Original Article

Predictors of adherence to prescribed antihypertensive medications among Hypertensive (15-49 years) in India: A secondary data analysis of National Family Health Survey 4

Mitasha Singh[1], Kartikey Yadav[2], Shweta Goswami[1], Mamta Parashar[2], Ekta Gupta[3], Madhur Verma[4], Sonu Goel[5], Sumit Malhotra[6]

[1]Community Medicine, ESIC Medical College and Hospital, Faridabad, Haryana, [2]Community Medicine, Lady Harding Medical College, New Delhi, [3]ICMR, National Institute of Cancer Prevention and Research, Sector 39, Noida, Gautam Budh Nagar, Uttar Pradesh, [4]Department of Community and Family Medicine, All India Institute of Medical Sciences, Bathinda, Punjab, [5]Department of Community Medicine and School of Public Health, Post Graduate Institute of Medical Education and Research, Chandigarh, [6]Centre for Community Medicine, All India Institute of Medical Science, New Delhi, India

Abstract

Background: Adherence to medications is one of the key determinants of therapeutic control of high blood pressure and is seen as a bottleneck in our fight against hypertension control. We have little scientific evidence from India that highlights the determinants of treatment adherence. **Aim:** The purpose of this study was to identify the predictor adherence to the currently prescribed antihypertensive medications. **Material and Methods:** We did a secondary data analysis of the National Family Health Survey, 2015-2016 datasets. As there were no direct variables to measure adherence, this was derived from the responses to the survey question: "currently taking a prescribed hypertensive medication to lower Blood Pressure" among those already diagnosed as hypertensives by the physician. The other sociodemographic and household-level variables were used as independent variables for analysis. **Results:** The level of awareness about their hypertensive status among the 15–49-year-olds who were subjected to blood pressure measurement was 9.34% (70,267/80,3081). Of these, 70,267 participants, 65878 with valid hypertensive individual data were included in the final analysis. Among them, 26.78% are currently adhering to antihypertensive medication. Female gender (adj OR; 95% CI: 1.17 [1.09–1.24]) and non-reserved caste ([OR] 1.24; 95% [CI]: 1.18–1.32) depicted better adherence to the current treatment. The hypertensives who preferred taking treatment from shops or at home or some other place in comparison to health facilities had a significant association with adherence (adj OR: 1.64; 95% CI: [1.43–1.88]). **Conclusion:** The current study reported low adherence to the current antihypertensive medication. Gender, higher age group, obesity, and place of taking the treatment were strongly associated with adherence to treatment.

Keywords: Behavioral factors, current treatment, health insurance, sociodemographic factors

Address for correspondence: Dr. Sonu Goel, Professor of Health Management, Department of Community Medicine and School of Public Health, Post Graduate Institute of Medical Education and Research, Chandigarh - 160 012, India. Adjunct Clinical Associate Professor, Public Health Masters Program School of Medicine and Health Research Institute (HRI), University of Limerick, Ireland.
E-mail: sonugoel007@yahoo.co.in

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Introduction

Hypertension is the leading risk factor for chronic disease burden in India and a preventable contributor to death, disease, and disability.[1] In 2017, about 7.9% of the total disability-adjusted life-years (DALYs) were attributed to high blood pressure in

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India.[2] In India, the National Family Health Survey (NFHS-4) of 2015–2016 reported age-adjusted prevalence of hypertension as 11.3% (95% CI: 11.16–11.43%) among the people aged between 15 and 49 years.[3]

Poor adherence to antihypertensive treatment is the most significant cause of uncontrolled blood pressure (BP). An estimate of about 50–70% of hypertensive patients do not adhere to their antihypertensive therapy as prescribed.[4] Various studies[5,6] in India have reported a wide variation in the rates of non-adherence to medication among the hypertensives. Medication adherence is defined by the World Health Organization as "the degree to which the person's behavior corresponds with the agreed recommendations from a health care provider."[7] The known factors affecting adherence to antihypertensive treatment include age, residence, religion and caste, knowledge toward the disease, knowledge toward its treatment, and utilization of pharmacy of a health facility.[7-10] The treatment adherence to hypertension reduces the risk of stroke, coronary heart disease, congestive heart failure, and mortality.[11-13]

