Prevalence and Socioeconomic Determinants of Hypertension among Women in India: A Cross-sectional Study from the Nationally Representative Data

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Abstract

Hypertension is a global health concern and is emerging as a prominent non-communicable disease in India. It has substantial implications for the health of women. This paper analyses demographic and socioeconomic determinants of hypertension among Indian women aged 15-49 years based on the data from the fifth round of the National Family Health Survey. The analysis reveals that the prevalence of hypertension increases with age which aligns with the global trend. Education plays a pivotal role, as women with lower educational levels are at higher risk of hypertension than women with higher levels of education. The prevalence of hypertension has also been found to be relatively higher in women with high standard of living and women residing in the rural areas. Obesity, diabetes, and smoking are found to be strong predictors of hypertension. The geospatial analysis reveals regional disparities, with higher prevalence in north-eastern and northern districts of the region. There is a need of adopting multifaceted approaches to addressing the problem of hypertension in India women. The findings of the study may serve as a vital resource for policymakers and public health practitioners for addressing the growing epidemic of hypertension in the country.

Introduction

According to the World Health Organization, there are five important risk factors for non-communicable diseases (NCDs), one of which is hypertension (Ezzati et al, 2002). Hypertension plays a substantial role in elevating the disability-adjusted life years (DALYs) related to cardiovascular diseases when compared to other metabolic risk factors such as elevated total cholesterol, increased fasting blood sugar level, and a high body mass index (BMI) (Ezzati et al, 2002). Hypertension is a severe and chronic medical condition that promotes the risk of mortality related to cardiovascular and kidney diseases. This condition arises when the pressure within blood vessels becomes excessively elevated (Abarca-Gómez

et al, 2017). The prevalence of hypertension is on the rise in recent years, and it has emerged as a particularly concerning issue among women globally and in India (Anchala et al, 2014). Approximately four out of every five people with hypertension do not receive adequate treatment of hypertension. It is, however, estimated that if countries can scale up the coverage, 76 million deaths may be averted between 2023 and 2050 (WHO, 2023). This is a matter of great importance, as health and well-being of women not only affect their own lives but have far-reaching implications for families and communities. The health consequences of hypertension can be compounded by other factors that increase the odds of heart attack, stroke, and kidney failure. These factors include tobacco use, unhealthy diet, harmful use of alcohol, lack of physical activity, exposure to persistent stress as well as obesity, high cholesterol, and diabetes mellitus (WHO, 2015).

With its diverse population and complex healthcare landscape, India presents a unique context for studying the prevalence and determinants of hypertension among women. Hypertension is a leading non-communicable disease in India (Dolui et al, 2023; Gupta, 2004) and the prevalence of hypertension in women aged 15-49 years is increasing (Bhimarasetty et al, 2022). Available studies substantiate the link between hypertension and BMI and family history of non-communicable diseases (Daniel et al, 2022). Among young adults aged 20-39 years, one in every nine, and in the general adult population, over 25 per cent have been found to be suffering from hypertension while one third of the young adults were found to be pre-hypertensive (Geevar et al, 2022). Among women aged 15 years and older, approximately 21 per cent have been diagnosed with hypertension, while 39 per cent are in the pre-hypertensive category (Government of India, 2021).

India has recently renewed its commitment to tackling hypertension on a population scale by introducing population-based screening programme for hypertension, diabetes, and cancers along with efforts to reinforce primary and secondary healthcare (Government of India, 2022). Management of hypertension in the community requires regular blood pressure evaluation to allow for the earliest possible introduction of secondary prevention measures (Saha et al. 2008). Screening of psychological distress in high-risk hypertensive patients, particularly those who struggle to attain adequate blood pressure control or are apprehensive about the potential complications associated with hypertension. It is estimated that 25 per cent of hypertensive patients exhibited signs of psychological distress, including symptoms associated with depression, anxiety, or stress. (Loke and Ching, 2022). Usual habits of an individual also play an important role as smoking and using smokeless tobacco and alcohol consumption have been found to be the risk factors of hypertension in women (Mishra et al, 2022). Socioeconomic and lifestyle factors are also found to be important reasons for the difference in the prevalence of hypertension in urban and rural India (Boro and Banerjee, 2022a).

