Original Article

Prevalence and associated factors for awareness of hypertension in India: Findings from national survey-4

Ashoo Grover[1]*, U. Venkatesh[2]*, Glory Ghai[3], Vignitha Babu[3], Sumit Aggarwal[4], Ravinder Singh[1], Palanivel Chinnakali[5], Jugal Kishore[3], Mahendra Pratap Singh[6], Sonu Goel[6#], Durga R[7], Yashwanth R D[8], Surekha Kishore[9]

[1]Division of Non Communicable Disease, Indian Council of Medical Research, New Delhi, [2]Department of Community Medicine & Family Medicine, All India Institute of Medical Sciences, Gorakhpur, Uttar Pradesh, [3]Department of Community Medicine, Vardhman Mahavir Medical College & Safdarjung Hospital, New Delhi, [4]Division of Epidemiology & Communicable Disease, Indian Council of Medical Research, New Delhi, [5]Department of Preventive and Social Medicine, JIPMER, Puducherry, [6]Department of Community Medicine and School of Public Health, PGIMER, Chandigarh, [7]Department of Paediatric and Prevention Dentistry, Faculty of Dental Sciences, KGMU, Lucknow, Uttar Pradesh, [8]Independent Researcher, New Delhi, [9]Executive Director, All India Institute of Medical Sciences, Gorakhpur, India

**Grover A and Venkatesh U have equal contribution. [#]Corresponding author*

Abstract

Background: Despite the fact that hypertension is increasing, merely 50% are aware of the disease. Being aware of hypertension is important to control it. **Aim:** The study's objective was to estimate the level of hypertension awareness in India and explore its associated sociodemographic factors. **Materials and Methods:** The data collected in National Family Health Survey 4 (2015–2016) among men aged 15–54 years and women aged 15–49 years were analyzed. Taking awareness of hypertension as an outcome variable, descriptive analysis, and multivariable logistic regression model were performed, by gender. **Results:** Of 1,41,215 hypertensive individuals analyzed, 34.7% of men and 53.6% of women were aware of being hypertensive. The control among those aware was 67.1% in men and 74.6% in women. The awareness varied among states ranging from 29.6% in Chhattisgarh to 75.6% in Tamil Nadu. The multivariable logistic regression model explained the awareness of hypertension in males increased with age (odds ratios [OR]: 0.226 for 95% confidence interval [CI]: 0.139–0.366 for 25–29 years of age increased to 0.599 for 95% CI: 0.48–0.74 for 40–44 years of age), education (OR of 0.66 for 95% CI: 0.51–0.85 for primary increased to 0.69 for 95% CI: 0.54–0.89 for secondary school level), and wealth status (OR of 0.407 for 95% CI: 0.309–0.535 for poor wealth quintile increased to 1.030 for 95% CI: 0.863–1.230 for the richest wealth quintile). For women, the awareness increased with age (OR of 0.306 for 95% CI: 0.119– 0.791 for the age of 20–24 years increased to 0.736 for 95% CI: 0.570–0.951 for the age of 45–49 years) and wealth status (OR of 0.28 for 95% CI: 0.18–0.44 for poor wealth quintile increased to 1.262 for 95% CI: 0.859–1.855 for the richest wealth quintile). **Conclusion:** Improving access to hypertension screening and awareness especially among men, with lower wealth and younger age is needed.

Keywords: Cardio health awareness, hypertension, NFHS-4, non-communicable disease

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, 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

Cardiovascular diseases mainly, ischemic heart disease (16%) and stroke (11%) were responsible for 27% of the world's total deaths in 2019.[1] Hypertension is considered one of its important modifiable risk factors.[2] There is robust evidence, suggesting that cardiovascular morbidity and mortality can

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reduce substantially by lowering blood pressure.[3] Elevated blood pressure or hypertension is also a leading cause of disability worldwide.[4] The prevalence of hypertension is rapidly increasing and presently, 1.13 billion people are living with hypertension, out of which two-thirds are in low- and middle-income countries.[5] This could be attributed to changing lifestyles in these countries, leading to an increase in risk factors for hypertension. India is witnessing a rapid increase in non-communicable diseases, while simultaneously battling the high number of infectious diseases.[6] According to the Global Burden of Disease report, 1.63 million deaths in India in 2016 were caused by hypertension as compared to 0.78 million in 1990 (+108%). Hypertension attributable disease burden (DALYs) also increased 89% from 21 million in 1990 to 39 million in 2016.[6]

Even though the prevalence of hypertension is increasing, less than 50% of the population affected with hypertension is aware of their status of raised blood pressure.[7] Hypertension is often called a "silent killer" because often it has no warning signs and symptoms.[5] Thus, it is more important to be aware of the illness. Further awareness is important to control and treat hypertension as it can lead to changes in lifestyle and dietary habits among the affected population. A few studies[8-15] have explored the level of awareness of hypertension in different countries of the world.

