

Association of different socio-economic factors with hypertension prevalence, awareness, treatment and control in India: a demographic analysis of NFHS-4

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Received: 23 December 2018

Accepted: 04 February 2019

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ABSTRACT

Background: National Family Health Survey (NFHS) is a periodically conducted survey, which delivers data on health and healthcare of a representative sample of households of India. Studies that have evaluated hypertension awareness, treatment and control and its association with patient level socioeconomic factors are limited in India. The objectives of this study were to determine association of demographic variables like age, sex, habitat, wealth, religion and educational status with prevalence, awareness, treatment, and control of hypertension among rural and urban subjects in different states and union territories of india from NFHS-4 data.

Methods: Data of 803211 subjects were taken from NFHS survey in 36 states and union territories of india, in 2015-2016. Prevalence of hypertension and its awareness, treatment, and control status and their association with age, sex, habitat, wealth, religion and educational status were determined. Logistic regression was carried out to evaluate the impact of different predictor variables.

Results: Data of 803211 subjects were taken from NFHS survey voluntarily given by them for our project, of which 565705 (70.43%) came from rural population. 103525 of them were male which comprised of 12.89% and rest 87.11% were female volunteers in 36 states and union territories of india. Hypertension prevalence, awareness, treatment and control level in India was 17.69%, 20.44%, 34.37% and 13.64% respectively. In general, these parameters were much better in urban population and in female. Although variations were observed between different study sites, they were low with poor education and wealth index.

Conclusions: Hypertension awareness, treatment, and control were mostly low among the male, rural, poor and less educated individuals with large state wise variations.

Keywords: Awareness, Blood pressure, Control, Demographic assessment, Hypertension, Treatment

INTRODUCTION

Hypertension is an important public health problem in India and one of the most important risk factors causing death and morbidity in all populations irrespective of gender, religion, socioeconomic class, education and wealth index. It is defined as systolic blood pressure more

than 140 or diastolic blood pressure 90mm of Hg or both as per joint national committee 8 (JNC-8). It leads to most cases of death worldwide in comparison to any other risk factor.¹ Hypertension is present in 20-30% of adults in the Indian subcontinent which include Bangladesh and Pakistan reported in different surveys.²⁻⁴ Hypertension control and treatment are crucial to prevent

cardiovascular and cerebrovascular complications.⁵ Though availability and regular intake of medicines are essential but multiple factors are associated with control. Physician-related, health-systems-related, social and patient-related factors are all responsible for awareness, control and treatment of hypertension.

NHFS survey is a periodically conducted survey, which delivers data on health and healthcare of a representative sample. Total 6,01,509 households, 1,12,122 men and 6,99,686 women were interviewed from numerous primary sampling units (PSU).⁶ It included rural areas and census enumeration blocks (CEB) in urban areas all over India (NFHS-4, 2015-16). In this article authors have made an effort to understand hypertension, and its association with patient level socioeconomic factors such as household age, sex, habitat, wealth, religion and educational status in all states and union territories of India.

METHODS

Authors requested NFHS-4 dataset from the demographic and health surveys (DHS) online archive and secondary data analysis was performed with due permission.^{7,8}

Case definition

A case is defined as a subject with systolic blood pressure more than 140mm of Hg or diastolic blood pressure 90mm of Hg or both as per Joint national committee 8 (JNC 8) and those diagnosed beforehand as per same definition and under diet control or /and treatment with one or more antihypertensive drugs.⁹ Those patients who were previously diagnosed and aware of raised BP (≥ 140 mm Hg systolic and/or ≥ 90 mm Hg diastolic) were put under the category of awareness of hypertension. Treatment group was defined as the patients who were on BP-lowering medicines (aware or unaware). People with hypertension who had BP of $< 140/90$ mm Hg was categorized as control.

Study Parameters

Hypertension awareness, treatment, control, baseline characteristics and demographic pattern are defined by descriptive statistics. Prevalence of hypertension and its awareness, treatment, and control status and their association with wealth, education was determined. It was also stratified by state and union territory wise distribution within India.

Education was categorized as primary education, secondary, no education and higher education in present study. Wealth index is defined as a composite measure of a household's cumulative living standard. It is calculated

using easy-to-collect data like ingredients used for construction of a housing, or a household's ownership of selected assets, such as televisions and bicycles, and types of sanitation and water supply.¹⁰

Analysis plan

The prevalence of hypertension, awareness, treatment, and control has also been categorized by residence (urban/rural), age and sex (men/women). Hypertension and its different determinants have been examined using justified logistic regression model at various levels. The list of each variable that was included is summarized in results section.

