

Prevalence and determinants of isolated systolic and isolated diastolic hypertension in India: Insights from the national family health survey (NFHS)- 4

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ABSTRACT

Background: Isolated Systolic Hypertension (ISH) and Isolated Diastolic Hypertension (IDH) are often the ignored forms of hypertension and are determinants of future cardiac and neurological events and contribute to mortality. However, the nationally representative estimates of both these forms of hypertension remain unknown from India. **Aim:** To estimate the ISH and IDH from a nationally representative survey of India. **Material and Methods:** The present study used data from 7,23,181 people (15–54 years), recorded during the fourth round (2015–2016) of the National Family Health Survey (NFHS), India. The prevalence of ISH and IDH was calculated for state comparison, while multilevel logistic regression analysis was done to assess the correlates of both types of hypertension. **Results:** The prevalence of ISH and IDH was found to be 1.2% (95% CI 1.0–1.4) and 5.7% (95% CI 5.2–6.2), respectively. The prevalence of both ISH and IDH increased with age, with a more significant increase in systolic pressure towards the higher age. Northeastern states of India (Assam, Meghalaya, and Arunachal Pradesh) had the highest prevalence of both forms of hypertension. On multilevel logistic regression, male gender, increasing age groups (highest odds ratio (OR) being in 45–49 year age group), alcohol, and diabetes positively predicted both ISH and IDH. Urban residence, literacy, and tobacco were positive predictors of IDH, whereas urban residence, smoking, and literacy negatively predicted ISH. **Conclusion:** ISH and IDH have a significant presence among the population of India. This data provides insights to formulate strategies at the primary and primordial prevention levels.

Keywords: Isolated diastolic hypertension, isolated systolic hypertension, national family health survey, prevalence

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Introduction

Hypertension contributes to the highest proportion of avoidable deaths and diseases in India and globally.^[1] In a recently published systematic analysis of the Global Burden of Disease Study 2017, high systolic blood pressure was the major risk factor for mortality and disability-adjusted life years (DALY's).^[2] According to a study conducted across 154 countries which included more

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than 8.5 million participants, the number of participants with Systolic Blood Pressure of at least 140 mm Hg has increased from 17.3% to 20.5% between 1990–2015.^[3]

The most common form of hypertension in the elderly is Isolated systolic hypertension (ISH), and contributes substantially to morbidity and mortality, chiefly through cardiovascular diseases. The systolic blood pressure rises with age, and diastolic blood pressure rises till 55 years of age and starts to decrease thereafter, leading to widening of the pulse pressure. The stiffening of the central aorta leading to rapid return of the reflected pulse wave from the periphery leads to an augmentation of the systolic blood pressure.^[4] ISH has a strong association with heart failure with preserved systolic function and is more common in women.

Hypertension diagnosed in middle age (30–50 years) usually has an elevated diastolic BP with a normal systolic BP- Isolated diastolic hypertension (IDH). This is more common in men and correlates with middle-aged weight gain.^[5] Without treatment, this entity invariably progresses to combined systolic-diastolic hypertension. The most likely cause for this is increased systemic vascular resistance with an inappropriately normal cardiac output.

There are very few reliable estimates of the prevalence of ISH and IDH globally and from India. In a recent study from Taiwan among drug naïve adults ≥ 19 years, the prevalence rates of ISH and IDH were 6.51% and 1.92%, respectively.^[6] According to the National Health and Nutrition Examination Survey (1999–2010), the prevalence of untreated ISH was 9.3% in the United States of America.^[7] Most studies in India have been restricted to the district population, and the prevalence estimates for ISH vary between 4.3%^[8] to 13.3%.^[9]

The objective of this study was to determine the prevalence and determinants of ISH and IDH in the national population using the National Family Health Survey (NFHS)-4 data which was conducted in 2015–16 and covered all the states and union territories of India.

Methods

Data Source and sample size

The present study used data from 7,23,181 people (15–54 years), recorded in 2015–16, during the fourth round of the National Family Health Survey (NFHS), which is nationally representative of the Indian population. The NFHS is a multi-round large-scale survey conducted in a representative sample of households throughout India.^[10] The Ministry of Health and Family Welfare (MOHFW), Government of India, designated the International Institute of Population Sciences (IIPS), Mumbai, India, as the nodal agency responsible for providing coordination and technical guidance for the NFHS. NFHS was funded by the United States Agency for International Development (USAID) with supplementary support from United Nations Children’s Fund (UNICEF).