Anchala *et al*.[15] conducted a systematic review and meta-analysis, summarizing the analysis of hypertension awareness, treatment, and control in 29 local studies in India where the level of awareness was found to be between 10% and 87.5%. The included articles had huge differences in sample size, large time-dependent biases (time lag and publication bias), and were not inclusive of all geographical areas of India. Therefore, knowledge about awareness of hypertension and the factors associated with it in India remains limited.

Hence, the study was planned with the objective to estimate the level of awareness about hypertension in India and its distribution pattern among various subgroups. The study also attempts to explore the sociodemographic factors associated with the awareness of hypertension. Identifying these factors can guide policymakers in delivering context-specific interventions targeted at the needs of those unaware of their hypertension status.

Materials and Methods

The secondary data analysis was conducted on the data collected in the National Family Health Survey 4 (NFHS-4), a household survey conducted between January 20, 2015, and December 4, 2016, in every district of all 29 states and 7 union territories of India. The NFHS-4 was conducted by the International Institute for Population Sciences (IIPS), Mumbai, under the leadership of India's Ministry of Health and Family Welfare, with technical assistance from ICF International.[16] Financially, the survey was supported by the US Agency for International Development and India's Ministry of Health and Family Welfare. The two-stage stratified random sampling approach was followed by first selecting primary sampling units, that is, villages in rural areas and census enumeration blocks in urban areas and then the households in the next stage.[17] Systematic random sampling was done to select households after complete mapping and household listing. A meticulous account of the process for data collection and quality assurance can be found in the official report of the NFHS-4,[18] NFHS-4 biomarker questionnaire,[19] the biomarker manual,[20] the supervisor manual[21], and the interviewer manual.[22]

The study included men of 15–54 years and women of 15–49 years taking into consideration of 5-year spousal age gap. Because of more focus on maternal and child health, the survey sampled more women than men. The blood pressure was measured three times in each individual on the same arm using a portable Omron BP monitor, model HEM-8712. The participant was allowed to sit for 5 min before the first measurement and a gap of at least 5 min was kept between each BP. For the study, we used the mean of the three BP measurements to calculate hypertension. In the case of one missing measurement, we used the mean of the remaining two measurements and for two missing measurements, we used the remaining measurement.

Variables

Hypertension

The participant was classified as a case of hypertension if the mean systolic BP ≥140 mm Hg or a mean diastolic BP ≥90 mm Hg (JNC-7 criteria of hypertension)[23]

OR

Response to any of the following questions was "yes"

a) Were you told on two or more different occasions by a doctor or other health professional that you had hypertension or high blood pressure? (Question 318 for women and 418 for men, Biomarker Questionnaire)
b) To lower your blood pressure, are you now taking prescribed medicine? (Question 319 for women and 419 for men, Biomarker Questionnaire)

The participants were considered to have "controlled" hypertension if they had mean systolic BP <140 mm Hg and diastolic BP <90 mm Hg as per the survey BP measurement. Those who were unaware of hypertension during the survey were excluded from the analysis while deriving "controlled" [Figure 1].

Awareness of hypertension

The dependent variable, awareness of hypertension was seen only among those with hypertension (as per the definition above). The participants were "aware" if they responded with "yes" to question 318 or 319 for women and 418 or 419 for men in Biomarker Questionnaire.

Independent variables

Age in 5-year groups, sex, type of place of residence (urban and rural), marital status, education (no education, primary education,