Statistical analysis

All statistical analyses were carried out by R version 3.3.3 R Studio version 1.0.136 (R foundation) statistical software (Language). $P < 0.05$ was considered as statistically significant. Logistic regression was carried out to evaluate the association of different predictor variables.

RESULTS

Data of 803211 subjects were taken from NFHS survey voluntarily given by them for present project, of which 565705 (70.43%) came from rural population. 103525 of them were male which comprised of 12.89% and rest were 87.11% made up of huge chunk of female volunteers in 36 states and union territories of India, in 2015.

Table 1 shows number and percentage of participants both male and female rural and urban from each state of our country. Mean age of study participants at recruitment was 29.86 (SD =9.776). Highest number of people participated from Uttar Pradesh (110600) whereas the lowest one from Chandigarh (866). Though the lowest rural population participated from Delhi (1.52%), Chandigarh a union territory and a capital of Haryana contributed only 4.5% of the population. Maximum rural population (92.35%) participated from Himachal Pradesh but Assam (86.37%), Bihar (86.11%) and Odisha (79.91%) contributed significant number of rural populations in present study.

Reasonable prevalence of Hypertension 17.69% was found among study population in our country. Though highest prevalence was found in Tamil Nadu (30.35%), Mean systolic (> 120 mm of Hg) and diastolic blood pressure (> 80 mm of Hg) were found higher in north east states like Arunachal Pradesh, Assam, Sikkim and Nagaland.

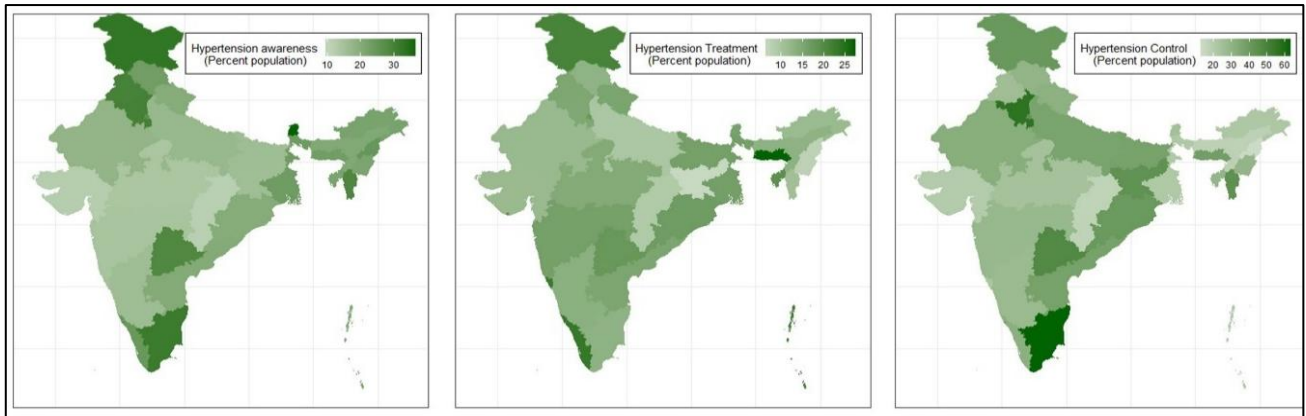


Figure 1: Choropleth map showing region wise distribution of hypertension awareness, treatment and control.