IIPS collaborated with several field organizations for survey implementation. The data is accessible on request. The link for the data is https://dhsprogram.com/data/dataset_admin/index.cfm.

Two-stage cluster random sampling, stratified by rural versus urban areas, within each district was used to cover all states. The NFHS-4 is the most recent national survey conducted in India and the only one that covers all states and union territories. However, it only included men aged 15–54 years and women aged 15–49 years.

In the NFHS-4, BP was measured three times (using the Omron HEM-8712) in the left upper arm, with at least 5 min intervals between each measurement as well as 5 min of quiet sitting before the first measurement. All BP measurements were recorded in mm of Hg.

The European Society of Cardiology (ESC) and European Society of Hypertension (ESH) 2018 guidelines were used to define hypertension (SBP ≥ 140 and/or DBP ≥ 90) and isolated systolic hypertension if SBP mmHg ≥ 140 with DBP < 90 mm Hg.^[11] Isolated diastolic hypertension was defined by the Joint National Committee (JNC) 7 criteria as systolic BP less than 140 mm Hg with a diastolic BP greater than or equal to 90 mm Hg.^[12]

Data analysis and statistical methods

Study parameters

The relationship with the prevalence of ISH and IDH with some of the associated socio-economic characteristics viz., gender, age-group, place of residence, level of education, and wealth index, self-reported risk factors, viz., habits of drinking alcohol, smoking, and chewing tobacco, and having a clinical history of diabetes and any heart disease have been assessed. [Table 1] Age as reported subjectively by individuals, and grouped into eight subgroups: 15–19, 20–24., 40–44, 45–49, and 50–54. The 50 to 54 age group includes data only for the male population. The type of place of residence is classified as rural and urban. The educational qualification is classified into four classes: no-formal education, primary, secondary and higher. The economical classification was done using the wealth index and is grouped into poor, middle, and rich income classes. The prevalence of ISH and IDH in different Indian states and Union territories has been reported to visualize the pattern and geographical variations, along with gender-wise variation.

Statistical analysis

Both the events of the occurrence of ISH and IDH is considered as dichotomous variable, where if the Isolated Systolic and Diastolic blood pressure occurs, then it denotes ‘1’ and ‘0’ for otherwise, respectively. A stepwise multivariate logistic regression model has been constructed to estimate the prevalence of ISH and IDH in the Indian population aged 15 to 54 years based on their socio-economic characteristics viz., gender, age-group, place of residence, level of education, and wealth index, self-reported

risk factors, viz., habits of drinking alcohol, smoking, and chewing tobacco, and having a clinical history of diabetes or any heart disease. The results obtained from the regression analysis have been presented in terms of the odds ratios (ORs) with 95% confidence interval (CI). Statistical analysis was performed using the Statistical Analysis System (SAS) package (University Edition).

Ethical approval

The study was ethically approved by the Institute's Ethics Committee, Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh (PGI/IEC/2021/001139).

Results

Demographics

More than 50% of the total of 7,23,181 people surveyed belonged to the 15–29 years age group. A little over 70 percent of the total surveyed population lived in a rural household, and 26.1% never had access to any form of education. A total of 39.2% of the population belonged to the poorest category according to the wealth index, 6.4% had a history of any form of alcohol intake, and 15.89% were smokers. According to the NFHS IV survey,

the prevalence of ISH and IDH was found to be 1.2% (95% CI 1.0–1.4) and 5.7% (95% CI 5.2–6.2), respectively. The prevalence of both ISH and IDH increased with age, with a more significant increase in systolic pressures towards the higher age.

Prevalence of isolated systolic and diastolic hypertension at national and state level

Significant heterogeneity is present in the state-wise distribution of isolated forms of hypertension [Table 2, Figure 1]. The northeastern states of Meghalaya (2.3%; 95% CI: 2–2.6) and Assam (2.2%; 95% CI: 1.9–2.5) had the highest prevalence of ISH, whereas Andhra Pradesh and Maharashtra had the lowest prevalence of ISH at (0.7%; 95% CI: 0.5–0.9). The highest prevalence of IDH was found in Arunachal Pradesh (9.5%; 95% CI: 8.9–10.8) followed by Assam (8.6%; 95% CI: 8.0–9.1) and Sikkim (8.6%; 95% CI: 8.0–9.1), and lowest in Bihar and Kerala (3.9%; 95% CI: 3.5–4.2). A concordant relationship was seen between ISH and IDH prevalence; states which had a higher prevalence of ISH also displayed a higher prevalence of IDH.

