

Hypertension in India: Shared Metabolic and Heterogeneous Social and Behavioural Correlates Across Regions and Sexes

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Abstract

Hypertension is a major contributor to cardiovascular disease and premature mortality worldwide and an increasing public health challenge in India, yet whether its associated factors operate consistently across regional and sex-specific population contexts remains unclear. This study examined regional and sex-specific variation in hypertension and its associated factors among Indian adults.

We analysed data from the National Family Health Survey (2019-21), including 756,030 adults. Hypertension was defined using the JNC 7 criteria (SBP $\geq$ 140 mmHg, DBP $\geq$ 90 mmHg, or current use of antihypertensive medication). Hypertension prevalence was estimated by region and sex, and multivariable logistic regression assessed associated factors.

The prevalence of hypertension was 21.6%, significantly higher among males (29.5%) than females (20.5%), with significant regional variation: highest in the Northeast (23.3%) and South (23.1%), followed by North (22.9%) and Central (22.2%), and the lowest in East (19.6%) and West (18.5%). Increasing age, central obesity, and high blood glucose were consistently associated with hypertension across all regions and both sexes. In contrast, the associations of marital status, education, employment, wealth, urban residence, alcohol consumption, tobacco use, and dietary pattern varied substantially by regions and sexes. Alcohol consumption was the most consistent behavioural correlate, particularly among males.

Hypertension in India reflects consistent metabolic correlates alongside heterogeneous social and behavioural associations across regions and sexes. These findings suggest that while strategies targeting obesity and dysglycaemia remain broadly relevant, effective hypertension prevention and control may benefit from approaches that are responsive to regional and sex-specific population contexts.

Summary Table

What is known about topic: Hypertension is a major public health concern in India, with increasing prevalence and known associations with age, obesity, and metabolic risk factors. Previous studies have documented regional and sex differences in prevalence but have largely examined these using aggregate models that assume uniform associations across populations.

What this study adds: This study shows that while biological factors such as age, central obesity, and elevated blood glucose are consistently associated with hypertension across regions and sexes, social and behavioural factors exhibit substantial heterogeneity. The findings demonstrate that patterns of association vary systematically by region and sex, highlighting context-specific differences that are not captured in aggregate analyses. These findings suggest that hypertension prevention and control strategies in India should move beyond uniform approaches to incorporate region- and sex-specific considerations.

Introduction

Hypertension is one of the leading modifiable risk factors for cardiovascular disease and premature mortality worldwide, contributing substantially to the burden of stroke, ischaemic heart disease, heart failure, and chronic kidney disease [1–3]. Although improvements in detection and treatment have been reported in some settings, the burden of hypertension continues to increase in many low- and middle-income countries undergoing rapid demographic, epidemiological, and nutritional transitions [1, 3]. India represents a major contributor to this global burden, with hypertension affecting a large and growing segment of the population and posing significant challenges to health systems and non-communicable disease control efforts [3].

The distribution of hypertension in India is characterised by considerable geographic and demographic heterogeneity. Previous studies have documented substantial variation in prevalence across states and regions, reflecting differences in urbanisation, socioeconomic development, lifestyle practices, population composition, and healthcare access [3]. Sex differences have also been consistently reported, with men generally exhibiting a higher prevalence of hypertension than women, although the magnitude of these differences varies across populations and stages of the life course [4, 5]. Alongside age, obesity and metabolic abnormalities have emerged as important correlates of hypertension, while socioeconomic and behavioural factors such as education, wealth, employment, alcohol consumption, tobacco use, and dietary practices have shown less consistent associations [1, 3].

Most evidence from India has focused on identifying correlates of hypertension using nationally aggregated analytical frameworks [6–9]. While these studies have generated important insights into demographic, socioeconomic, behavioural, and metabolic factors associated with hypertension, they largely assume that these associations operate similarly across populations. Such an assumption may be problematic in a country as socially, culturally, and geographically diverse as India. Regional differences in social organisation, economic development, behavioural practices, and health environments may influence the relative importance of hypertension-associated factors. Furthermore, biological and social processes shaping hypertension may differ between males and females, potentially contributing to variation in observed associations across population groups [5, 10].