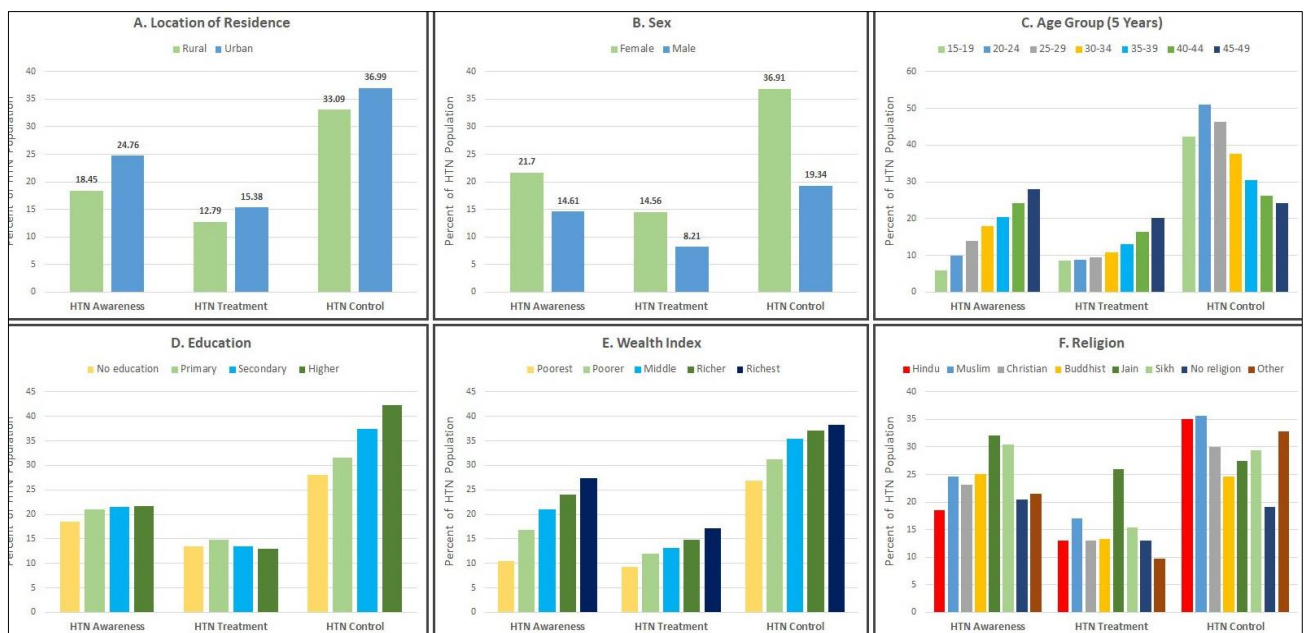


Figure 2: Bar diagram showing effect of different socio-economic factors on hypertension awareness, treatment and control.

Choropleth map was used to demonstrate hypertension awareness, treatment, and control showing state and union-based territories wise distribution highlighted in (Figure 1). Hypertension awareness was maximum in Sikkim (37.73%) overall being 20.44% in India and least in Daman and Diu 8.75%.

Prevalence of all people in present study population undergoing hypertensive treatment was 13.64% whereas Jharkhand contributed least number of treated cases (6.24%) and most found in Meghalaya (27.08%). Control of hypertension was highest in Tamil Nadu 63.04% and least in Nagaland 13.72% whereas overall in India it came around 34.37%. Chhattisgarh had shown exceptionally low awareness (11.16%), treatment (9.1%) and control (17.6%) level in comparison to most of the states. In rural vs. urban population, awareness, treatment and control of hypertension were much better in the later (P <0.001, chi-square test) reflected in (Figure 2A).

Women were more responsive in compared to men, in terms of hypertension awareness (21.7% vs. 14.61%), treatment (14.56% vs. 8.21%), and control (36.91% vs. 19.34%) (P <0.001, chi-square test). (Figure 2B) A remarkably attractive pattern was observed while comparing hypertension awareness, treatment, and control in different age groups as vividly depicted in (Figure 2C). Hypertension awareness and treatment improve with increase in age. In other words, older population were significantly more aware about the fact that they had hypertension and were more often treated (P <0.001, chi-square test). But hypertension control reduces with age which was contrary to our previous observations. (Figure 2C)

Although variations were observed between different study sites, over- all the level of awareness control and treatment were low with poor education (Figure 2D) and low wealth index (Figure 2E). Certain observations were

noticed when these parameters were compared in respect to religion. Hypertension control was comparable in Hindu and Muslim populations, but awareness and treatment were noticeably better in Muslims. (Figure 2F).

Multivariate logistic regression analysis depicted the effect of different predictor demographic variables on the Hypertension prevalence, awareness, treatment and control (Table 2).

Table 1: Demographic pattern of study participants in all states and union territories of india.

