertension with statistical significance. There have been reports of an acute blood pressure rise associated with tobacco use, but it is unclear if long-term smoking causes persistent hypertension. A comparable relationship was found by Pais et al. [27].

Adherence to antihypertensive medications as measured using MMAS-8 in our study was 57% whereas it was 67.8% in a study by Asgedom et al. [28] due to difference in dichotomising the MMAS-8 score. Sutar et al. [29], Hema et al. [6] and Kumarswamy et al. [30] it was more than current study whereas less in studies by Kumar et al. [18] and Shelini et al. [31] which might be due to difference in study settings and medication scale used.

A number of variables were assessed for their impact on medication non-adherence; however, there was occasionally inconsistency in their correlation. While Kumarawamy et al. [30] found that affordability was the primary factor contributing to medication non-adherence; our study found that forgetfulness was the primary cause of non-adherence, in line with studies by Deepthi et al. [32] and Bhandari et al. [33]. The results of the current study are consistent with the analysis of other studies, which shows that the most frequent causes of non-adherence are forgetfulness, inability to pay, the asymptomatic nature of the illness, or a lack of awareness of any risk or potentially fatal consequence.

In our univariate analytic study, the probability of unmarried/divorced/window subjects not adhering to their hypertension medication was 2.44 times higher than that of married participants. This finding is comparable to the study of Ahmad et al. [34], which found a 1.95-fold increase in odds. Additionally, Ahmad et al. demonstrated univariate association adherence with characteristics like as age, family history, lifestyle choices, etc. that are not present in our study. Age groups under 50 and non-working individuals had dependent associations on multivariate analysis, which differs from Pedro Pallangyo et al. [35] findings, which are related to differences in the variables included and the adherence scale.

Conclusion

The study's findings indicate that the population under investigation had a moderate level of medication adherence. A few of the demographic traits significantly impacted adherence. Providing health education and counselling during hospital visits and home visits by healthcare professionals can raise the adherence rate, which is essential for managing chronic illnesses. Enhancing the study population's literacy could help overcome these obstacles, and actions should also be taken to ensure that behaviour modification and health education are communicated effectively

Strengths of the study

This is a first of its kind study in our study settings with an appropriate sample size. Using a MMAS-8 scale to measure adherence which is highly valid and reliable is an added strength.

Limitation of the study

Recall bias could have affected our study because we did not do a follow up study. Certain factors that could influence adherence, like medication history and specifics of the healthcare facility were not included in the analysis.

Recommendations

Based on the observations of the present study, the following recommendations are made regarding prevention and control of hypertension.

1. Group meetings have to be organized for risk groups and screening has to be done for health promotion, behavioural modification and early detection of cases.
2. The formation of Hypertension clubs, which meet once or twice a week, can help increase medication adherence. Doctors should emphasise the value of treatment adherence during review visits and home visits, and hypertension clubs can help.

Conflicts of interest

The authors declares that they do not have conflict of interest.

Funding

No funding was received for conducting this study.

References

1. World Health Organization (WHO). Global Status Report on Non Communicable diseases. 2018. Available from: https://www.who.int/publications/i/item/9789241514620
2. Chobanian A V, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JLJ, et al. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 report. JAMA. 2003 May;289(19):2560–72.
3. Sidenur B, Shankar G. A Cross-Sectional Study of Hypertension among 20–40 Years Old Residing in an Urban Area of Bagalkot City, North Karnataka. Indian J Community Med. 2023;48(1). Available from: https://journals.lww.com/ijcm/fulltext/2023/48010/a_cross_sectional_study_of_hypertension_among.14.aspx
4. Murarkar S, Pokale A, Gothankar J, Deshmukh R, Gupta V. Prevalence of hypertension and associated risk factors in urban slums: A community based cross sectional study in India. Indian J Public Health. 2023;67(3):474–6.
5. Singh S, Shankar R, Singh GP. Prevalence and Associated Risk Factors of Hypertension: A Cross-Sectional Study in Urban Varanasi. Int J Hypertens. 2017;2017:5491838.
6. Hema DK, Padmalatha DP. Adherence to medication among Hypertensive patients attending a tertiary care hospital in Guntur, Andhra Pradesh. In 2015. Available from: https://api.semanticscholar.org/CorpusID:32981098
7. Bhadoria AS, Kasar PK, Toppo NA, Bhadoria P, Pradhan S, Kabirpanthi V. Prevalence of hypertension and associated cardiovascular risk factors in Central India. J Family Community Med. 2014 Jan;21(1):29–38.