Understanding whether hypertension-associated factors are consistent or context-specific has important implications for prevention and control strategies. Consistent associations across populations would support broad population-level interventions, whereas substantial heterogeneity would suggest the need for approaches tailored to local epidemiological and social contexts. However, evidence examining regional and sex-specific variation in hypertension-associated factors at the national level remains limited.

Using data from the National Family Health Survey (NFHS-5, 2019–21), this study examines regional and sex-specific variation in hypertension among Indian adults. Specifically, it estimates hypertension prevalence across regions and sexes and evaluates the associations of demographic, socioeconomic, behavioural, and metabolic characteristics within these population strata. We hypothesised that metabolic correlates of hypertension would remain relatively consistent across regions and sexes, whereas social and behavioural correlates would exhibit substantial heterogeneity. By examining these patterns, the study seeks to contribute to a more nuanced understanding of hypertension in India and inform regionally responsive approaches to prevention and control.

Materials and Methods

Study design and data source

This study used data from the fifth round of the National Family Health Survey (NFHS-5), conducted between 2019 and 2021 under the Demographic and Health Surveys (DHS) programme. NFHS-5 is a nationally representative household survey designed to provide reliable estimates of demographic, socioeconomic, and health indicators at national, state, and union territory levels. The survey employed a stratified two-stage sampling design, with villages selected as primary sampling units (PSUs) in rural areas and census enumeration blocks serving as PSUs in urban areas [4].

Study population

NFHS-5 collected information from 825 954 individuals across India. The present analysis was restricted to adults with valid blood pressure measurements and complete information on study variables. Pregnant women and women who had

delivered within two months preceding the survey were excluded. The final analytical sample comprised 756 030 individuals, including 96 003 males aged 15–54 years and 660 027 females aged 15–49 years (Fig. 1).

Outcome Variable

Hypertension was defined according to the Seventh Report of the Joint National Committee (JNC-7) criteria as systolic blood pressure (SBP) ≥ 140 mmHg, diastolic blood pressure (DBP) ≥ 90 mmHg, or current use of antihypertensive medication [11].

Blood pressure was measured using standardised NFHS-5 procedures. Three measurements were obtained using calibrated digital blood pressure monitors, and the average of the recorded measurements was used for analysis.

Explanatory variables

Explanatory variables were selected based on previous evidence identifying demographic, socioeconomic, behavioural, and metabolic correlates of hypertension [1, 3, 5–10]. This included age, sex, place of residence, marital status, education, employment status, household wealth index, dietary pattern, tobacco use, alcohol consumption, waist circumference (WC), waist-to-hip ratio (WHR), and blood glucose.

Age was categorised into 10-year groups; *marital status* was grouped as never married, married, and divorced/separated/widowed; *wealth index* as low, middle, and high; and *dietary pattern* as vegetarian or non-vegetarian.

Central obesity was defined as WC ≥ 90 cm in males and ≥ 80 cm in females [12], and *High WHR* ≥ 0.90 in males and ≥ 0.80 in females [12]. High blood glucose was defined as blood glucose > 140 mg/dL or self-reported diabetes [13].

Regional classification: To examine geographical variation, states and union territories were grouped into six regions: North, East, West, Central, South, and Northeast. The composition of each region is presented in Fig. 2. To assess whether the regional patterns observed in the primary analyses were also evident within high-burden settings, additional state-level analyses were conducted for Punjab and Sikkim. These states were selected because they represented among the highest hypertension prevalence estimates within the study population and have been identified in previous studies as high-burden settings for hypertension in India.

Statistical analysis

Hypertension prevalence was estimated overall and according to region and sex. Differences in prevalence across categories were assessed using chi-square tests. Multivariable logistic regression models were used to examine associations between hypertension and demographic, socioeconomic, behavioural, and metabolic characteristics. Adjusted odds ratios (AORs) and corresponding 95% confidence intervals (CIs) were reported.