Data and Methods

The analysis is based on the data available from the Round 5 of the National Family Health Survey (NFHS-5) which was conducted during the period 2019-2021) by the International Institute for Population Sciences (IIPS), Mumbai under the aegis of the Government of India, Ministry of Health and Family Welfare. The survey covered the entire

country and covered 6,36,699 households, 1,01,839 men aged 15-54 years, and 7,24,115 eligible women aged 15-49 years. Estimates of the prevalence of hypertension are available from the survey for the country, for states/Union Territories and for 707 districts, with reference to the status as of March 31st, 2017. Details of NFHS-5 including the sampling frame, survey design, and data collection process are discussed elsewhere (Government of India, 2022). The present analysis is limited to the data on systolic and diastolic blood pressure measured from 7,24,115 women aged 15-49 years covered during the survey. Based on the level of systolic and diastolic blood pressure, a woman was classified as hypertensive if at least one of four conditions were satisfied: 1) woman reported high blood pressure on two or more occasions by a doctor or other health professional, 2) woman taking prescribed medicine to lower blood pressure at the time of the survey, 3) woman had an average systolic blood pressure (SBP) ≥140 mmHg, 4) woman had an average diastolic blood pressure (DBP) ≥90 mmHg at the time of the survey. The blood pressure of the women was measured three times with an interval of five minutes using Omron Blood Pressure Monitor during the survey and the average of the three measurements are taken for the purpose of classification.

The outcome variable of the present analysis is a dichotomous variable which takes value 1 if a woman is hypertensive and 0 otherwise. On the other hand, a set of explanatory variables including age, education, religion, caste, standard of living, residence, Body Mass Index (BMI), whether woman is diabetic or not, type of cooking fuel used in the house, smoking behaviour, experience of passive Smoking, and use of tobacco. Bivariate and multivariate statistical methods have been used to explore the determinants of hypertension. Descriptive statistics are used to understand the variation in the prevalence of hypertension by background characteristics. Logistic regression analysis has been used to assess how different explanatory variables influence the prevalence of hypertension. The multicollinearity test using variance inflation factors (VIF) is applied to root out multicollinearity among explanatory variables. Finally, geospatial patterning of the prevalence of hypertension was carried using district level data. All statistical analysis and spatial mapping exercise was performed using STATA 17.0 and ArcGIS 10.8.2 software.

Results

Table 1 provides background characteristics of women aged 15-49 years covered during the 1920-2021 round of NFHS. A large proportion of women was in the age group 15-29 years. More than half of the women had at least higher secondary level education. More than three-fourth were Hindu while around 43 per cent belonged to Other Backward Classes. More than two-third were residing in rural areas. The prevalence of obesity, as measured by BMI, was around 24 per cent while around 18 per cent of women had low BMI. The prevalence of diabetes was 2.6 per cent, around 4 per cent were smokers, and around 3 per cent were consuming tobacco. Around 48 per cent women experienced passive smoking. Around 44 per cent were exposed to polluting cooking fuel.

Table 2 presents the prevalence of hypertension among women by their background characteristics. The overall prevalence of hypertension was around 14 per cent but it was higher in women aged 45-49 years. The prevalence of hypertension was higher

in women with no education, women belonging to other religions and Other Social Classes. The prevalence of hypertension was higher in urban obese women than in rural obese women, and in smokers and tobacco chewers. There the prevalence of hypertension increases with the standard of living of the woman, The prevalence of hypertension was the lowest among women with the poorest standard of living.

Table 1: Background characteristics of women aged 15-49 years surveyed.

Background Characteristics	Women surveyed	
	Per cent	Number
Age		
15-29	49.60	359559
30-44	38.63	280497
45-49	11.77	84059
Education		
No Education	22.43	167304
Primary	11.73	84983
Secondary	50.18	370012
Higher	15.65	101816
Religion		
Hindu	81.36	546007
Muslim	13.48	90729
Others	5.16	87379
Caste		
Scheduled Caste	21.89	139957
Scheduled Tribe	9.29	135239
Other Backward Classes (OBC)	42.92	276881
Others	25.91	172038
Wealth Index		
Poorest	18.50	149844
Poorer	20.00	160340
Middle	20.52	151505
Richer	20.81	139607
Richest	20.17	122819
Region		
North	14.11	147615
Central	31.04	184017
East	16.61	104342
Northeast	3.69	103433
West	13.94	69811
South	20.60	114897
Residence		
Urban	32.49	179535
Rural	67.51	544580
Body Mass Index (BMI)		
Underweight	18.38	124989
Normal	57.74	420415

Background Characteristics	Women surveyed	
	Per cent	Number
Overweight	23.88	153957
Diabetes		
No	97.33	707116
Yes	2.67	16999
Uses of Cooking Fuel		
Clean Fuel	55.88	367560
Polluting Fuel	44.12	356555
Self-Smoking		
No	96.04	678443
Yes	3.96	45672
Exposure to Passive Smoking		
No	52.27	362507
Yes	47.73	361608
Uses of Tobacco		
No	97.26	690703
Yes	2.74	33412
Total	100	724115

Source: Authors' calculations.