States with the highest percentage of females with ISH were Meghalaya (2.3%) and Assam (2%), and with IDH were Arunachal

Table 1: Distribution of ISH and IDH with Socio-demographic characteristics and risk factors

Variables	Total (n=723181) n (%)	Isolated		P
		Systolic Hypertension (n=8710, P=1.2%) n (%)	Diastolic Hypertension (n=41314, P=5.7%) n (%)	
Gender				<0.0001
Male	100709 (13.9)	2092 (24.0)	8108 (19.6)	
Female	622472 (86.07)	6618 (76.0)	33206 (80.4)	
Age (years)				<0.0001
15-19	136307 (18.8)	703 (8.1)	2903 (7.0)	
20-24	128229 (17.7)	824 (9.5)	4196 (10.2)	
25-29	117901 (16.3)	846 (9.7)	5709 (13.8)	
30-34	98689 (13.6)	909 (10.4)	6772 (16.4)	
35-39	90799 (12.5)	1244 (14.3)	7828 (19.0)	
40-44	75280 (10.4)	1611 (18.5)	6885 (16.7)	
45-49	68838 (9.5)	2279 (26.2)	6223 (15.1)	
50-54	7138 (0.9)	294 (3.4)	798 (1.9)	
Place of residence				<0.0001
Urban	206918 (28.6)	2107 (24.2)	12891 (31.2)	
Rural	516263 (71.4)	6603 (75.8)	28423 (68.8)	
Education Level				<0.0001
Higher	84970 (11.7)	718 (8.2)	4587 (11.1)	
Secondary	357565 (49.4)	3474 (39.9)	18447 (44.7)	
Primary	91217 (12.6)	1214 (13.9)	5963 (14.4)	
No education	189429 (26.1)	3304 (37.9)	12317 (29.8)	
Wealth index				<0.0001
Poorest	284194 (39.2)	3437 (39.5)	15250 (36.9)	
Middle	148945 (20.5)	1729 (19.9)	8557 (20.7)	
Richest	290042 (40.1)	3544 (40.7)	17507 (42.4)	
Drink alcohol	46787 (6.4)	1046 (12.0)	4648 (11.3)	<0.0001
Smoker	114981 (15.8)	1993 (22.9)	8994 (21.8)	<0.0001
Chewing tobacco	8582 (1.1)	137 (1.6)	715 (1.7)	<0.0001
Currently has diabetes	8579 (1.1)	226 (2.6)	853 (2.1)	<0.0001
Currently has heart disease	9197 (1.2)	171 (2.0)	669 (1.6)	<0.0001

Table 2: State-wise distribution of ISH and IDH

States/ Territories	Total	Isolated Systolic Hypertension		Isolated Diastolic Hypertension	
		(%)	(95%CI)	(%)	(95%CI)
A & N Islands	9916	0.8	0.7-1.0	7.0	6.5-7.5
Andhra Pr.	10042	0.7	0.5-0.9	6.4	6.0-6.9
Arunachal Pr.	14204	2.0	1.7-2.3	9.5	8.9-10.1
Assam	29034	2.2	1.9-2.5	8.6	8.0-9.1
Bihar	47816	1.0	0.8-1.2	3.9	3.5-4.2
Chandigarh	698	0.9	0.7-1.0	5.6	5.1-6.0
Chhattisgarh	27531	1.3	1.1-1.6	5.4	5.0-5.9
D & N Haveli	937	0.8	0.6-0.9	5.8	5.3-6.2
Daman & Diu	1651	1.3	1.0-1.5	4.8	4.4-5.2
Delhi	4722	1.1	0.9-1.3	4.4	4.0-4.8
Goa	2369	1.2	1.0-1.4	6.2	5.7-6.7
Gujarat	26651	1.1	0.9-1.3	6.4	5.9-6.9
Haryana	19817	1.7	1.5-2.0	6.1	5.7-6.6
Himachal Pr.	10716	1.3	1.1-1.5	7.9	7.3-8.4
J &K	24967	1.8	1.5-2.0	5.2	4.8-5.7
Jharkhand	29349	1.0	0.8-1.2	5.4	4.9-5.8
Karnataka	27448	1.3	1.1-1.5	6.0	5.5-6.5
Kerala	12127	1.4	1.2-1.6	3.9	3.5-4.3
Lakshadweep	1143	1.8	1.5-2.0	4.8	4.4-5.2
Madhya Pr.	68192	1.0	0.8-1.2	5.4	5.0-5.8
Maharashtra	30996	0.7	0.5-0.9	6.8	6.3-7.3
Manipur	13979	0.9	0.7-1.1	7.4	6.9-7.9
Meghalaya	9187	2.3	2.0-2.6	4.2	3.8-4.6
Mizoram	12078	0.8	0.6-1.0	6.2	5.7-6.6
Nagaland	10935	1.3	1.1-1.6	8.4	7.8-8.9
Orissa	34050	1.2	1.0-1.4	5.1	4.7-5.6
Pondicherry	3636	0.9	0.8-1.1	6.4	5.9-6.8
Punjab	19906	2.0	1.7-2.2	7.2	6.7-7.7
Rajasthan	44765	1.1	0.9-1.3	4.5	4.1-4.9
Sikkim	5206	1.6	1.3-1.8	8.6	8.0-9.1
Tamil Nadu	25829	0.9	0.7-1.1	6.0	5.5-6.5
Tripura	5056	1.1	0.9-1.3	7.1	6.6-7.6
Uttar Pr.	102265	1.0	0.8-1.2	4.7	4.2-5.1
Uttaranchal	17551	1.0	0.8-1.2	6.1	5.6-6.6
West Bengal	18412	1.6	1.3-1.8	5.1	4.7-5.5
India	723181	1.2	1.0-1.4	5.7	5.2-6.2