Separate regression models were constructed for males and females within each region to evaluate regional and sex-specific heterogeneity in associated factors. Additional analyses were conducted for states representing highest hypertension profiles, including Sikkim and Punjab. Statistical significance was defined as $p < 0.05$. All analyses were performed using IBM SPSS Statistics version 27.0

Results

Prevalence of Hypertension Across Regions and Sexes

The overall prevalence of hypertension was 21.6%, with a significantly higher prevalence among males than females (29.5% vs. 20.5%, $p < 0.001$). Hypertension prevalence varied significantly across regions ($p < 0.001$), ranging from 18.5% in the West to 23.3% in the Northeast. The South (23.1%), North (22.9%), and Central (22.2%) regions also exhibited higher prevalence than the East (19.6%) and West regions. Across all regions, males consistently showed a higher prevalence of hypertension than females (Fig. 2).

Associations of Sociodemographic, Behavioural, and Metabolic Characteristics with Hypertension

Age, central obesity, and high blood glucose emerged as the most consistent correlates of hypertension across all regional and sex-specific analyses (Tables 1–4). Increasing age showed a strong gradient, with adults aged ≥ 45 years having 1.62-to 4.84-fold higher odds of hypertension than those aged 15–24 years across all regional and sex-specific analysis. Similarly, elevated waist circumference and elevated blood glucose were independently associated with hypertension in both sexes throughout the country. The strongest associations were observed among males in the North and females in the South. WHR showed less consistent associations than waist circumference. High WHR was associated with hypertension across all male regional models but remained significant among females only in the Central region. *Elevated blood glucose* also increases the odds of hypertension by 30% to 83% (AOR range: 1.30–1.83), with the strongest associations observed among males in the South and West, and among females in the Central region.

In contrast to metabolic correlates, **social and behavioural factors** varied considerably across regions and sexes (Tables 1 to 4). *Urban residence* was associated with higher odds of hypertension among males in the North (AOR = 1.18), Northeast (AOR = 1.29), East (AOR = 1.13), and South (AOR = 1.12), whereas among females this association was observed only in the South (AOR = 1.11).

Marital status showed a relatively consistent association among males, with both married and DSW men exhibiting higher odds of hypertension across all regions. The strongest association was observed among DSW men in the Eastern region (AOR = 2.44). Among females, marital status demonstrated greater heterogeneity, with DSW status associated with hypertension in the North (AOR = 1.41), West (AOR = 1.44), Central (AOR = 1.62), and Northeast (AOR = 1.26), while associations in the East and South were attenuated after adjustment. Currently married women showed independent association with higher odds only in the North (AOR = 1.25, $p < 0.001$) and West (AOR = 1.22, $p < 0.05$).

Educational attainment exhibited distinct sex-specific patterns. Among males, education was associated with hypertension only in the South, where secondary and higher educational attainment was linked to modestly increased odds of hypertension (AOR = 1.14–1.16). In contrast, lower educational attainment was associated with higher odds of hypertension among females in the Central, Northeast, and Southern regions, with the strongest associations observed among women with no education in the Northeast (AOR = 1.34) and South (AOR = 1.32). *Employment status* was associated with hypertension among males in the North (AOR = 1.14), East (AOR = 1.28), West (AOR = 1.23), and Northeast (AOR = 1.16), whereas among females it was largely unrelated to hypertension except in the South, where non-employed women had modestly higher odds (AOR = 1.15, $p < 0.01$). *Wealth index* was largely attenuated after adjustment, with an independent association observed only among Northern men in the highest wealth category (AOR = 1.08, $p < 0.001$).

Alcohol consumption emerged as the most consistent behavioural correlate. Among males, alcohol use was associated with 31–58% higher odds of hypertension across all regions (AOR range: 1.31–1.58). Among females, alcohol consumption was associated with hypertension in the East (AOR = 2.05), Northeast (AOR = 1.44), and South (AOR = 1.30). Associations involving *tobacco use and dietary pattern* were comparatively inconsistent and restricted to specific regions. *Tobacco use* was associated with higher odds of hypertension among females in the East (AOR = 1.21), whereas lower odds were observed among females in the Northeast (AOR = 0.89) and males in the North (AOR = 0.87). A *non-*

vegetarian diet was associated with hypertension among males in the North (AOR = 1.10) and females in the Northeast (AOR = 1.26).