Remarks: The sample size for BMI was 699361 as BMI for 24754 women was missing.

The prevalence of hypertension among women aged 15-49 years has been found to be different in different regions of the country. The central region of the country comprising of the states of Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, and Uttar Pradesh has relatively the highest prevalence of hypertension whereas the prevalence was relatively the lowest in the west region. The prevalence of hypertension in women has also been found to be relatively high in the north and south regions compared to east and northeast regions of the country.

Table 2: Prevalence of hypertension by background characteristics of women.

Background Characteristics	Hypertension		
	Prevalence (per cent)	χ^2	N
Age		350.14 (p<0.05)	
15-29	7.19		359559
30-44	18.25		280497
45-49	29.70		84059
Education		624.20 (p<0.05)	
No Education	19.43		167304
Primary	17.41		84983
Secondary	12.13		370012
Higher	10.40		101816
Religion		717.27 (p<0.05)	
Hindu	13.92		546007
Muslim	14.14		90729

Background Characteristics	Hypertension		
	Prevalence (per cent)	χ^2	N
Others	17.07		87379
Caste		39.10 (p<0.05)	
Scheduled Caste	13.93		139957
Scheduled Tribe	13.20		135239
OBC*	14.20		276881
Others	14.46		172038
Wealth Index		672.07 (p<0.05)	
Poorest	12.84		149844
Poorer	13.46		160340
Middle	14.41		151505
Richer	14.70		139607
Richest	15.03		122819
Regions		671.15 (p<0.05)	
North	14.96		147615
Central	15.04		184017
East	13.47		104342
Northeast	13.86		103433
West	11.65		69811
South	14.37		114897
Residence		190.65 (p<0.05)	
Urban	14.48		179535
Rural	13.94		544580
BMI**		235.74 (p<0.05)	
Underweight	8.21		124989
Normal	12.42		420415
Overweight	25.24		153957
Diabetes		725.25 (p<0.05)	
No	13.46		707116
Yes	38.04		16999
Uses of Cooking Fuel		792.63 (p<0.05)	
Clean Fuel	14.96		367560
Polluting Fuel	13.04		356555
Self-Smoking		580.09 (p<0.05)	
No	13.92		678443
Yes	18.88		45672
Exposure to Passive Smoking		137.14 (p<0.05)	
No	14.43		362507
Yes	13.77		361608
Uses of Tobacco		388.85 (p<0.05)	
No	13.98		690703
Yes	19.00		33412
Total	14.11		724115