State / Union territory	N	Rural (%)	Male (%)	Age (SD)	Hypertension (%)	Systolic BP Mean (SD)	Diastolic BP Mean (SD)
Andaman and Nicobar Island	3222	2652 (82.31)	411 (12.76)	31.42 (9.63)	631 (19.71)	115.52 (15.23)	78.47 (12.71)
Andhra Pradesh	11827	8035 (67.94)	1399 (11.83)	31.34 (9.73)	2108 (19.08)	112.56 (14.86)	77.56 (14.57)
Arunachal Pradesh	16224	12664 (78.06)	1930 (11.9)	30.45 (9.65)	4067 (25.87)	120.4 (16.28)	81.65 (18.04)
Assam	32307	27905 (86.37)	3860 (11.95)	30.14 (9.67)	7519 (23.82)	121.57 (15.68)	81.2 (13.6)
Bihar	51245	44127 (86.11)	5433 (10.6)	28.75 (9.76)	6017 (11.88)	113.11 (13.23)	76 (16.12)
Chandigarh	866	39 (4.5)	120 (13.86)	30.71 (9.78)	144 (18.53)	113.02 (14.96)	76.46 (14.34)
Chhattisgarh	28701	20692 (72.1)	3529 (12.3)	29.63 (9.87)	3804 (13.39)	115.77 (14.41)	77.74 (14.92)
Dadra and Nagar Haveli	1002	548 (54.69)	206 (20.56)	29.15 (9.23)	126 (12.99)	113.12 (13.47)	78.12 (18.24)
Daman and Diu	1825	680 (37.26)	432 (23.67)	29.59 (9.31)	209 (12.2)	116.08 (13.38)	78.37 (13.1)
Delhi	6586	100 (1.52)	672 (10.2)	29.87 (9.57)	803 (15.46)	109.39 (15.42)	75.35 (13.99)
Goa	2463	1259 (51.12)	767 (31.14)	32.07 (9.9)	367 (14.96)	115.78 (13.9)	77.85 (11.65)
Gujarat	28506	18160 (63.71)	5574 (19.55)	30.42 (9.77)	4190 (15.13)	115.71 (14.44)	78.19 (16.65)
Haryana	25035	16261 (64.95)	3381 (13.51)	29.73 (9.53)	6809 (27.61)	118.48 (13.13)	78.69 (14.24)
Himachal Pradesh	12114	11187 (92.35)	2185 (18.04)	31.47 (9.75)	2612 (22.06)	117.19 (14.7)	80.41 (18.21)
Jammu and Kashmir	29384	23829 (81.1)	5584 (19)	29.62 (9.52)	6471 (22.42)	118.72 (14.51)	78.46 (16.85)
Jharkhand	32866	24237 (73.74)	3820 (11.62)	29.21 (9.65)	5686 (17.61)	115.17 (13.82)	78.3 (17.64)
Karnataka	30051	19763 (65.76)	3760 (12.51)	30.65 (9.62)	4901 (16.77)	116.22 (14.31)	78.27 (15.98)
Kerala	12897	7974 (61.83)	1864 (14.45)	32.04 (9.98)	1660 (12.95)	114.99 (14.28)	75.65 (15.56)
Lakshadweep	1226	178 (14.52)	156 (12.72)	31.62 (9.36)	205 (16.91)	117.54 (15.5)	77.52 (13.82)
Madhya Pradesh	72299	50600 (69.99)	9496 (13.13)	29.62 (9.85)	9503 (13.34)	115.1 (13.46)	77.5 (14.78)
Maharashtra	33915	21298 (62.8)	4455 (13.14)	30.36 (9.71)	5218 (15.85)	112.93 (14.27)	77.31 (13.94)
Manipur	15340	9752 (63.57)	1747 (11.39)	30.71 (9.66)	3027 (19.82)	117.69 (13.94)	79.97 (13.08)
Meghalaya	10346	8142 (78.7)	1144 (11.06)	29.14 (9.75)	1824 (18.02)	115.66 (15.08)	76.66 (15.39)
Mizoram	13896	6891 (49.59)	1617 (11.64)	30.36 (9.48)	2758 (20.11)	115.01 (13.03)	78.8 (15.28)
Nagaland	12230	8036 (65.71)	1440 (11.77)	30.47 (9.65)	2632 (22.34)	120.59 (16.59)	81.59 (16.82)
Odisha	37930	30311 (79.91)	4209 (11.1)	30.42 (9.87)	6637 (17.8)	115.12 (14.3)	77.39 (15.6)
Puducherry	4622	1138 (24.62)	610 (13.2)	31.53 (9.79)	1368 (29.71)	115.98 (14.32)	78.28 (12.19)
Punjab	22511	14195 (63.06)	3027 (13.45)	30.75 (9.55)	5127 (23.01)	120.36 (14.67)	80.1 (12.76)
Rajasthan	47857	34702 (72.51)	5892 (12.31)	29.11 (9.67)	6123 (12.93)	115.57 (12.95)	77.09 (14.61)
Sikkim	6094	4451 (73.04)	801 (13.14)	30.07 (9.31)	1669 (27.51)	122.28 (15.05)	82.09 (16.41)
Tamil Nadu	33614	18558 (55.21)	4794 (14.26)	31.38 (9.8)	10080 (30.35)	114.41 (14.54)	77.87 (14.2)
Telangana	8621	5466 (63.4)	1054 (12.23)	30.53 (9.59)	1815 (22.54)	111.64 (15.78)	76.99 (14.87)
Tripura	5625	4010 (71.29)	821 (14.6)	30.75 (9.69)	1101 (19.96)	117.97 (13.66)	80.31 (13.87)
Uttar Pradesh	110600	79975 (72.31)	12939 (11.7)	28.63 (9.84)	15795 (14.43)	114.98 (13.29)	77.1 (13.6)
Uttarakhand	19294	13405 (69.48)	1994 (10.33)	29.51 (9.82)	3165 (16.73)	115.78 (13.87)	78.34 (15.36)
West Bengal	20070	14485 (72.17)	2402 (11.97)	30.28 (9.86)	3172 (16.22)	118.65 (14.38)	79.13 (14.12)
Overall	803211	565705(70.43)	103525(12.89)	29.86 (9.77)	139343 (17.69)	115.96 (14.28)	78.04 (15.09)