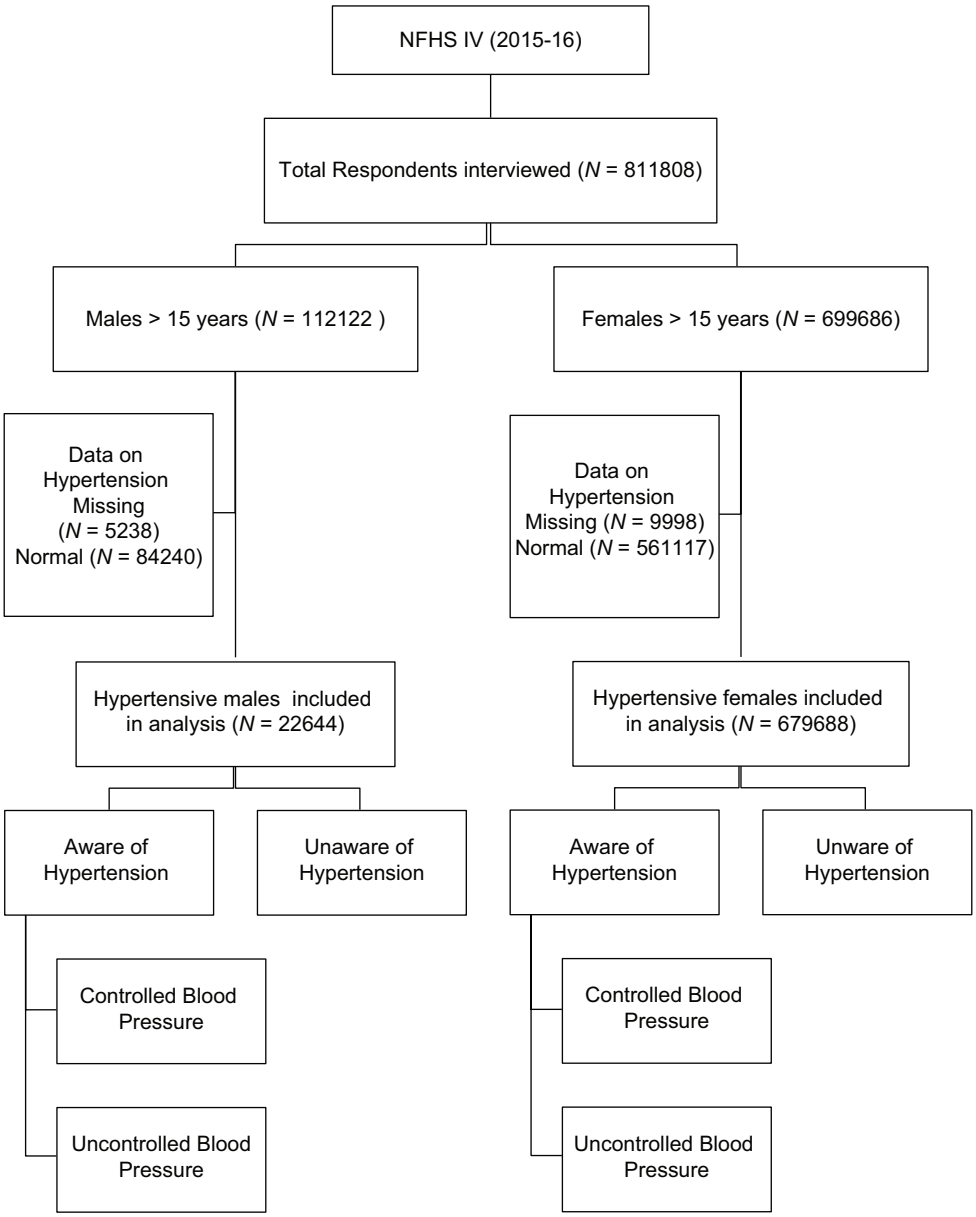

Figure 1: Flow chart showing the breakdown of sample sizes for secondary data analysis for determining the prevalence of awareness of hypertension and its control

secondary, and higher education), and wealth quintile (poorest, poorer, middle, richer, and richest). Occupation groups were not included in the analyses owing to a large number of missing data. A few lifestyle factors for hypertension were also taken as independent variables such as the presence of diabetes mellitus, tobacco usage (yes, no), alcohol intake (yes, no), and frequency of alcohol consumption (every day, once a week, less than once a week and never).

Statistical Analysis

The data were analyzed using IBM SPSS version 21.0. The awareness of hypertension was considered the outcome variable for this study. The relationship between awareness level and independent variables was analyzed using the Chi-square test. Because, gender is one of the factors in explaining the variations in hypertension awareness in other countries,[8-10] multivariable logistic regression model was performed by gender to determine the factors associated with the awareness of hypertension. Odds ratios (OR) with 95% confidence interval (CI) were estimated. A P value < 0.05 was considered significant.

Ethical Approval

The analysis received ethical approval from the Institute Ethics Committee of PGIMER, Chandigarh, India (PGI/IEC/2019/002357) to conduct secondary data analysis from NFHS-4 data because the authors had access to publicly available de-identified data only.

Results

Characteristics of study participants

The NFHS-4 household survey consisted of 8,11,808 participants, out of which 6,99,686 were women and 1,12,122 were men. Of these participants, 3.1% (25236/811,808) had a missing BP measurement or response to the questions defining the outcome. Among the study participants, 48.9% were 30 years or older, 26.1% had no education, 26.1% were never married, and 70.4% lived in rural areas. Also, 1.9% of male and 1.4% of female participants self-reported to be diabetic. Furthermore, 31.5% of males had a history of alcohol intake and 49.3% were tobacco users. In total, 17.4% (unweighted) of participants had hypertension [Table 1], of which 20.2% of males and 16.9% of female participants had hypertension.

Awareness of hypertension by demographic states

The awareness of hypertension among the cases was 50.5% (95% CI: 47.9%–53.2%). Even though men had a higher prevalence of hypertension than women (20.2%, 95% CI: 17.9%–22.6% compared to 16.9%, 95% CI: 16.1%–17.8%); however, the awareness was less among men as compared to women (34.7%, 95% CI: 32.7%–36.6% compared to 53.6%, 95% CI: 50.7%–56.4%) [Table 2]. Among those aware of the hypertensive status, more women had blood pressure under control (74.6% [95% CI: 70.9%–77.3%]) as compared to men (61.7% [95% CI: 58.2%–64.9%]) [Figure 2].