There is a paucity of reliable information on the factors affecting adherence to the prescribed antihypertensive medications in India which will help in designing appropriate interventions aimed at effectively addressing hypertension. NFHS-4 has indirectly measured adherence to treatment through a cross-sectional interview about currently taking prescribed antihypertensive medication.[14] Besides, important information collected in the NFHS-4 that could influence the patients' adherence to their treatment, such as wealth index, religion and caste (social group), place of residence, preferred place of treatment, and any health insurance has hardly been studied in India. This study is the first in India to provide the predictors of adherence to antihypertensive medications using the recent large-scale survey data.

Material and Methods

Study design and study population

This is a secondary data analysis of a population-based national survey. We used data from NFHS-4, which was conducted during 2015–2016. The International Institute for Population Sciences is designated as a nodal agency for conducting the survey under the stewardship of the Ministry of Health and Family Welfare, Government of India (GOI). It is a state representative survey covering 29 states and seven union territories of India.[14] The NFHS-4 is a cross-sectional survey involving a two-stage cluster random sampling method and population proportionate to the size-sampling methodology. The survey gathered information from 6,01,509 households, 6,99,686 women, and 1,03,525 men. The information on the individuals interviewed was available among the 15–49-year age group. A detailed secondary analysis was carried out in June–July 2021.

Data variables and definitions

The data variables were extracted from the NFHS-4, India database, and imported into the Microsoft Excel sheet for data cleaning and analysis.

Outcome variable

The aim of this secondary data analysis was to determine the adherence to the prescribed antihypertensive medication. The 15–49-year age group population already diagnosed by the physician (SHB18) for hypertension was derived from the response to the following question asked in the survey: "Were you told on two or more occasions by doctor or other health care professional that you had high BP?" (Question number 318 in the NFHS-4 questionnaire.)

As there were no direct variables to measure adherence, this was derived from the responses to the following question asked in the survey: "currently taking a prescribed hypertensive medication to lower BP" (SHB19) among those already diagnosed as hypertensives by the physician. This variable was taken as a proxy indicator to measure adherence to antihypertensive medication, and thus, became our key outcome variable. Hence, those currently taking prescribed antihypertensive medication for the study were classified as adherent to treatment.

Explanatory variables

The study included individual- and household-level covariates. At the individual level, the study population's sociodemographic characteristics were included, that is, age, gender, education, current marital status, and body mass index (BMI). At the household level, important determinants of adherence to medication in the country, such as place of residence (rural or urban), wealth index, religion and caste (social group), preferred place of treatment, and availing of any health insurance scheme, were included. The wealth index is calculated using the household's possession of selected assets such as television and bicycles; materials used for housing construction; and type of water access and sanitation facilities.[15]

Data and statistical analysis

SPSS version 21 (IBM Corp., Armonk, NY, USA.) was used to carry out the statistical analysis in the study. The prevalence of hypertension was calculated using the Joint National Committee Seventh (JNC 7) Report Criteria[16] and self-reported prevalence by the respondents upon their primary diagnostic status by the physician or health professional (question no. 318 as mentioned above). To account for disproportionate sampling and non-response, sample weights specific to men and women (provided along with the dataset) were used in the analysis. A Chi-square test of significance was used to test the distribution of variables in the bivariate analysis. A P value < 0.05 was considered statistically significant. The collinearity between the independent variables was checked using the correlation matrix, *a priori*. The adjusted odds ratio (OR) with 95% confidence interval (CI) were calculated as measures

of association (logistic regression analysis) currently adhering to the prescribed medications as the outcome variable.

Ethical consideration

The study was ethically approved by the Institute's Ethical Committee, Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh (PGI/IEC/2019/002357).