Table 2: Logistic regression showing the effect of predictor variables on the Hypertension prevalence, awareness, treatment and control.

Background characteristic		Hypertension prevalence	Hypertension awareness	Hypertension treatment	Hypertension control
Age	Age in years (+1 Year)	1.072*** (1.071,1.073)	1.053*** (1.051,1.056)	1.043*** (1.04,1.045)	0.957*** (0.956,0.959)
	Non-smoker ®	1.00	1.00	1.00	1.00
Smoking Habit	Smoker	0.954** (0.922,0.986)	1.132** (1.035,1.238)	0.970 (0.881,1.067)	1.338*** (1.249,1.434)
	Female ®	1.00	1.00	1.00	1.00
Sex	Male	1.176*** (1.151,1.202)	0.572*** (0.538,0.607)	0.517*** (0.484,0.552)	0.336*** (0.32,0.352)
	Rural ®	1.00	1.00	1.00	1.00
Residence	Urban	1.015* (0.998,1.032)	1.058* (1.013,1.106)	0.990 (0.95,1.031)	1.035* (1.003,1.067)
	No education ®	1.00	1.00	1.00	1.00
Education level	Primary	1.112*** (1.087,1.137)	1.196*** (1.127,1.269)	1.19*** (1.125,1.258)	1.065*** (1.02,1.112)
	Secondary	1.117*** (1.096,1.139)	1.317*** (1.252,1.385)	1.166*** (1.111,1.222)	1.158*** (1.117,1.199)
	Higher	1.082*** (1.052,1.113)	1.311*** (1.213, 1.417)	1.099* (1.022, 1.181)	1.319*** (1.252, 1.39)
	Hindu®	1.00	1.00	1.00	1.00
Religion	Muslim	1.246*** (1.221,1.270)	1.541*** (1.463, 1.623)	1.436*** (1.369, 1.505)	0.972 (0.937, 1.009)
	Christian	1.179*** (1.149,1.209)	1.265*** (1.186, 1.349)	0.983 (0.92, 1.049)	0.725*** (0.691, 0.761)
	Other	1.386*** (1.346,1.427)	1.454*** (1.357, 1.558)	0.997 (0.927, 1.071)	0.710*** (0.671, 0.750)
	Poorest ®	1.00	1.00	1.00	1.00
Wealth Index	Poorer	1.126*** (1.100,1.152)	1.600*** (1.485, 1.725)	1.251*** (1.169, 1.34)	1.277*** (1.218, 1.339)
	Middle	1.274*** (1.245,1.304)	1.984*** (1.843, 2.136)	1.379*** (1.29, 1.476)	1.547*** (1.476, 1.621)
	Richer	1.448*** (1.413,1.484)	2.225*** (2.063, 2.401)	1.546*** (1.443, 1.657)	1.653*** (1.574, 1.736)
	Richest	1.462*** (1.423,1.503)	2.505*** (2.310,2.717)	1.822*** (1.692,1.961)	1.756*** (1.665,1.852)

Abbreviations: ® - Reference group, Significance codes: '****' 0.001 '**' 0.01 '*' 0.05

DISCUSSION

This study shows that there are large variations in prevalence of hypertension within different states and Union Territories of India. Authors have noticed that prevalence of hypertension is higher in urban locality, among older people and, among subjects with greater wealth, and higher educational status. Hypertension awareness, treatment, and control are better in women, and significantly lower in rural participants and those with low wealth index and educational status. Authors did not evaluate health policy issues as well as other socioeconomic markers of low hypertension treatment and control such as availability or access to treatment, costs of drug, provision of free medicines, and health

insurance status, and hence cannot comment on their relevance.