Sex Differences in Hypertension

Across all regions, males exhibited higher odds of hypertension than females after adjustment for demographic, socioeconomic, behavioural, and metabolic characteristics (Table 5). Individuals aged ≥ 35 years, those with high WC, and high blood glucose showed significantly higher odds of hypertension among males than females across most regions, with effect sizes approaching twofold in several models.

Beyond these metabolic correlates, several region-specific differences were observed. In the North, married men (AOR = 2.14) and DSW men (AOR = 1.83) had higher odds of hypertension than women in the corresponding marital categories. Similar associations for DSW men were observed in the West (AOR = 1.96) and Central (AOR = 1.61) regions. In the Central region, high WHR was associated with nearly twofold higher odds of hypertension among males compared with females (AOR = 1.98). In the Southern region, urban residence (AOR = 1.86, $p < 0.001$) and alcohol consumption (AOR = 1.56, $p < 0.01$) were associated with higher odds of hypertension among males compared with females. Alcohol consumption was also associated with sex differences in the Southern (AOR = 1.56, $p < 0.05$) and Northeastern regions (AOR = 1.56, $p < 0.001$). In the Southern region, men from urban residence have almost two times higher odds of hypertension compared to women in urban settings (AOR = 1.86, $p < 0.001$).

Overall, sex differences in hypertension were driven primarily by metabolic factors that remained consistent across regions, whereas the influence of marital status, adiposity distribution, urban residence, and alcohol consumption varied according to regional context.

State-Level Patterns in High-Prevalence Settings

Additional analyses conducted in Sikkim and Punjab, two states with among the highest hypertension prevalence estimates in the study population, largely mirrored the regional findings (**Supplementary Tables 4–5**).

In Sikkim, hypertension demonstrated a strong age gradient in both males and females, with the odds of hypertension increasing progressively across successive age groups (25–34 years: AOR = 2.25; 35–44 years: AOR = 4.59; 45–54 years: AOR = 5.03; all $p < 0.001$) and females (25–34 years: AOR = 2.63; 35–44 years: AOR = 4.19; 45–49 years: AOR = 5.56; all $p < 0.05$). Among males, hypertension was additionally associated with current employment (AOR = 1.90), alcohol consumption (AOR = 1.69), and high WHR (AOR = 2.39), whereas among females High WC remained the principal metabolic correlate (AOR = 1.59).

A broadly similar pattern was observed in **Punjab**. Age (females: 25–34 years, AOR = 1.83, $p < 0.001$; 35–44 years, AOR = 2.94, $p < 0.001$; 45–49 years, AOR = 5.48, $p < 0.001$ | males: 35–44 years, AOR = 1.54, $p < 0.01$; 45–54 years, AOR = 2.34, $p < 0.01$), high WC (females: AOR = 1.59, $p < 0.001$ | males: AOR = 1.71, $p < 0.001$), and high blood glucose (females: AOR = 1.57, $p < 0.001$ | males: AOR = 1.70, $p < 0.01$) were consistently associated with hypertension in both sexes. Rural residence was also associated with higher odds in both sexes (females: AOR = 1.29; males: AOR = 1.24; $p < 0.05$). Among males, additional independent associations were observed for marital status (married: AOR = 1.75; DSW: AOR = 1.95), current employment (AOR = 1.28), and alcohol consumption (AOR = 1.63) (all $p < 0.05$).

Discussion

Using nationally representative NFHS-5 data, this study examined regional and sex-specific variation in hypertension and its associated factors among Indian adults. Three principal findings emerged. First, hypertension prevalence varied across regions and was consistently higher among males than females. Second, age, central obesity, and elevated blood glucose were associated with hypertension across all regions and sexes, indicating a high degree of consistency in

metabolic correlates. Third, social and behavioural factors demonstrated substantial heterogeneity, with associations varying according to regional and sex-specific contexts. Collectively, these findings suggest that while hypertension in India is underpinned by common cardiometabolic processes, its social patterning differs across populations.