Results

Out of the 8,03,081 individuals in the 15–49-year age group, 7,02,67 (8.7%) were told that they had high BP on two or more occasions by a doctor or other health professionals, whereas the prevalence of hypertension using the JNC-7 criteria was 11.3%. Out of the population diagnosed by the physician as "hypertensive" (7,06,27), valid information about the key exposure and outcome variables was available in only 6,58,78 subjects, hence, data analysis was conducted on 6,58,78 individuals. Among those already diagnosed by physician, 26.8% were currently adhering to the prescribed antihypertensive medication, whereas 26.1% were adhering to the prescribed medication among self-reported hypertensives [Figure 1] Since both the figures (26.8 and 26.4%) were almost similar, the "already diagnosed population with hypertension" variable was used for further analysis.

The proportion of females adhering to antihypertensive medication was 27.0% as compared to 24.4% in the males ($P < 0.001$). There was a linear increasing trend of the proportion of adherence from 15 years (14.9%) among the 15–29-year age group) to 49 years of age (40.3%) among the 40–49 year age group). A higher proportion of adherence was observed among urban hypertensives (27.7%), the richer and richest of the wealth index groups (28.3%), obese (45.2%), those taking treatment from the public health facilities (25.8%), and those not covered by any health insurance scheme (28.1%) [Table 1].

Table 2 shows the logistic regression analysis for comparing the hypertensive patients adhering to treatment with other

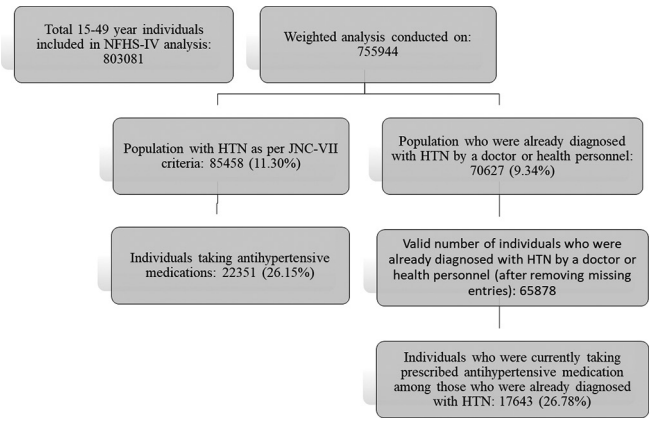

Figure 1: Flowchart showing NFHS-4 data on 15–49-year age group individuals, deriving the population currently adhering to antihypertensive treatment ($n = 65,878$)

variables after adjusting for the potential confounders. The female gender had 17% higher odds of adhering to medication as compared to the males (adj OR 1.17; 95% CI: 1.09–1.24). Those aged 40–49 years had around three times higher odds of medication adherence as compared to the younger individuals (adj OR 3.38; 95% CI: 3.20–3.57). The obese individuals had twice higher odds of taking medication as compared to those having normal BMI (adj OR 2.37; 95% CI: 2.24–2.50). Individuals availing treatment from public (adj OR 1.57; 95% CI: 1.37–1.80**)** and private health facilities (adj OR: 1.64; 95% CI: 1.43–1.88) had a significant positive association with treatment adherence as compared to those taking from shops or other places.

Discussion

The aim of this study was to identify the predictors currently adhering to prescribed antihypertensive medication among the 15–49-year-old hypertensive patients across India by exploring the data from the fourth round (2015–2016) of the NFHS. In this analysis, the proportion of individuals currently taking prescribed medications among the already diagnosed hypertensives was 26.8%. In a meta-analysis by Anchala R *et al.*[17] (1950–2013), the pooled estimate for the adherence of anti-hypertensives treatment (38% overall) in rural and urban areas was 24.9% (16.7–33.0) and 37.6% (23.9–51.2), respectively. A study from rural Iran (2013) reported an adherence rate of 24% among sample hypertensives.[18] Single-centric studies from India reported a great variation in treatment adherence, ranging from 0.01% in the rural Nicobar tribe[19] to 18.7% from urban Chennai; 47% from rural Himachal Pradesh and as high as 80% from an urban area of Odisha.[20-22] The variation is probably due to different definitions of hypertension, geographical and sociocultural differences.