Source: Authors' calculations

Figure 1 illustrates the spatial clustering of the prevalence of hypertension among women across states and union territories. The overall prevalence of hypertension in the country is estimated to be around 14.1 per cent. The prevalence of hypertension among women, however, is relatively the highest in Sikkim (25.2 per cent) followed by Punjab (23.6 per cent) and Arunachal Pradesh (22.2 per cent) but lowest in Dadra and Nagar Haveli (8.7 per cent).
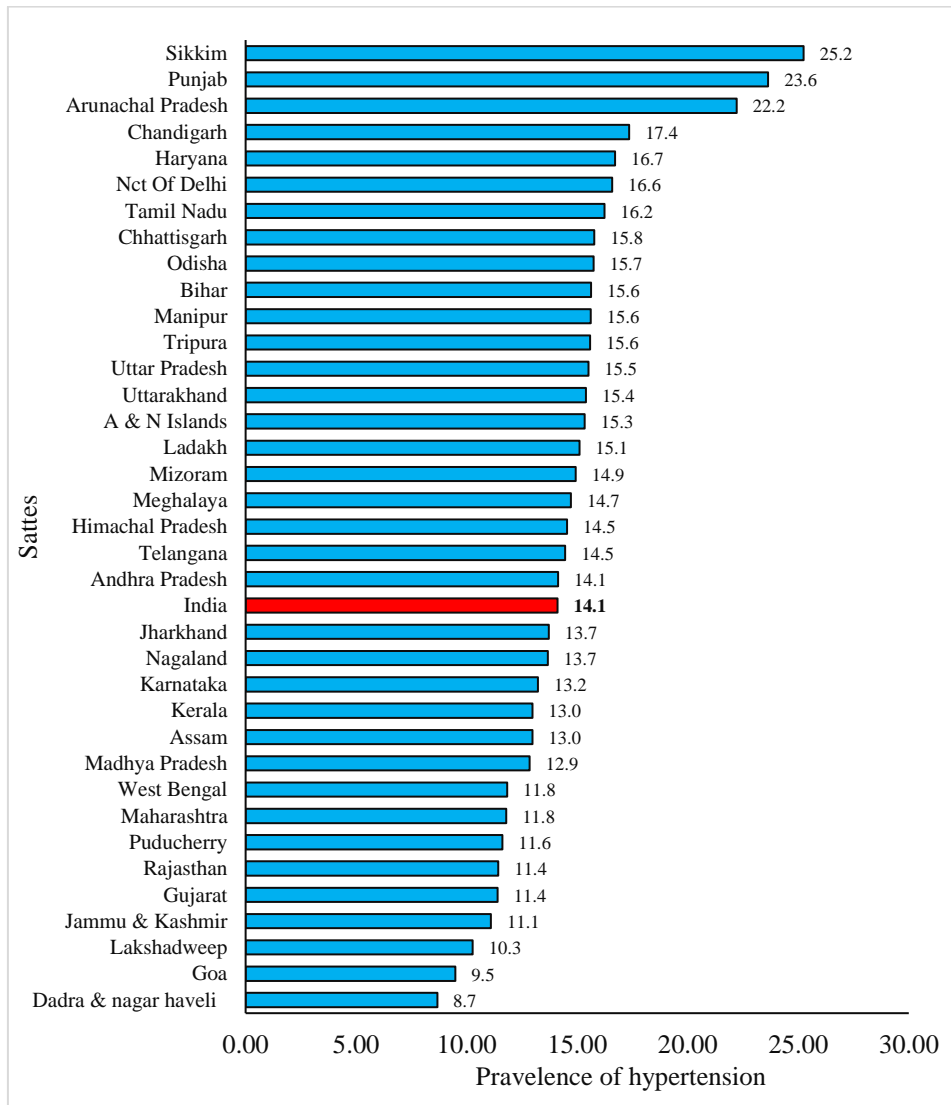

Figure 1: Prevalence (per cent) of hypertension in states and Union Territories of India, 2019-2021.
Source: Authors