The awareness of hypertension among hypertensive individuals varied from 29.6% in Chhattisgarh to 75.6% in Tamil Nadu. Twenty-one states and union territories had lesser awareness compared to the national prevalence of awareness (50.5%). Chhattisgarh (29.6%), Gujarat (33.9%), Assam (36.8%), Nagaland (37.1%), and Madhya Pradesh (38.5%) had the level of awareness even lower than 40%, whereas Tamil Nadu (75.6%), Puducherry (73.7%), and Haryana (71.7%) had the level of awareness above 70% [Figure 3].

Factors associated with the awareness of hypertension

A significant (*P*-value < 0.05) level of relationship was found between awareness of hypertension and age groups, residential area (urban and rural), education (for men until secondary school

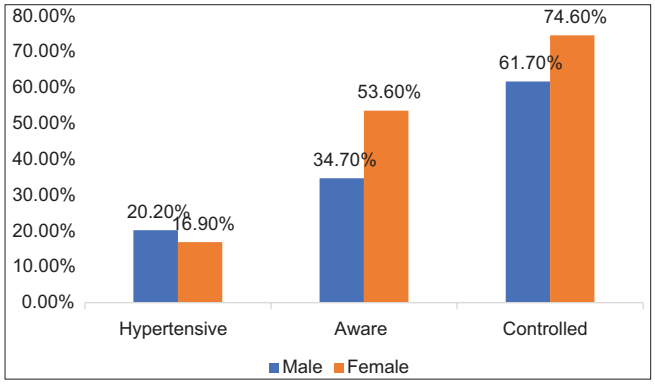

Figure 2: Prevalence of hypertension, awareness, and control by gender

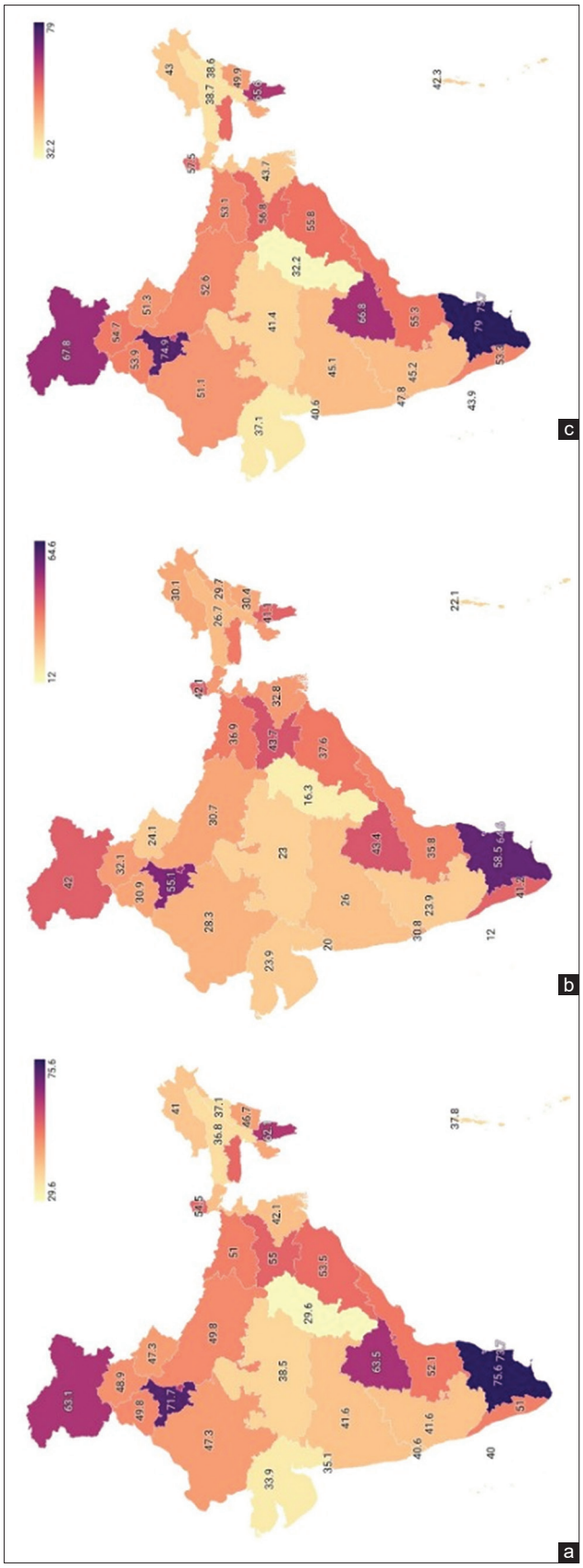

Figure 3: Spatial distribution of the proportion of population aware about hypertension (a) overall, (b) among males, and (c) among females