The rural–urban divide

The urban areas in the current analysis had a marginally higher proportion of adherence to antihypertensive treatment which was consistent with the findings of the other authors.[18,23] The multi-country Prospective Urban Rural Epidemiology (PURE) study (2003–2009) reported that 42.3% of the urban and 33.9% of the rural hypertensive population was adhering to antihypertensive treatment. A multi-site study on Indian women (2004–2007) reported that merely one-fourth and half of the hypertensive population were aware of the disease of which 46.5 and 38.6% of the respondents were adhering to the treatment in the rural and urban areas, respectively.[24] A similar trend of poor treatment adherence was reported among rural areas as compared to urban in a metanalysis by Anchala R *et al.*[17] The urban–rural divide was significantly wider in the low- and middle-income countries and low-income countries.[23] The high level of awareness of fear of complications, better diagnostic facilities, affordability of medication, encouragement from the health care providers, and family support are some of the frequent enablers of treatment adherence in urban as compared to the rural population.[25]

Table 1: Distribution of predictors of adherence to antihypertensive medication (*n*=65,878)

Characteristics of hypertensive population	Currently taking antihypertensive medication (adherence to treatment) Percentage (95% CI)	Total *n* (%)	*P*
Total	26.8% (26.4-27.1)	65878 (100)	
Sex			
Male	24.4% (23.3-25.4)	6298 (9.6)	<0.001
Female	27.0% (26.7-27.4)	59580 (90.4)	
Area of residence			
Rural	26.1% (25.7-26.6)	38413 (58.3)	<0.001
Urban	27.7% (27.2-28.3)	27466 (41.7)	
Age groups (in years)			
15-29	14.9% (14.4-15.4)	21913 (33.3)	<0.001
30-39	23.7% (23.1-24.3)	20137 (30.6)	
40-49	40.3% (39.7-40.9)	23828 (36.2)	
Type of caste or tribe			
Scheduled caste	24.3% (23.6-24.9)	14065 (21.4)	<0.001
Scheduled tribe	28.5% (27.1-29.9)	3808 (5.8)	
Other backward class (OBC)	24.5% (23.9-24.9)	32031 (48.6)	
None of the above	33.2% (32.5-33.9)	15974 (24.3)	
Religion			
Hindu	25.9% (25.5-26.2)	53271 (80.9)	<0.001
Muslim	31.1% (30.1-32.2)	8117 (12.3)	
Christian	30.4% (28.4-32.4)	1986 (3.0)	
Sikh	28.3% (26.2-30.6)	1610 (2.4)	
Other	32.2% (29.1-35.2)	896 (1.4)	
Marital status			
Never married	16.9% (15.9-17.8)	6070 (9.2)	<0.001
Currently married	27.4% (27.0-27.7)	56443 (85.7)	
Formerly/ever married	34.8% (33.2-36.4)	3365 (5.1)	
Education attained			
No education or do not know	30.5% (29.8-31.2)	16182 (24.6)	<0.001
Incomplete primary	33.8% (32.4-35.3)	4214 (6.4)	
Complete primary but incomplete secondary	26.1% (25.6-26.6)	29973 (45.5)	
Secondary and higher	22.3% (21.7-22.9)	15509 (23.5)	
Wealth index			
Poorest and poorer	26.0% (25.4-26.7)	16732 (25.4)	<0.001
Middle	23.9% (23.3-24.7)	13918 (21.1)	
Richer and richest	28.3% (27.8-28.7)	35228 (53.5)	
BMI (kg/m^2)			
<18.5 (underweight)	19.9% (19.1-20.8)	8331 (12.7)	<0.001
18.5-24.9 (normal)	21.9% (21.4-22.3)	33478 (50.8)	
25-29.9 (overweight)	31.8% (31.1-32.5)	16659 (25.3)	
30+ (obese)	45.2% (44.1-46.4)	7410 (11.2)	
Preferred place of treatment			
Public health facility	25.8% (25.4-26.3)	29790 (45.2)	<0.001
Private health facility	27.9% (27.4-28.4)	34624 (52.7)	
Shop or home or other	19.8% (17.9-21.9)	1464 (2.2)	
Covered by any health insurance scheme			
Yes	24.5% (24.0-25.1)	23708 (35.9)	0.006
No	28.1% (27.6-28.5)	42170 (64.0)	