Pradesh and Assam, 9.2% and 8.3%, respectively. The highest percentage of males with ISH were seen in Lakshadweep (4.9%), followed by Haryana (4.3%), and with IDH were Sikkim (11.9%) and Arunachal Pradesh (11.5%) [Table 3].

Determinants of ISH and IDH

Age was found to be significantly associated with ISH, with the prevalence of ISH steadily increasing with age group until 49 years of age. A similar trend was seen with IDH with a peak at the age of 35–39 followed by a decrease. Stepwise Logistic Regression has been adopted for the selection of concomitant variables to remove non-significant variables from the model [Table 4]. Higher age was found to be associated with a higher odds ratio (OR) for the development of ISH and IDH.

The urban households were associated with lower odds of having ISH (OR 0.81, CI 0.77–0.86, $P < 0.0001$) but higher odds of developing IDH (OR 1.12, CI: 1.10–1.15, $P < 0.0001$).

Educational qualification had an inverse relationship with ISH and IDH with higher education status predicting lower odds of developing ISH (OR 0.75; CI 0.69–0.82, $P < 0.0001$), and primary education status was associated with higher odds of IDH (OR 1.10; CI 1.06–1.14, $P < 0.0001$). Alcohol and diabetes were found to be positively associated with the development of these two forms of hypertension, whereas tobacco use had an OR of 1.11 for IDH.

Discussion

To the best of our knowledge, this is the first study that determines the prevalence of ISH and IDH in India stratified by the geographical region, gender, and socio-demographic determinants, based on the NFHS-4 data collected in the year 2015–16.

The overall prevalence of ISH (1.2%) is very low in contrast to other studies conducted in India and abroad. The prevalence of ISH has been estimated at 4.3%^[8] in Lucknow, 25% in the Davengere district of Karnataka,^[13] and 15.3% in the National capital of Delhi,^[12] India in an elderly population (> 60 years). Similar estimates have been reported from the United States, with a prevalence of 9.4%^[7] in adults aged > 18 years and 45.5% among older adults.^[14] The low prevalence of ISH in our study may be due to the inclusion of younger age groups (15–54) in the analysis, and ISH is predominantly a disease of the older population. However, the prevalence of ISH increased with age in our study, with the maximum proportion falling in the 45–49 year age group (26.2%) which is similar to studies reported above.

The prevalence of IDH in our study was found to be high at 5.7% when compared to other studies. Mittal *et al.* reported a prevalence of 4% in a semi-rural population of South India.^[15] Another community-based survey conducted in Uttar Pradesh and Mizoram showed a prevalence of IDH at 4.5%^[16] and 3.43%^[17] respectively. A Chinese study with 23,10,184 participants in the PEACE (Patient-Centered Evaluative Assessment of Cardiac Events) Million Persons Project showed a prevalence of IDH as 3.2%.^[18] It is evident that diastolic pressure rises till 55 years of age and falls thereafter. The same has been found in the present study, with a steady increase in the prevalence of IDH till 39 years and decreasing thereafter.