Table 1: Characteristics of the sample population, National Family Health Survey, 2015-2016

Sample	Male *n* (%)	Female, *n* (%)	Total *n* (%)
n	112,122 (100)	699,686 (100)	811,808 (100)
Hypertension *n* (%)			
Normal	84240 (75.1)	561117 (80.2)	645357 (79.50)
Hypertensive	22644 (20.2)	118571 (16.9)	141215 (17.40)
Total	106884 (95.3)	679688 (97.1)	786572 (96.89)
Missing	5238 (4.7)	19998 (2.9)	25236 (3.11)
Age group			
15-19	19082 (17.0)	124878 (17.8)	143960 (17.73)
20-24	16630 (14.8)	122955 (17.6)	139585 (17.19)
25-29	16151 (14.4)	115076 (16.4)	131227 (16.16)
30-34	14640 (13.1)	97048 (13.9)	111688 (13.76)
35-39	13897 (12.4)	90433 (12.9)	104330 (12.85)
40-44	11954 (10.7)	76627 (11.0)	88581 (10.91)
45-49	11171 (10.0)	72669 (10.4)	83840 (10.33)
50-54	8597 (7.7)	-	8597 (1.06)
Region			
Urban	35526(31.7)	204735(29.3)	240261(29.60)
Rural	76596(68.3)	494951(70.7)	571547 (70.40)
Education			
No education	15007 (13.4)	196556 (28.1)	211563 (26.06)
Primary	14351 (12.8)	88290 (12.7)	102641 (12.64)
Secondary	65260 (58.2)	333927 (47.8)	399187 (49.17)
Higher	17504 (15.6)	79913 (11.4)	97417 (12)
Wealth quintile			
Poorest	18412 (16.4)	133249 (19.0)	151661 (18.68)
Poorer	23220 (20.7)	149466 (21.4)	172686 (21.27)
Middle	24331 (21.7)	147168 (21.0)	171499 (21.13)
Richer	23383 (20.9)	138502 (19.8)	161885 (19.94)
Richest	22776 (20.3)	131301 (18.8)	154077 (18.98)
Marital status			
Unmarried*	40273 (35.9)	171797 (24.6)	21207 (26.12)
Married	70215 (62.6)	499627 (71.4)	569842 (70.19)
Widowed	848 (0.8)	20408 (2.9)	21256 (2.62)
Divorced	347 (0.3)	3112 (0.4)	3459 (0.43)
No longer living together/separated	439 (0.4)	4742 (0.6)	5181 (0.64)
Smoking			
Yes	55237 (49.3)	73013 (10.4)	128250 (15.79%)
No	56885 (50.7)	626673 (89.4)	683558 (84.20%)
Drinks alcohol			
No	76840 (68.5)	682381 (97.5)	759221 (93.52)
Yes	35282 (31.5)	17305 (2.5)	52587 (6.48)
Frequency of drinking alcohol			
Almost every day	4881 (4.4)	2212 (0.3)	7093 (13.49)
About once a week	14635 (13.1)	6773 (1.0)	21408 (40.7)
Less than once a week	15766 (14.1)	8320 (1.2)	24086 (45.8)
Diabetes#			
No	108698 (96.9)	679425 (97.1)	788123 (97.08)
Yes	2150 (1.9)	9538 (1.4)	11688 (1.44)
Do not know	1274 (1.1)	10723 (1.5)	11997 (1.48)
Awareness of hypertension (*n*=1,41,215)			
Aware	7851 (34.7)	63532 (53.6)	71383 (50.55)
Unaware	14793 (65.3)	55039 (46.4)	69832 (49.45)
Total	22644 (100)	118571 (100)	141215 (100)
BP control			
Controlled	4845 (61.7)	47372 (74.6)	52217 (73.2)
Uncontrolled	3006 (38.3)	16160 (25.4)	19166 (26.8)
Total	7851 (100)	63532 (100)	71383 (100)

*Includes married, gauna not performed. #Self-reported diabetes mellitus

and above), different wealth quintile, history of smoking and drinking, and awareness of diabetes for both men and women. The marital status did not have a significant relationship with awareness of hypertension [Table 3].