World health organization has reported that hypertension prevalence is the highest in low and lower-middle income countries as compared to upper-middle and high- income countries.¹ Authors have shown that hypertension is common in India, with state wise variations (Table 1). Focus should be given to vulnerable groups to better control of hypertension in the regions of poor awareness and control. CVS morbidity and mortality, which are sequelae to poor hypertension management can only be reduced by adequate intervention. India, China, Russia, Pakistan, and Indonesia have reported that high BP is the most important risk factor for global mortality. This is

published in global burden of diseases study.^{2,3} Limited data are available from South Asia where high BP is estimated to cause to more than a million deaths annually.¹¹⁻¹³ South Asian region is the most populous in the world and our data, which may be nationally representative, show a poor status of hypertension management.¹⁴ Hypertension awareness, treatment, and control were 48.2%, 42.8%, and 12.8% in Malaysia while in China it was 41.6%, 34.4%, and 8.2%, respectively. In present study India showed 20.44%, 13.64% and 34.37% respectively which showed hypertension control was best among the three. In Pure study, hypertension prevalence in South-East Asia was more in low socioeconomic status subjects whereas it showed an opposite result in South Asians. Education related information in both areas were similar.¹⁵ Relationship with education was one of the prime highlights of our survey shown in (Figure 2 and Table 2). There are only few studies that have reported association of various socioeconomic indicators with hypertension treatment and control which have been demonstrated in our survey.¹⁶

Multiple reasons are associated with better hypertension awareness and include national health and education policies and health services-related factors. In the Pure study, it has been reported that despite a lower prevalence of risk factors in low-income countries (India, Bangladesh, Pakistan, and Zimbabwe), strokes and coronary heart disease related mortality was greater.¹⁷ This suggests that the higher cardiovascular death rate may be due to lack of adequate health care facilities, inadequate primary prevention (hypertension, cessation of smoking habit) as well as poor management of diseases.¹⁸ Present study survey confirms poor hypertension awareness, treatment and control status in India. Hypertension management is a marker of overall cardiovascular risk factor management and could be a marker of strength of health systems. World health organization and united nations has targeted 25% reduction in non-communicable mortality by 2025 (25×25 strategy) and has focused on hypertension prevention and management as an important means to achieve this target.¹⁹ Our results indicate that it is important to improve hypertension treatment and control status in different states and union territories in order to achieve these targets.

Previous studies on healthcare access and utilization in low and lower-middle income countries have reported multiple social and economic barriers.²⁰ A qualitative study among rural women with hypertension in India highlighted problems of access and costs and also highlighted use of more expensive medicines by physicians.²¹ Similar studies in urban patients with hypertension in India and Pakistan reported lack of family and peer support, financial issues, lack of understanding of nature of disease, and physician inertia as factors responsible for low adherence to antihypertensive treatment and poor control.^{22, 23}

Present study data survey has its strengths and limitations. Authors have covered all states and union territories and tried to cover most of the demographic findings in comparison to a south Asian study and Pure study which were not nationally representative.¹⁸ Authors have reported lower hypertension awareness, treatment, but better control in lower age groups. Inability to show chronological trend of hypertension prevalence due to lack of evaluable data from NHFS 1, 2 and 3 is one of the major limitations of this study.

On the other hand, this is going to be one of the largest surveys on hypertension prevalence in India and provides information on important determinants of awareness, treatment, and control.

CONCLUSION

In conclusion, this study shows that hypertension is common in India, with large state wise variations in hypertension awareness, treatment, and control. However, the rates of these parameters are low among the rural, the poor, and less educated individuals. Focus on these vulnerable groups to better control hypertension in different states and union territories of India is urgently required to reduce cardiovascular disease morbidity and mortality.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Mukhopadhyay K, Mukherjee S, Barkandaj B, Chatterjee C. Association of different socio-economic factors with hypertension prevalence, awareness, treatment and control in India: a demographic analysis of NFHS-4. *Int J Res Med Sci* 2019;7:815-21.