In our study, greater proportions of both ISH and IDH were found in people living in rural areas, achieved secondary education level, and belonged to the richest quintile of the wealth index. In a study conducted in China, ISH prevalence was higher among rural women, similar to our study.^[19]

Table 3: Gender wise distribution of ISH and IDH

States or Territories	Total		Isolated Systolic Hypertension (%)		Isolated Diastolic Hypertension (%)	
	Male	Female	Male	Female	Male	Female
Andaman and Nicobar Islands	1342	8574	1.71	0.70	11.03	6.32
Andhra Pradesh	1304	8738	1.61	0.56	10.51	5.84
Arunachal Pradesh	1828	12376	3.61	1.78	11.54	9.18
Assam	3719	25315	3.79	2.01	10.08	8.34
Bihar	5472	42344	1.35	0.94	5.65	3.64
Chandigarh	103	595	1.94	0.67	8.74	5.04
Chhattisgarh	3647	23884	2.17	1.21	7.57	5.11
Dadra and Nagar Haveli	195	742	1.03	0.67	9.23	4.85
Daman and Diu	383	1268	1.83	1.10	3.66	5.13
Delhi	468	4254	2.56	0.94	5.34	4.33
Goa	791	1578	1.64	0.95	9.23	4.69
Gujarat	5513	21138	1.71	0.89	8.02	5.97
Haryana	2872	16945	4.32	1.29	9.02	5.65
Himachal Pradesh	2102	8614	2.85	0.94	11.47	6.98
Jammu and Kashmir	5309	19658	2.94	1.44	6.12	5.01
Jharkhand	3592	25757	1.50	0.90	7.10	5.14
Karnataka	3699	23749	2.24	1.14	9.30	5.50
Kerala	1919	10208	2.24	1.23	4.90	3.69
Lakshadweep	162	981	4.94	1.22	3.09	5.10
Madhya Pradesh	9690	58502	1.24	0.91	7.37	5.07
Maharashtra	4296	26700	1.37	0.61	10.68	6.19
Manipur	1711	12268	2.05	0.72	10.70	6.95
Meghalaya	1120	8067	2.23	2.32	6.25	3.87
Mizoram	1552	10526	1.87	0.62	9.73	5.63
Nagaland	1341	9594	3.73	0.99	10.59	8.06
Orissa	4152	29898	1.71	1.13	7.44	4.81
Pondicherry	518	3118	1.74	0.80	10.04	5.74
Punjab	2914	16992	3.53	1.70	10.50	6.66
Rajasthan	5918	38847	2.31	0.88	6.91	4.17
Sikkim	734	4472	3.41	1.27	11.99	8.01
Tamil Nadu	4192	21637	1.60	0.73	10.09	5.22
Tripura	798	4258	1.75	0.99	7.14	7.07
Uttar Pradesh	12975	89290	1.48	0.95	6.25	4.43
Uttaranchal	1982	15569	1.87	0.91	10.85	5.49
West Bengal	2396	16016	2.38	1.47	6.64	4.86
India	100709	622472	2.07	1.06	8.05	5.33

On multilevel logistic regression, male, increasing age groups (highest OR being in 45–49 year age group), alcohol and diabetes positively predicted both ISH and IDH. Urban residence, literacy, and tobacco were positive predictors of IDH, whereas urban residence, smoking, and literacy negatively predicted ISH. The findings are similar to a study conducted in the rural population of China, where ISH was positively correlated with age, alcohol, and obesity.^[20]

The association of ISH with alcohol in our study corroborates with the literature. In the Davengere district of India, a higher prevalence of ISH was seen in current alcoholics and ex-smokers.^[13] Similarly, a significant association of ISH was seen with age, alcohol, and smoking, and a non-significant association was seen with urban residence and socio-economic status in a district of Lucknow.^[8] In a study conducted in China, smoking was found to be the strongest modifiable predictor of ISH.^[20]

However, it was in contrast to our study wherein smoking was negatively associated with ISH.

The prevalence of ISH and IDH was higher in males (24 and 19.6) as compared with females (1.06 and 5.33, respectively). Being male was significantly associated with an increased risk for IDH has also been reported in other studies.^[15-18] Regarding ISH, other studies have reported no association with male gender or females having a higher chance of ISH.^[20] One of the important points to be noted is that females were overrepresented in our study, possibly because it was a household survey, and it is likely that the survey team encountered the non-working females at the time of the survey.