Age and BMI

The adherence to the prescribed treatment improved with age in the analysis by Gupta *et al.*,[24] on Indian women and Balasubramanian *et al.*,[8] in rural Kerala which was concurrent with the current analysis. The Cohort Study of Medication Adherence in Older Adults (CoSMO) (2006–2007) has also reported young age and high BMI as predictors of low adherence.[26] The findings of the CoSMO study were similar to the current analysis in context to age except that the young age group (15–29 years) in the current analysis was younger as compared to the CoSMO study (where the mean age was 75.0 years). A community-based survey from South India too reported the least prevalence of adherence in the age less than 30 years.[10] Increasing age has a higher likelihood

Table 2: Association of determinants with treatment adherence of adult (15-49 years) hypertensives

Characteristics	Unadjusted odds ratio (95% CI)*	Adjusted odds ratio (95% CI)*
Gender		
Male		Reference
Female	**1.15 (1.08-1.22)**	**1.17 (1.09-1.24)**
Place of Residence		
Rural		Reference
Urban	**1.09 (1.05-1.12)**	**0.91 (0.87-0.94)**
Age (in years)		
15-29		Reference
30-39	**1.77 (1.68-1.86)**	**1.62 (1.54-1.72)**
40-49	**3.85 (3.68-4.03)**	**3.38 (3.20-3.57)**
Member of household covered by a health scheme or health insurance		
Yes		Reference
No	**1.05 (1.01-1.10)**	**1.19 (1.14-1.23)**
Caste		
Scheduled caste		Reference
Scheduled tribe	**1.24 (1.15-1.35)**	**1.22 (1.12-1.33)**
OBC	1.01 (0.96-1.06)	**0.92 (0.88-0.97)**
None of the above and do not know	**1.55 (1.48-1.63)**	**1.24 (1.18-1.32)**
Religion		
Other (Buddhism/Jain/Parsi/other/no religion)		Reference
Hindu	**0.74 (0.64-0.85)**	**0.80 (0.69-0.93)**
Muslim	0.95 (0.82-1.11)	0.98 (0.84-1.15)
Christian	0.92 (0.78-1.09)	0.94 (0.79-1.13)
Sikh	**0.83 (0.70-0.99)**	**0.63 (0.52-0.76)**
Marital status		
Never married		Reference
Currently married	**1.78 (1.66-1.90)**	**0.85 (0.79-0.92)**
Formerly/ever married	**2.47 (2.24-2.72)**	**0.89 (0.79-0.99)**
Education		
Secondary and higher		Reference
No education	**1.52 (1.45-1.60)**	**1.08 (1.01-1.15)**
Incomplete primary	**1.78 (1.65-1.91)**	**1.37 (1.26-1.48)**
Complete primary and incomplete secondary	**1.23 (1.17-1.29)**	**1.08 (1.03-1.14)**
Wealth Index		
Poorer & Poorest		Reference
Middle	**0.89 (0.85-0.94)**	**0.84 (0.80-0.89)**
Richer and richest	**1.12 (1.07-1.17)**	**0.92 (0.87-0.97)**
BMI (kg/m^2)		
18.5-24.9		Reference
<18.5	**0.89 (0.84-0.94)**	0.99 (0.93-1.05)
25-29.9	**1.66 (1.60-1.74)**	**1.41 (1.35-1.47)**
≥30	**2.95 (2.80-3.10)**	**2.37 (2.24-2.50)**
Place of treatment		
Shop/home/other		Reference
Public health facility	**1.41 (1.24-1.61)**	**1.57 (1.37-1.80)**
Private health facility	**1.56 (1.37-1.78)**	**1.64 (1.43-1.88)**

*CI: Confidence interval. The values in bold are statistically significant.