The multivariable logistic regression model indicated that male participants were less likely to be aware of hypertension if they were younger, less educated, and poorer. The likelihood of being aware of hypertension status increases significantly with age (OR increased from 0.226 [95% CI: 0.139–0.366] for 25–29 years of age to 0.599 [95% CI: 0.48–0.74] for 40–44 years of age). Similarly, odds of being aware of hypertension increased significantly if the level of education increased from primary (OR of 0.66 for 95% CI: 0.51–0.85) to secondary school level (OR of 0.69 for 95% CI: 0.54-0.89). Participants belonging to the poor wealth quintile were 60% less likely to be aware (OR of 0.407 for 95% CI: 0.309–0.535), whereas those belonging to the middle wealth quintile were 48% (OR of 0.522 for 95% CI: 0.413–0.659) less likely to be aware as compared to the highest wealth quintile (OR of 1.030 for 95% CI: 0.863–1.230). The participants who drank alcohol about once a week and less than once a week were 28% (OR of 1.289 for 95% CI: 1.082–1.535) and 15% (OR of 1.159 for 95% CI: 1.007–1.335) more likely to be aware of hypertension when compared with those who drink almost every day. The awareness of hypertension was not found

Table 2: Level of awareness of hypertension among hypertensive cases, National Family Health Survey, 2015-2016

Population	Aware *n* (%)	Not aware *n* (%)	Total
Total population	71383 (50.54%)	69832 (49.45%)	141215
Currently hypertensive (uncontrolled)	19166 (21.53%)	69832 (78.46%)	88998
Male	7851 (34.7%)	14793 (65.3%)	22644
Female	63532 (53.6%)	55039 (46.4%)	118571

Table 3: Distribution of awareness patterns of hypertension among the hypertensive population by gender, National Family Health Survey, 2015-2016

Characteristics	Male			Female		
	14793	7851	Chi square, *P*	55039	63532	Chi square, *P*
	Unaware	Aware		Unaware	Aware	
Age group						
15-19	715 (61.3)	451 (38.7)	Reference	3305 (46.5)	3802 (53.5)	Reference
20-24	1240 (66.3)	631 (33.7)	0.006	4561 (36.7)	7876 (63.3)	<0.001
25-29	1705 (65.4)	901 (34.6)	0.015	6246 (38.9)	9799 (61.1)	<0.001
30-34	2091 (66.9)	1036 (33.1)	<0.001	7856 (44.7)	9711 (55.3)	0.011
35-39	2429 (68.1)	1139 (31.9)	<0.001	10215 (49.8)	10306 (50.3)	<0.001
40-44	2301 (66.2)	1177 (33.8)	0.003	10871 (51.4)	10263 (48.6)	<0.001
45-49	2396 (64.5)	1319 (35.5)	0.051	11985 (50.4)	11775 (49.6)	<0.001
50-54	1916 (61.5)	1197 (38.5)	0.916			
Region						
Urban	4968 (61.7)	3077 (38.3)	Reference	15833 (41.4)	22446 (58.6)	Reference
Rural	9825 (67.3)	4774 (32.7)	<0.001	39206 (48.8)	41086 (51.2)	<0.001
Wealth quintile						
Poorest	2024 (74.4)	695 (25.6)	Reference	10716 (59.8)	7217 (40.2)	Reference
Poorer	2719 (69.8)	1177 (30.2)	<0.001	11841 (51.6)	11099 (48.4)	<0.001
Middle	3174 (65.0)	1710 (35.0)	<0.001	11297 (45.1)	13779 (54.9)	<0.001
Richer	3396 (62.3)	2022 (37.3)	<0.001	11178 (42.0)	15437 (58.0)	<0.001
Richest	3480 (60.8)	2247 (39.2)	<0.001	10007 (38.5)	16000 (61.5)	<0.001
Marital status						
Unmarried*	2836 (65.2)	1511 (34.8)	Reference	6598 (50.9)	6376 (49.1)	Reference
Married	11674 (65.4)	6182 (34.6)	0.877	45127 (45.7)	53696 (54.3)	0.877
Widowed	158 (62.2)	96 (37.8)	0.358	2816 (51.2)	2684 (48.8)	0.358
Divorced	59 (64.1)	33 (35.9)	0.912	337 (50.2)	334 (49.8)	0.912
No longer living together/separated	66 (69.5)	29 (30.5)	0.454	431 (49.4)	442 (50.6)	0.454
Smoking						
Yes	8110 (67.5)	3900 (32.5)	Reference	8077 (54.0)	6869 (46.0)	Reference
No	6683 (62.9)	3951 (37.1)	<0.001	46962 (45.3)	56663 (54.7)	<0.001
Drink alcohol						
No	8778 (63.8)	4989 (36.2)	Reference	52383 (45.8)	61935 (54.2)	Reference
Yes	6015 (67.8)	2862 (32.2)	<0.001	2656 (62.4)	1597 (37.5)	<0.001
Frequency of drinking alcohol	6015	2862		2656	1597	
Almost every day	1147 (70.8)	472 (29.2)	Reference	393 (66.9)	194 (33.1)	Reference
About once a week	2544 (68.0)	1198 (32.0)	0.039	1133 (64.8)	616 (35.2)	0.039
Less than once a week	2324 (66.1)	1192 (33.9)	<0.001	1130 (58.9)	787 (41.1)	<0.001
Diabetes#						
No	14168 (65.9)	7324 (34.1)	Reference	52581 (46.6)	60165 (53.4)	Reference
Yes	421 (49.7)	426 (50.3)	<0.001	1293 (35.3)	2373 (64.7)	<0.001
Don't know	204 (66.9)	101 (33.1)	0.771	1165 (53.9)	994 (46.1)	0.771

*Includes married, gauna not performed. #Self-reported diabetes

to be significantly associated with the region of residence (urban vs rural), marital status, and history of diabetes in men [Table 4].