Consistent Metabolic Correlates Across Regions and Sexes

Despite marked geographic, sociocultural diversity across India, age, central obesity, and elevated blood glucose emerged as remarkably consistent correlates of hypertension. These findings are consistent with previous studies from India and other LMICs that have identified ageing, adiposity, and metabolic dysregulation as central components of hypertension risk [3, 6, 7, 8, 14].

Age was the strongest correlate of hypertension across all models. Individuals aged 45 years and older exhibited substantially higher odds of hypertension than younger adults, reflecting well-established physiological processes including arterial stiffening, endothelial dysfunction, vascular remodelling, and progressive loss of arterial compliance with advancing age [3, 5]. The stronger associations observed among older women are also consistent with evidence suggesting that menopausal transition and declining oestrogen levels contribute to adverse vascular and metabolic changes that increase hypertension risk [5].

Central obesity, particularly as measured by WC, was independently associated with hypertension across all regional and sex-specific models. This finding supports growing evidence that abdominal adiposity is more strongly associated with cardiometabolic risk than overall body size within South Asian populations [15–17]. Excess visceral adiposity contributes to hypertension through multiple mechanisms, including activation of the sympathetic nervous system, chronic low-grade inflammation, insulin resistance, and dysregulation of the renin-angiotensin-aldosterone system [17]. The consistency of these associations across regions suggests that central obesity represents a common biological pathway linking diverse populations to elevated blood pressure.

Elevated blood glucose was similarly associated with hypertension across all regional and sex-specific analyses. This finding aligns with evidence demonstrating the close clustering of hypertension and dysglycaemia within the broader cardiometabolic syndrome [18]. Hyperglycaemia and insulin resistance may contribute to elevated blood pressure through endothelial dysfunction, oxidative stress, vascular inflammation, and altered renal sodium handling [19, 20]. The persistence of this association across heterogeneous populations highlights the importance of metabolic health in hypertension prevention and supports integrated approaches targeting both hypertension and diabetes.

The consistency of these associations across regions is noteworthy. Although the prevalence of hypertension differed geographically, the principal metabolic correlates remained largely unchanged. This suggests that common cardiometabolic processes underpin hypertension across diverse Indian populations and supports population-wide strategies targeting obesity, metabolic dysfunction, and early cardiovascular risk detection.

Heterogeneous Social and Behavioural Correlates of Hypertension

In contrast to the stability observed for metabolic factors, social and behavioural correlates demonstrated substantial regional and sex-specific variation. Associations involving marital status, education, employment, wealth, urban residence, alcohol consumption, tobacco use, and dietary pattern were neither uniform nor consistently observed across populations.

Marital status showed relatively consistent associations among males but considerably greater variation among females. Previous studies have reported elevated hypertension risk among previously married and DSW individuals, often attributing these patterns to psychosocial stress, social isolation, economic vulnerability, and changes in health-related behaviours following marital disruption [21–24]. The stronger and more consistent associations observed among

men may reflect sex-specific differences in social support networks and behavioural responses to marital transitions, although the cross-sectional design precludes causal inference [21, 24].

Educational attainment likewise demonstrated sex-specific differences, with lower education associated with hypertension primarily among women in selected regions, whereas educational gradients among men were largely absent. Similar socioeconomic gradients have been reported in other low- and middle-income settings, where educational attainment may influence health literacy, healthcare utilisation, and preventive health behaviours, particularly among women [25–27].

Urban residence and employment status were associated with hypertension only in particular regional contexts, while wealth index showed limited independent association after adjustment. Collectively, these findings suggest that socioeconomic correlates of hypertension are not uniformly distributed across India and may operate differently across regional and demographic settings [3, 14, 28, 29].

Among behavioural factors, *alcohol consumption* emerged as the most consistent correlate, particularly among males, where it was associated with higher odds of hypertension across all regions. This finding is consistent with extensive evidence linking alcohol consumption to elevated blood pressure across diverse populations [29]. By contrast, associations involving tobacco use and dietary pattern were inconsistent and often limited to specific regions, suggesting that their effects may be modified by local behavioural and environmental factors.