Figure 2 depicts the variation in the prevalence of hypertension in women across districts. High prevalence of hypertension is found in districts of northeastern, and northern region, whereas low prevalence is found in districts of western and central regions. A few districts from the southern region also have high prevalence of hypertension. Moderate and high prevalence may also be observed in some of the districts of western and eastern regions. The prevalence of hypertension is found to be the highest (30.9 per cent) in North district of Sikkim but the lowest (2.4 per cent) in Shupiyan district of Jammu & Kashmir.
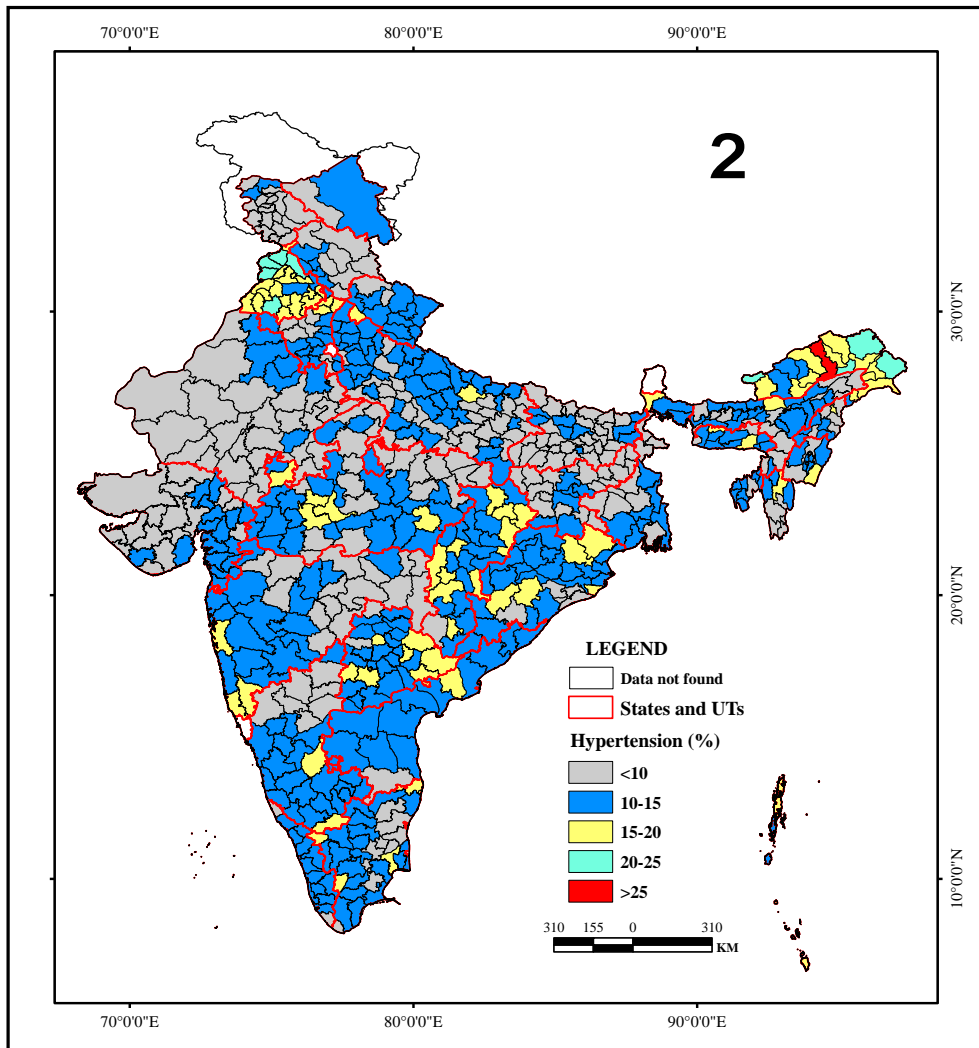

Figure 2: Variation in the prevalence of hypertension in women across districts of India, 2019-2021.
Source: Authors

Results of the logistic regression analysis are presented in table 3 in terms of unadjusted odds ratios (UOR) and adjusted odds ratios (AOR). We have presented both UOR and AOR to understand the independent effect of the explanatory variables on the prevalence of hypertension. The UOR shows the crude association between the cofounder and the outcome variable without controlling other factors, while AOR reflects the associations after controlling the potential cofounders to assess true effects because it prevents the distortion resulting from the external factors.

Table 3: Binary logistic regression model showing associations and determinants of hypertension among women in India.

Background characteristics	Hypertension			
	UOR [CI: 95%]	'p'	AOR [CI: 95%]	'p'
Age				
15-29®	1		1	
30-44	2.883 [2.838-2.929]	0.000	2.270 [2.230-2.310]	0.000
45-49	5.456 [5.351-5.563]	0.000	4.003 [3.914-4.094]	0.000
Education				
No Education	2.077 [2.031-2.125]	0.000	1.330 [1.293-1.368]	0.000
Primary	1.816 [1.769-1.864]	0.000	1.299 [1.261-1.339]	0.000
Secondary	1.188 [1.163-1.214]	0.000	1.139 [1.112-1.166]	0.000
Higher secondary®	1		1	
Religion				
Hindu®	1		1	
Muslim	1.018 [0.998-1.038]	0.072	1.053 [1.031-1.076]	0.000
Others	1.273 [1.238-1.308]	0.000	1.267 [1.229-1.306]	0.000
Caste				
Scheduled Caste	0.957 [0.939-0.976]	0.009	1.016 [0.994-1.038]	0.163
Scheduled Tribe	0.899 [0.876-0.922]	0.000	1.099 [1.068-1.131]	0.000
OBC*	0.978 [0.963-0.995]	0.000	1.024 [1.005-1.042]	0.012
General®	1		1	
Wealth Index				
Poorest®	1		1	
Poorer	1.056 [1.033-1.079]	0.000	1.046 [1.022-1.071]	0.000
Middle	1.142 [1.118-1.167]	0.000	1.083 [1.055-1.111]	0.000
Richer	1.169 [1.145-1.195]	0.000	1.079 [1.048-1.110]	0.000
Richest	1.201 [1.175-1.123]	0.000	1.066 [1.031-1.102]	0.000
Residence				
Urban®	1		1	
Rural	0.956 [0.942-0.969]	0.000	1.034 [1.016-1.052]	0.000
BMI**				
Underweight®	1		1	
Normal	1.585 [1.550-1.620]	0.000	1.274 [1.245-1.304]	0.000
Overweight	3.774 [3.688-3.862]	0.000	2.479 [2.418-2.541]	0.000
Diabetes				
No®	1		1	
Yes	3.948 [3.832-4.068]	0.000	2.257 [2.187-2.330]	0.000