On applying the multivariable logistic regression model to female hypertensive participants, similar statistical associations were found between awareness of hypertension and age, and wealth status. As age increased, the likelihood of awareness increased (OR increased from 0.306 [95% CI: 0.119–0.791] for the age of 20–24 years to 0.736 [95% CI: 0.570–0.951] for the age of 45–49 years [with exception to the age group of 25 to 29 years]). The women of 25–29 years of age are found to be 74.3% (OR of 0.257 for 95% CI: 0.143–0.459) less likely to be aware of hypertension. The relationship between hypertension awareness and wealth depicted a significant trend as women belonging to the poorer wealth quintile were 72% (OR of 0.28 for 95% CI: 0.18–0.44) and middle wealth quintile were 45% (OR of 0.557 for 95% CI: 0.365–0.850) less likely to be aware of hypertension when compared to those belonging to the richest wealth quintile (OR of 1.262 for 95% CI: 0.859–1.855). However, the region of residence (urban vs. rural), education, and marital status were not found to be significantly associated with awareness of hypertension among women [Table 4].

Discussion

One of the key factors in controlling hypertension is its timely awareness and subsequent treatment. Thus, a detailed understanding of the factors related to hypertension awareness can help in preparing the relevant guidelines to improve awareness and control of hypertension. One of the methods of increasing awareness is screening, which is being implemented under the National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular diseases and Stroke (NPCDCS) through the National Health Mission. Initially, opportunistic screening was launched for screening of risk factors among patients visiting health care centers followed by population-based screening using the Community-Based Assessment Checklist.[24] Even after the launch of various screening programs, the level of awareness of hypertension is not much studied. This article has mapped the prevalence of awareness of hypertension across different states in India by sex and examined socioeconomic and lifestyle factors associated with awareness of hypertension, which can help in guiding future interventions to make the screening of hypertension more effective.

The results of our study showed a gender difference in the prevalence of awareness of hypertension as it was 34.7% in men

Table 4: Multivariable logistic regression model for awareness of hypertension among the male and female hypertensive population, National Family Health Survey, 2015-2016

Characteristics	Male hypertensive population		Female hypertensive population	
	Odds ratio (95% CI for OR)	Significance	Odds ratio (95% CI for OR)	Significance
Age group				
15-19		Reference		Reference
20-24	0.342 (0.163-0.717)	0.005	0.306(0.119-0.791)	0.014
25-29	0.226(0.139-0.366)	0.000	0.257(0.143-0.459)	0.000
30-34	0.454(0.342-0.604)	0.000	0.435(0.301-0.629)	0.000
35-39	0.521(0.411-0.660)	0.000	0.567(0.418-0.769)	0.000
40-44	0.599 (0.483-0.744)	0.000	0.709 (0.547-0.919)	0.009
45-49	0.897 (0.731-1.100)	0.297	0.736 (0.570-0.951)	0.019
50-54	0.858 (0.699-1.052)	0.141	-	-
Region				
Urban		Reference		Reference
Rural	1.080 (0.938-1.244)	0.283	1.076 (0.839-1.380)	0.565
Education				
No education		Reference		Reference
Primary	0.660 (0.511-0.851)	0.001	1.393 (0.816-2.377)	0.224
Secondary	0.697 (0.546-0.891)	0.004	1.228 (0.765-1.973)	0.395
Higher	0.776 (0.645-0.934)	0.007	1.696 (0.986-2.917)	0.056
Wealth quintile				
Poorest		Reference		Reference
Poorer	0.407 (.309-0.535)	0.000	0.284 (0.182-0.443)	0.000
Middle	0.522 (0.413-0.659)	0.000	0.557 (0.365-0.850)	0.007
Richer	0.863 (0.711-1.049)	0.139	0.925 (0.617-1.388)	0.707
Richest	1.030 (0.863-1.230)	0.741	1.262 (0.859-1.855)	0.236
Frequency of drinking alcohol				
Almost every day		Reference		Reference
About once a week	1.289 (1.082-1.535)	0.004	1.087 (0.814-1.452)	0.572
Less than once a week	1.159 (1.007-1.335)	0.040	0.893 (0.734-1.087)	0.260
Diabetes				
No		Reference		Reference
Yes	0.761 (0.497-1.165)	0.208	0.846 (0.572-1.251)	0.402
Do not know	1.350 (0.823-2.215)	0.235	1.671 (0.860-3.246)	0.130

and 53.6% in women. A similar gender difference in awareness, women being more aware than men, is also reported in other countries such as the USA and Bangladesh.[9-10] The gender disparity in awareness could be attributed to gender patterns in health care use, which result in a lower probability that men will visit doctors and get blood pressure measured, hence low awareness of hypertensive status compared to women.[10]