Collectively, these findings indicate that although hypertension is underpinned by common biological mechanisms, its social and behavioural correlates are shaped by regional and sex-specific contexts.

Regional and Sex Differences in Hypertension

The Northeast and South exhibited the highest prevalence of hypertension whereas the West showed the lowest prevalence. Although prevalence varied geographically, the principal metabolic correlates remained largely consistent across regions. This contrast suggests that regional differences in hypertension are more likely related to variation in the distribution and clustering of risk factors than to fundamentally different determinants of hypertension [30, 31].

The findings also highlight the importance of considering sex-specific pathways to hypertension. While men consistently exhibited a higher prevalence and higher adjusted odds of hypertension than women, the factors contributing to these differences varied across regions. Metabolic factors, particularly central obesity and elevated blood glucose, were the most consistent contributors to male-female disparities, supporting previous evidence that sex differences in adiposity distribution, hormonal regulation, and cardiometabolic function influence blood pressure regulation [5, 10, 14]. In contrast, the contribution of social and behavioural factors varied between regions. Marital status, employment, urban residence, and alcohol consumption were associated with sex differences in some regions but not others, highlighting the contextual nature of these associations [10, 14, 21–23, 32].

Sikkim and Punjab, selected as high-burden states with the highest hypertension prevalence in the Northeastern and Northern regions, respectively, largely mirrored the regional findings. In both states, age, central obesity, and elevated blood glucose remained the most consistent correlates of hypertension, whereas associations involving alcohol use, employment, and marital status varied. These state-level findings therefore support the broader distinction observed throughout the study between stable metabolic correlates and more context-dependent social and behavioural association [33–35].

Taken together, the study suggests that effective hypertension prevention in India requires a dual strategy: universal interventions targeting common cardiometabolic risk factors alongside region-specific approaches that address the heterogeneous social and behavioural environments in which hypertension develops.

Strengths and Limitations

This study has several strengths. It utilised a large national dataset comprising more than 750,000 adults, enabling robust examination of hypertension across diverse population groups. The stratified regional and sex-specific analytical approach allowed identification of heterogeneity that may be obscured in nationally aggregated analyses. Furthermore, the inclusion of demographic, socioeconomic, behavioural, and metabolic characteristics provided a comprehensive assessment of factors associated with hypertension.

Several limitations should also be acknowledged. First, the cross-sectional design precludes causal inference, and the observed associations should not be interpreted as causal relationships. Second, NFHS-5 includes women aged 15–49 years and men aged 15–54 years, limiting the generalisability of findings to older populations where hypertension burden is highest. Third, several behavioural variables, including dietary pattern, alcohol consumption, and tobacco use, were measured using relatively broad categories and may not fully capture the frequency, intensity, or duration of exposure. Fourth, important factors such as physical activity, dietary salt intake, psychosocial stress, family history, and medication adherence were not available in the dataset and therefore could not be examined.

Conclusion

Hypertension among Indian adults is characterised by a combination of consistent metabolic correlates and heterogeneous social and behavioural associations. Across regions and sexes, increasing age, central obesity, and elevated blood glucose emerged as robust correlates of hypertension, suggesting the presence of common cardiometabolic pathways underlying elevated blood pressure. In contrast, associations involving marital status, education, employment, wealth, urban residence, alcohol consumption, tobacco use, and dietary pattern varied substantially across population contexts.

These findings indicate that while strategies targeting obesity, dysglycaemia, and cardiometabolic risk are likely to be broadly relevant across India, the social patterning of hypertension is not uniform. Effective prevention and control efforts should therefore combine population-wide metabolic risk reduction with regionally and sex-specific approaches that account for local social and behavioural contexts. Recognising this heterogeneity may improve the design and implementation of hypertension prevention programmes in India's diverse populations.

Declarations

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Author contributions: AL have contributed to the study's conceptualisation, formal analysis, methodology, software, supervision, validation, visualisation, original draft writing, writing review and editing. TSS have contributed to the data curation, formal analysis, methodology, software, validation, visualisation, original draft writing and editing. NKD and KNS has contributed to the study's conceptualisation, original draft writing, supervision, writing review, visualisation and validation. VP have contributed to the data curation. All authors edited and approved the final version of the manuscript.