In our study, the northeastern states of Assam and Meghalaya had the highest prevalence of ISH, and Sikkim and Arunachal Pradesh had the highest prevalence of IDH. States of

Table 4: Multilevel Stepwise Logistic regression analysis of selected demographic and risk factors

Factors	Isolated Systolic Hypertension				Isolated Diastolic Hypertension			
	OR	(95%CI)		P	OR	(95%CI)		P
		Lower	Upper			Lower	Upper	
Gender (Male, Female (ref))	1.88	1.76	2.00	<0.0001	1.30	1.26	1.34	<0.0001
Age (years)								
15-19 (ref)	1.00				1.00			
20-24	1.27	1.15	1.41	<0.0001	1.55	1.48	1.63	<0.0001
25-29	1.39	1.25	1.54	<0.0001	2.32	2.22	2.43	<0.0001
30-34	1.75	1.58	1.93	<0.0001	3.35	3.20	3.50	<0.0001
35-39	2.57	2.33	2.82	0.0014	4.29	4.10	4.48	<0.0001
40-44	3.98	3.63	4.37	<0.0001	4.57	4.37	4.79	<0.0001
45-49	6.11	5.59	6.69	<0.0001	4.53	4.32	4.75	<0.0001
50-54	4.76	4.11	5.52	<0.0001	4.09	3.75	4.46	<0.0001
Residence (Urban, Rural (ref))	0.81	0.77	0.86	<0.0001	1.12	1.10	1.15	<0.0001
Education								
No education (ref)	1.00				1.00			
Primary	0.88	0.82	0.94	0.5502	1.10	1.06	1.14	<0.0001
Secondary	0.85	0.80	0.89	0.2208	1.08	1.05	1.11	0.0006
Higher	0.75	0.69	0.82	<0.0001	1.03	0.99	1.07	0.091
Alcohol (Yes)	1.20	1.11	1.29	<0.0001	1.39	1.33	1.44	<0.0001
Smoke (Yes)	0.86	0.81	0.91	<0.0001				
Tobacco (Yes)					1.11	1.03	1.20	0.0078
Diabetes (Yes)	1.41	1.23	1.62	<0.0001	1.26	1.17	1.35	<0.0001