Further, the result of the study was comparable with other Asian countries such as China (44.7%),[11] Nepal (43.6%),[12] and Pakistan (42.3%).[13] The awareness of hypertension is low in India when compared to developed countries such as the USA (81%), Canada (83%), and England (65%).[14] The barriers at the level of the health care system, health care providers, and patients are likely impeding the awareness and control of hypertension in less-developed countries such as lack of access to care, costly medications, overburdened healthcare providers, lack of treatment guideline adherence, low patient health literacy, and adverse side effects.[25]

The state-level analysis was done to unmask the variation in awareness among different states. We found wide variation in awareness among states ranging from 12.6% in Lakshadweep to 64.6% in Puducherry in men and 32.2% in Chhattisgarh to 79% in Tamil Nadu in women. The awareness among men was less than women in all states and UTs. Puducherry, Tamil Nadu, Haryana, NCT of Delhi, and Chandigarh had higher awareness among both men and women. The states performing better had higher GDP per capita[26] compared to poor-performing states and poor wealth status led to lower odds of hypertension awareness reported in the present study also.

A relatively higher prevalence of hypertension awareness was observed in our study compared to the study conducted by Anchala *et al*.[15] in India, which could also be due to the opportunistic screening of non-communicable diseases.

The present study revealed that poor wealth quintile decreased the likelihood of being aware of the disease, which is similar to the result of the study conducted by Basu *et al*.[27] on the World Health Organization (WHO) SAGE study data on six countries China, Ghana, India, Mexico, Russia, and South Africa to understand the socio epidemiology of hypertension. The finding can be explained by the poor wealth quintile as the barrier to access to health care services. People with low income also have lower odds of treatment-seeking,[28] leading to a missed opportunistic screening of hypertension, hence lower awareness.

The younger age is also found to be associated with low awareness of the disease in both males and females, which is similar to the multinational study conducted by Basu *et al*.[27] Hypertension often has no symptoms in the early course of disease and complication occurs at a later age, this could be one of the cause for low awareness of the disease among younger participants.

The current study has many strengths, first, it is conducted on the NFHS data, which are based on a sample of households representative at the national, state, and district levels, hence estimate of the prevalence of awareness of hypertension across the country. Second, the study attempted at bringing clarity toward the prevalence, distribution, and associated factors with awareness of hypertension in India. Third, the multivariable logistic regression identified key predictors for awareness of hypertension among men and women in India.

This study has a few limitations too. First, participants of only specific age groups were included in the analysis; 15–54 years for men and 15–49 years of women. Thus, the findings of the study are not representative of the entire population in India; however, the age group in the study represented 61.8% of the total population of India in 2015.[29] Second, the focus of NFHS-4 was more on maternal and child health as the survey sampled fewer men than women. However, the study included 1,06,884 men, out of which 22,644 had hypertension, which was sufficient to provide the awareness of hypertension in men with reasonable precision. The analysis was performed separately for men and women so that our estimates can be generalized to India's population despite excess sampling of women.

Third, we defined hypertension based on three BP measurements taken during one occasion; however, to clinically diagnose hypertension, BP measurements are required to be raised on at least two different occasions.[30,31] Thus, our study may have overestimated[32] the prevalence of hypertension, which could further result in the underestimation of awareness of hypertension.[33] Also, 3.11% of the total participants had a missing value for the outcome variable, who may have a different probability of having hypertension and awareness than those included in the analysis. Because the study was done by secondary data analysis, the role of many behavioral factors, which can affect the awareness of hypertension, could not be studied because of the unavailability of the data. The study used cross-sectional data, thus a causal relationship between the outcome variables and explanatory variables cannot be explained.

In conclusion, the awareness of hypertension in India is low, which is comparable with the neighboring countries but lower in comparison to developed countries. The awareness of hypertension is lower among male gender, younger age, and lower wealth index. The study thus suggests creating more opportunities for screening among males for non-communicable diseases in NPCDCS through special interventions. Further research is needed to understand the reason for the gender differences in awareness of hypertension so that more focused guidelines can be made to increase the diagnosis of hypertension in males, to address higher morbidity and mortality caused by hypertension among men. The study also pointed toward the importance of comprehensive primary health care in hypertension management. A further need is felt for improving knowledge about hypertension in the young population so that they may get diagnosed early in the course of the disease.

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Conflicts of interest

There are no conflicts of interest.

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