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Ethical approval: The study is based on the dataset available in the public domain for research purposes which does not include any personally identifiable information about survey respondents; hence, no ethical approval from any institutional board was required. Participant confidentiality was ensured during data collection, and informed consent was obtained from all respondents during the NFHS survey.

Competing interests: The authors declared no competing interests.

Data Availability Statement

All National Family Health Survey datasets used in this study are accessible through the official Demographic and Health Surveys (DHS) Program website: <https://dhsprogram.com/data/availabledatasets.cfm>. To obtain this data, you must register as a DHS data user and request access for research purposes: <https://dhsprogram.com/data/Access-Instructions.cfm>

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Tables

Table 1. Prevalence of Hypertension According to Demographic, Socioeconomic, Behavioural, and Metabolic Characteristics Across Regions Among Indian Males

Males		Hypertension % (95% CI)					
Variables	Northern Region	Eastern Region	Western Region	Central Region	Southern Region	Northeast Region	Total
<i>Age</i>							
15 - 24 Years	19.0 (18.2-19.9)	14.7 (13.8-15.7)	14.1 (13.2-15.0)	16.3 (15.1-17.6)	15.9 (14.8-17.0)	17.9 (16.7-19.0)	16.6 (16.2-17.0)
25 - 34 Years	30.8 (29.7-31.9)	24.8 (23.5-26.2)	24.3 (23.1-25.5)	30.8 (29.2-32.4)	28.7 (27.3-30.1)	31.0 (29.7-32.4)	28.5 (28.0-29.0)
35 - 44 Years	39.1 (37.4-40.7)	32.5 (30.5-34.6)	29.0 (27.3-30.9)	38.7 (36.2-41.2)	41.2 (39.2-43.2)	39.5 (37.5-41.5)	36.7 (35.9-37.5)
45 - 54 Years	46.9 (45.5-48.2)	38.1 (36.5-39.8)	38.2 (36.7-39.8)	45.8 (43.8-47.8)	48.8 (47.2-50.3)	46.9 (45.3-48.5)	44.3 (43.7-45.0)
χ^2 Value, <i>p</i> -value	1300.97***	637.17***	758.76***	643.16***	1122.35***	805.50***	5286.05***
<i>Residence</i>							
Rural	29.5 (28.8-30.1)	24.8 (24.0-25.6)	24.3 (23.5-25.1)	29.9 (28.9-30.8)	31.6 (30.7-32.5)	31.1 (30.3-32.0)	28.4 (28.1-28.8)
Urban	35.9 (34.7-37.0)	28.8 (27.2-30.5)	25.1 (23.9-26.3)	33.3 (31.3-35.4)	35.2 (33.9-36.5)	37.9 (36.2-39.7)	32.7 (32.1-33.3)
χ^2 Value, <i>p</i> -value	92.48**	19.54***	1.16	9.165**	19.54***	48.28***	159.13***
<i>Current Marital Status</i>							
Never in Union	18.6 (17.8-19.4)	13.6 (12.7-14.6)	13.5 (12.7-14.4)	16.3 (15.1-17.6)	17.9 (16.9-19.0)	19.1 (18.0-20.2)	16.8 (16.4-17.1)
Married	39.3 (38.5-40.1)	31.7 (30.8-32.7)	30.2 (29.4-31.1)	37.4 (36.3-38.6)	40.8 (39.8-41.8)	39.7 (38.7-40.7)	36.6 (36.2-37.0)
DSW	41.6 (36.6-46.8)	40.8 (33.7-48.2)	32.9 (27.8-38.3)	41.8 (35.6-48.2)	47.3 (40.2-54.5)	43.7 (37.6-50.0)	40.8 (38.4-43.3)
χ^2 Value, <i>p</i> -value	1192.60***	572.46***	588.07***	498.96***	818.63***	608.51***	4221.82**
<i>Level of Education</i>							
No education	29.7 (28.0-31.5)	25.1 (23.4-26.9)	24.4 (22.4-26.5)	29.4 (27.2-31.8)	29.9 (27.8-32.0)	29.8 (27.7-31.9)	28.0 (27.2-28.9)
Primary	32.1 (30.1-34.1)	24.9 (23.1-26.7)	23.8 (21.9-25.8)	30.3 (28.1-32.6)	31.1 (28.8-33.5)	30.4 (28.5-32.5)	28.7 (27.8-29.5)
Secondary	31.2 (30.4-31.9)				33.1 (32.1-34.1)	33.1 (32.1-34.1)	29.7 (29.3-30.1)
Higher							