8. Shukla AN, Madan T, Thakkar BM, Parmar M, Shah K. Prevalence and Predictors of Undiagnosed Hypertension in an Apparently Healthy Western Indian Population. Adv Epidemiol. 2015;2015:1–5. Available from: https://api.semanticscholar.org/CorpusID:72714716
9. Prabakaran J, Vijayalakshmi N, Venkatarao E. Prevalence of Hypertension among Urban Adult Population (25-64 years). In 2013. Available from: https://api.semanticscholar.org/CorpusID:5148719
10. Anand MP. Prevalence of hypertension amongst Mumbai executives. J Assoc Physicians India. 2000 Dec;48(12):1200–1.
11. Das SK, Sanyal K, Basu A. Study of urban community survey in India: growing trend of high prevalence of hypertension in a developing country. Int J Med Sci. 2005;2(2):70–8.
12. Joseph A, Kutty VR, Soman CR. High risk for coronary heart disease in Thiruvananthapuram city: a study of serum lipids and other risk factors. Indian Heart J. 2000;52(1):29–35.
13. Gupta R, Gupta VP, Sarna M, Bhatnagar S, Thanvi J, Sharma V, et al. Prevalence of coronary heart disease and risk factors in an urban Indian population: Jaipur Heart Watch-2. Indian Heart J. 2002;54(1):59–66.
14. Mohan V, Deepa R, Rani SS, Premalatha G. Prevalence of coronary artery disease and its relationship to lipids in a selected population in South India: The Chennai Urban Population Study (CUPS No. 5). J Am Coll Cardiol. 2001 Sep;38(3):682–7.
15. Rao CR, Kamath VG, Shetty A, Kamath A. High blood pressure prevalence and significant correlates: a quantitative analysis from coastal karnataka, India. ISRN Prev Med. 2013;2013:574973.
16. Laxmaiah A, Meshram II, Arlappa N, Balakrishna N, Rao KM, Reddy CG, et al. Socio-economic & demographic determinants of hypertension & knowledge, practices & risk behaviour of tribals in India. Indian J Med Res. 2015 May;141(5):697–708.
17. Mahmood SE, Ahmad A, Kashyap S. Prevalence and predictors of hypertension among adults of urban Lucknow, India: A community-based study. Hear India. 2019;7:43.
18. Kumar S, Ray D, Durge PM, Ferdows S, Ghose G. Prevalence and covariates of adult hypertension: A community-based cross-sectional study in the rural areas of Nagpur. Med J Dr DY Patil Univ. 2015;8:153. Available from: https://api.semanticscholar.org/CorpusID:72122442
19. Manimunda SP, Sugunan AP, Benegal V, Balakrishna N, Rao MV, Pesala KS. Association of hypertension with risk factors & hypertension related behaviour among the aboriginal Nicobarese tribe living in Car Nicobar Island, India. Indian J Med Res. 2011 Mar;133(3):287–93.
20. Singh RB, Beegom R, Ghosh S, Niaz MA, Rastogi V, Rastogi SS, et al. Epidemiological study of hypertension and its determinants in an urban population of North India. J Hum Hypertens. 1997 Oct;11(10):679–85.
21. Deswal BS, Satyamoorthy TS, Dutta PK, Ganguly SS. An Epidemiological Study Of Hypertension Among Residents In Pune. Indian J Community Med. 1991;16:21. Available from: https://api.semanticscholar.org/CorpusID:74664087
22. Madhumitha M, Naraintran S, Manohar CR, Revathi S, Biradar MK, Patil RS. HYPERTENSION - Prevalence and Risk Factors Among Urban Population In North Karnataka. Int J Curr Res Rev. 2014;6:39–45. Available from: https://api.semanticscholar.org/CorpusI

D:58260279
23. Chandwani HR, Pandor J, Jivarajani PJ, Jivarajani HP. Prevalence and correlates of hypertension among adults in the urban area of Jamnagar, Gujarat, India. In 2010. Available from: https://api.semanticscholar.org/CorpusID:55256791
24. Ragoobirsingh D, McGrowder D, Morrison EY, Johnson P, Lewis-Fuller E, Fray J. The Jamaican hypertension prevalence study. J Natl Med Assoc. 2002 Jul;94(7):561–5.
25. Shanthirani CS, Pradeepa R, Deepa R, Premalatha G, Saroja R, Mohan V. Prevalence and risk factors of hypertension in a selected South Indian population--the Chennai Urban Population Study. J Assoc Physicians India. 2003 Jan;51:20–7.
26. Saunders JB, Beevers DG, Paton A. Alcohol-induced hypertension. Lancet (London, England). 1981 Sep;2(8248):653–6.
27. Pais P, Fay MP, Yusuf S. Increased risk of acute myocardial infarction associated with beedi and cigarette smoking in Indians: final report on tobacco risks from a case-control study. Indian Heart J. 2001;53(6):731–5.
28. Asgedom S, Atey T, Desse T. Antihypertensive medication adherence and associated factors among adult hypertensive patients at Jimma University Specialized Hospital, southwest Ethiopia. BMC Res Notes. 2018;11.
29. Sutar PA, Shah HK. A study of adherence pattern toward antihypertensive therapy (antihypertensive drugs, dietary habits, and physical activity) and certain factors affecting it. Int J Med Sci Public Heal. 2017;6:1. Available from: https://api.semanticscholar.org/CorpusID:78190888
30. Kumaraswamy RC, Kauser M, Jagadeesh Mk, Kumar Ru, Afreen A, Kumar SR, et al. Study of determinants of nonadherence to anti-hypertensive medications in essential hypertension at a Teaching Hospital in Southern India. CHRISMED J Heal Res. 2015;2:57.
31. Sheilini M, Hande HM, Prabhu MM, Pai MS, George A. Impact of multimodal interventions on medication nonadherence among elderly hypertensives: a randomized controlled study. Patient Prefer Adherence. 2019;13:549–59.
32. Denny DC, G. Andhuvan. Evaluation Study on Anti-Hypertensive Adherence in Hypertensive Population. Indo Am J Pharm Res. 2013;3:6304–11. Available from: https://api.semanticscholar.org/CorpusID:70616995
33. Bhandari Phd B, Bhattarai M, Bhandari M, Ghimire A, Pokharel P, Morisky D. Adherence to Antihypertensive Medications: Population Based Follow up in Eastern Nepal. 2015;13:38–42.
34. Ahmad S. Assessment of adherence to antihypertensive treatment among patients attending a health care facility in North India. In 2015. Available from: https://api.semanticscholar.org/CorpusID:31652195
35. Pallangyo P, Komba M, Mkojera ZS, Kisenge PR, Bhalia S, Mayala H, et al. Medication Adherence and Blood Pressure Control Among Hypertensive Outpatients Attending a Tertiary Cardiovascular Hospital in Tanzania: A Cross-Sectional Study. Integr Blood Press Control. 2022;15:97–112.