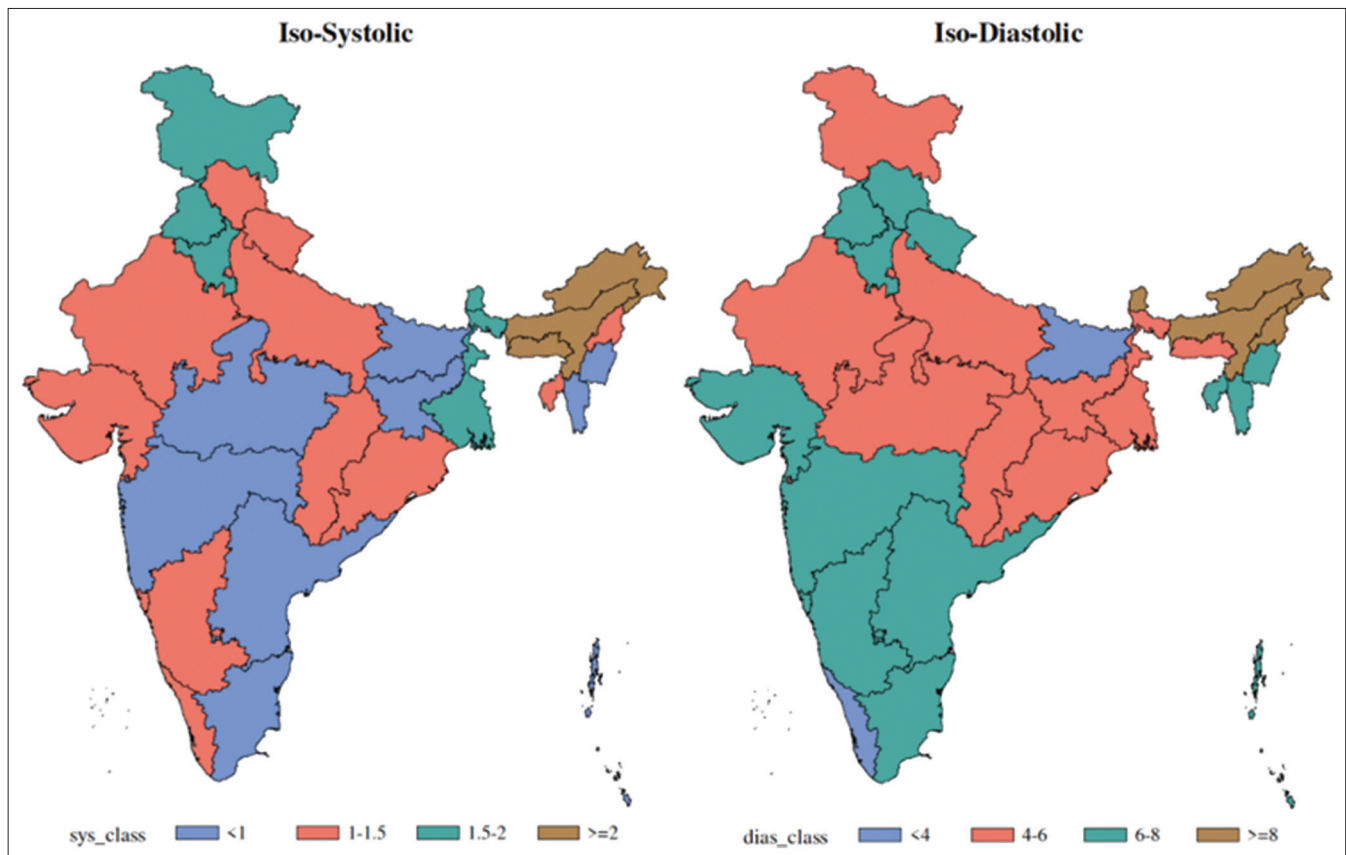


Figure 1: State-wise distribution of isolated systolic and isolated diastolic hypertension

Andhra Pradesh and Maharashtra had the lowest prevalence of ISH, and states of Bihar and Kerala had the lowest prevalence

of IDH. To the best of our knowledge, this is the first study to capture all the states and union territories of the country.

Some studies have reported the state-wise prevalence of ISH and IDH. In the ICMR-INDIAB study^[21] published in 2015, wherein individuals >20 years of age were surveyed in three states (Tamil Nadu, Maharashtra, and Jharkhand) and one union territory of Chandigarh, the prevalence of ISH was 12.1% in Tamil Nadu and Jharkhand, 10.5% in Maharashtra and 7.8% in Chandigarh. The prevalence of IDH was 4.6%, 4%, 3.8%, and 2.5% in Maharashtra, Jharkhand, Chandigarh, and Tamil Nadu, respectively. In another study from Mizoram, the prevalence of ISH and IDH was 2.05% and 3.43%, respectively.^[17]

The main strengths of the study are that it is nationally representative data with a huge sample size providing robust estimates of ISH and IDH prevalence. The data fills a critical gap in knowledge about the burden of ISH and IDH in a relatively younger population (15–54 years), which was unknown so far for India. Both forms of hypertension are determinants of future cardiac and neurological events, and active treatment of patients with ISH can reduce all-cause mortality by 13%, cardiovascular mortality by 18%, all cardiovascular events by 26%, stroke by 30%, and coronary events by 23%.^[22] So any intervention at the primordial, primary, or secondary level can have a huge impact on outcome improvement. ISH and IDH have been conspicuous by their absence in any form of national programs in India, and there is a strong unmet need to include them in future studies and national policies. However, we acknowledge a few limitations. Firstly, women have been over-represented, and this may have skewed the data and increased the overall prevalence of IDH because it is more common in women. Secondly, the age group has been restricted to 54 years, and ISH is predominantly a disease of the elderly, so it may have led to an underestimation of the actual burden of disease. Thirdly, since this is a survey-based study done in an uncontrolled environment, it may have some element of measurement errors.

Conclusion

The prevalence of ISH and IDH in India was found to be 1.2% and 5.7%, respectively. Increasing age, male, rural household, alcohol intake, and diabetes emerged as significant predictors for ISH. Along with these, other significant determinants of IDH are literacy and tobacco use. This information can help formulate and modify public health policies and programs targeting non-communicable diseases and can go a long way towards achieving sustainable development goals.

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Conflicts of interest

There are no conflicts of interest.

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