Background characteristics	Hypertension			
	UOR [CI: 95%]	'p'	AOR [CI: 95%]	'p'
Uses of Cooking Fuel				
Clean Fuel®	1		1	
Polluting Fuel	0.852 [0.841-0.864]	0.000	0.916 [0.899-0.934]	0.000
Self-Smoking				
No®	1		1	
Yes	1.440 [1.397-1.484]	0.000	1.144 [1.080-1.211]	0.000
Exposure to Passive Smoking				
No®	1		1	
Yes	0.947 [0.935-0.959]	0.000	0.929 [0.916-0.942]	0.000
Uses of Tobacco				
No®	1		1	
Yes	1.443 [1.392-1.497]	0.000	0.991 [0.926-1.06]	0.000
Pseudo R^2			0.084	
Chi-Square			48508.309	
Akaike crit. (AIC)			529704.406	
Bayesian crit. (BIC)			530025.228	
Log-likelihood			-264824.2	

Source: Authors' calculations

Note: CI - Confidence interval at 95 per cent significance level; ® - Reference category; OBC - Other Backward Classes; BMI - Body Mass Index; AIC - Akaike's information criterion; BIC - Bayesian information criterion.

It may be seen from table 3 that the odd of having hypertension is more than four times higher in women aged 45-49 years compared to women aged 15-29 years as revealed through the adjusted odds ratio. On the other hand, the odd of having hypertension is around 33 per cent higher in women having no education as compared to women having more than secondary level education after controlling other factors. On the contrary, the odd of having hypertension is found to be the highest in women with middle standard of living but the lowest in women with poor level of standard of living relative to the odd of having hypertension in women with the poorest standard of living. The difference in the odd of having hypertension in women of different standard of living, however, has not been found to be large. The table also suggests that women living in the rural areas are less likely to have hypertension as compared to women living in the urban areas. However, when other factors are controlled, rural women have relatively higher chance of having hypertension compared to urban women. Obese women definitely have higher chance of having hypertension compared to normal women. Similarly, women having diabetes have higher chance of having hypertension compared to non-diabetic women. The chance of having hypertension is definitely higher in smoking women as compared to non-smoking women but the chance of having hypertension is relatively lower in passive smokers compared to women who are not passive smokers. On the basis of UOR, Scheduled Tribes women residing in the rural areas are less likely to have hypertension as compared to women of General Class but, on the basis of AOR, they are more likely to have hypertension compared to General Class women of the rural areas. However, the AOR is found to be statistically insignificant,

Discussion

Hypertension is a prominent risk factor for cardiovascular diseases and frequently contributes to multimorbidity (Dolui et al, 2023; Mohanty et al, 2021). The prevalence of hypertension has been found to be the highest among all morbidities (Dolui et al, 2023). The present analysis has unveiled several noteworthy findings. Our analysis confirms that prevalence of hypertension increases with age. It is well-known that the prevalence of hypertension was significantly higher among women of older ages compared to women of younger ages (Pires et al, 2013). Our finding aligns with similar observations in India, where the prevalence of hypertension is found to be higher among adults in the age group 45 years and above (Geldsetzer et al, 2018; Meshram et al, 2022; Mohanty et al, 2021). This association can be attributed to the progressive increase in mean systolic blood pressure throughout adulthood, with a steeper rise of blood pressure observed in women compared to men (Kearney et al, no date; Ong et al, 2008; Pimenta, 2011; Roger et al, 2011; Westheim et al, 2001).