of occurrence of complications and severity of diseases.[27] Further, better awareness of the health status and increasing responsibilities of the older age group adds to the adherence to treatment.[28] Contrarily, a study from rural Iran reported higher adherence among the 30–39-year age group.[18] Obesity was associated with a twice higher likelihood of adherence to treatment from the current analysis which was in contrast to the CoSMO study.[26] A probable explanation for the higher adherence among the obese population may be due to it being present in the older age group and urban population, who are complying with the treatment. Another possible explanation is based on the information-motivation–behavioral skills model; that the elderly obese residing in urban areas have better knowledge, physical and financial capability, easy accessibility to medicines, and environment to modify their lifestyle, thus, better adherence.[29]

Gender

The female gender was positively associated with good treatment adherence in the current analysis. This was in line with the PURE survey. Venkatachalam *et al.*[10] from South India and Al-Dabbagh SA *et al.*[30] from Iraq who reported treatment adherence and control of hypertension were better among the females as compared to the males.[23] Contrastingly, Ahmad S *et al.*,[31] from a single-centric study in North India, and Mazzaglia *et al.*,[32] in their analysis from an Italian database, reported good adherence among the males. As per the health belief model in the existing literature, women tend to be more compliant to advice, lifestyle modifications, and treatment adherence as compared to their counterparts.[33] It has been discussed in the adherence studies of other chronic diseases.[34,35]

Education

In the current analysis, the association of education with treatment adherence was equivocal. This was concurrent with the findings reported in a review by Jin *et al.*'s[33] single-centric study from Maharashtra, India, Cyprus, and Turkey.[36,37] Gupta *et al.*[24] in their study on Indian women also reported that the education status did not play an important role in treatment adherence and control of hypertension. The PURE survey contrastingly presented higher education to be associated with a higher proportion of treatment rates in low-income countries.[23] The methodological differences between the NFHS survey and the above studies may be one of the reasons for the differences in the findings. The notion that less education represents lower adherence is negated in this analysis, hinting at the changing societal influences. Further, those who had incomplete primary schooling were more adherent to the treatment in the current analysis, suggesting that being able to read and understand instructions are sufficient to understand the importance of treatment.[7]

Socioeconomic status and health-care-seeking behavior

Evidence from the literature, however, quotes poor socioeconomic conditions as a probable reason for poor treatment and control.[26,30-32] However, in the current study. no significant association was observed with the wealth index (socioeconomic status) and neither with the health insurance schemes. The possible reason behind the discordant findings could be due to the use of varying socioeconomic scales in other studies.[26,30-32] The treatment sought from the private health facility was positively associated with currently taking antihypertensive medications in comparison to public or shops. A community-based study from the rural district of South India presented an opposite finding of the treatment from the public health facility being associated with adherence. However, the same study also reported the health center nearer to the house and purchased medicines positively associated with adherence.[10] The subsidized or free medicines available at the public health facilities or pharmacies are many times not of the same brand as prescribed by the doctor, hence, quoted as a factor in low adherence.[38] This may be due to conflicts of interest which arise between the prescribers and drug store owners.[39]

Limitation

The analysis is based upon the secondary data available from the cross-sectional NFHS survey, where the availability of individual BP and related measures for age group are 15–49 years only, limited us from measuring the current treatment intake in the higher age group which is mostly affected by hypertension. Also, the survey is biased toward higher female proportion data leading to a biased estimate. Moreover, due to the absence of direct measures of adherence to hypertensive treatment in the dataset of NFHS-IV, a proxy variable was used. It only contributed a cross-sectional view of the patient's treatment status.

Conclusion

The prevalence of hypertension among the 15–49-year age group as analyzed by the BP recordings of NFHS-IV was 11.3% and only 9.3% were aware of their hypertensive status. Among those who were aware of their hypertension status, only 26.8% were currently taking antihypertensive medications. The sociodemographic characteristics like gender and age, lifestyle risk factors like obesity, and health-care-seeking behavior were strong predictors of those adhering to treatment. However, marital status, wealth index, health insurance, religion, or caste had an equivocal association. Targeted intervention is the need of the hour for middle-aged hypertensives who are capable of accepting the lifestyle changes irrespective of their education status.

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Conflicts of interest

There are no conflicts of interest.

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