We have also found that educational level of women is negatively associated with the prevalence of hypertension. This finding aligns with a previous study, which has also demonstrated that individuals with below-average educational level have higher risk of hypertension (Sun et al, 2022). It has also been observed that, for each additional year of education, there is a corresponding decrease in the systolic blood pressure, which reduces the likelihood of hypertension (Liu et al, 2011). The risk of hypertension is also found to be low in Scheduled Tribes and Other Backward Classes (OBC), exhibited lower awareness and were more prone to hypertension. Additionally, Women from Scheduled tribe categories are likely to be part of the causes of the high prevalence of hypertension, as suggested by previous studies (Anchala et al, 2014; Chakma et al, 2017; Gupta, 2004; Laxmaiah et al, 2015; Rizwan et al, 2014). Similarly, some studies revealed that women from tribal backgrounds with lower educational attainment face a higher risk of hypertension (Gupta et al, 1994; Hajjar et al, 2001; Kopp, 2005; Laxmaiah et al, 2015; Stamler et al, 1996, 2002). The present study also confirms that the risk of hypertension is directly related to the standard of living – the higher the standard of living the higher the prevalence of hypertension as observed in other studies (Mohanty et al, 2021).

Likewise, our study has revealed that women in the urban areas have higher risk of hypertension compared to women in the rural areas. An earlier study (Gupta et al, 1995) has also found higher risk of hypertension in urban women. However, the adjusted odds ratio suggests that the risk of hypertension is higher in rural women than in urban women which is also supported by various studies (Bisquera et al, 2022; Boro and Banerjee, 2022; Busingye et al, 2017; Chauhan et al, 2021; Gupta, 2004). The risk of hypertension has also been found to be directly associated with the obesity in women as revealed through BMI. A similar study has also reported that obese individuals with hypertension are at a greater risk of developing coronary heart disease than the non-obese one (Chiang et al, 1969). On the contrary, some studies have highlighted that low BMI can also be a contributing risk factor for hypertension, particularly among people in rural areas who may have low BMI because of chronic micronutrient deficiencies (Chakma et al, 2017; Dolui, et al, 2023; Goldbourt et al, 1987; Hu et al, 2000; Tesfaye et al, 2007).

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The prevalence of hypertension among diabetic women is notably higher and regressively associated in various aspects when compared to other groups. These findings align with those from earlier studies (Chauhan et al, 2021; Geldsetzer et al, 2018). Additionally, a significant risk factor for hypertension among women is self-smoking. Earlier studies have shown that maternal smoking or smoking during pregnancy leads to the risk of hypertension (Liang et al, 2022; Seal et al, 2013). However, the present analysis suggests passive smoking does not appear to be a risk factor in hypertension.

The present study has certain limitations. First, it is based on the cross-sectional data, which may not capture the long-term trend in the prevalence of hypertension or causality. Second, the study is limited to women aged 15-49 years only, which may not fully represent the entire women population. The National Family Health Survey has also collected data on the blood pressure for men covered under the survey and there are several studies that have analysed the prevalence of hypertension and its determinants in both men and women using the NFHS data. In the present analysis, however, we have focused, particularly, on women aged 16-49 years to find out how selected demographic and socio-economic characteristics of these women impact upon the level of blood pressure. These limitations should be considered when interpreting the findings of the present analysis and may offer opportunities for further research and data collection to address these gaps.

Conclusion

The present study draws attention to the pressing issue of hypertension among women in India and offers crucial insights into the chronic burden of women, which contributes substantially to the prevalence of cardiovascular diseases and multimorbidity. The findings emphasise that elderly women, those with lower levels of education, and belonging to the socioeconomically disadvantaged section of the community, face a higher risk of hypertension. The prevalence of hypertension may lead to other non-communicable diseases, such as diabetes, and reveals the impact of smoking on blood pressure. Recognising these vulnerability factors is of utmost importance for the development of effective public health interventions aimed at reducing the prevalence of hypertension and associated risk factors in women. The government of India has launched the India Hypertension Control Initiative (IHCI) in 2017 which aims aims to accelerate progress towards the Non-Communicable Diseases (NCD) target set by the Government of India by supplementing and intensifying evidence-based strategies to strengthen the building blocks of hypertension management and control. The Government of India aims to reduce premature mortality due to non-communicable diseases (NCDs) by 25 per cent by 2025. One of the nine voluntary targets is to reduce the prevalence of high blood pressure by 25 per cent by 2025. The present study suggests that target-specific interventions based on education, wealth and age such as awareness campaigning for quitting smoking substances, healthy dietary patterns, physical activities, community diagnosis and screening and easy access to low-cost or free antihypertensive medication is necessary to manage hypertension in women.

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