	31.6 (30.3-32.9)	25.9 (25.0-26.9)	24.7 (23.8-25.5)	30.4 (29.2-31.6)	34.4 (32.8-36.1)	34.4 (32.4-36.6)	30.5 (29.8-31.2)
		25.6 (23.7-27.6)	24.6 (23.1-26.1)	32.5 (30.1-35.0)			
χ^2 Value, p-value	3.60	1.39	0.62	3.58	12.83*	14.76**	25.13***
<i>Currently Working</i>							
No	21.1 (20.1-22.0)	15.6 (14.5-16.8)	14.6 (13.5-15.7)	21.9 (20.4-23.5)	20.0 (18.6-21.4)	21.8 (20.4-23.1)	19.2 (18.7-19.7)
Yes	35.3 (34.6-36.0)	29.2 (28.3-30.1)	27.5 (26.8-28.3)	33.4 (32.4-34.5)	36.4 (35.5-37.3)	36.0 (35.1-36.9)	33.0 (32.7-33.4)
χ^2 Value, p-value	479.97***	271.68***	274.35***	124.07***	308.24***	248.19***	1670.50***
<i>Wealth Index</i>							
Lower	28.6 (27.7-29.5)	23.6 (22.5-24.7)	23.5 (22.6-24.5)	29.0 (27.7-30.3)	31.0 (29.8-32.1)	30.5 (29.4-31.7)	27.6 (27.2-28.1)
Middle							
High	31.1 (29.8-32.3)	25.5 (23.9-27.1)	24.2 (22.8-25.6)	28.8 (26.9-30.7)	32.4 (30.8-34.0)	31.8 (30.1-33.4)	29.1 (28.5-29.7)
	34.2 (33.2-35.2)	27.6 (26.5-28.8)	26.1 (25.0-27.3)	33.3 (31.8-34.8)	35.4 (34.1-36.7)	35.1 (33.8-36.4)	32.0 (31.5-32.5)
χ^2 Value, p-value	70.81***	23.73***	12.68**	22.19***	25.53***	28.05***	172.74***
<i>Dietary Pattern</i>							
Vegetarian	30.1 (29.3-30.8)	25.5 (24.8-26.3)	24.7 (23.8-25.7)	30.9 (29.8-32.0)	32.8 (32.0-33.6)	32.5 (31.7-33.2)	29.7 (29.3-30.0)
Non-vegetarian	32.5 (31.7-33.4)	26.4 (24.1-28.8)	24.3 (23.5-25.2)	29.8 (28.3-31.3)	33.2 (31.0-35.4)	32.8 (28.0-37.8)	29.2 (28.7-29.8)
χ^2 Value, p-value	17.35***	0.45, P>0.05	0.35, P>0.05	1.43, P>0.05	0.12, P>0.05	0.014, P>0.05	1.74, P>0.05
<i>Tobacco Use</i>							
No	29.6 (28.8-30.3)	21.3 (20.4-22.3)	21.9 (21.0-22.7)	27.8 (26.6-29.0)	31.2 (30.3-32.1)	28.7 (27.6-29.9)	27.2 (26.9-27.6)
Yes	33.8 (32.8-34.7)	29.3 (28.3-30.3)	27.9 (26.9-28.9)	33.5 (32.2-34.8)	37.6 (36.0-39.1)	35.1 (34.1-36.1)	32.5 (32.0-32.9)
χ^2 Value, p-value	48.54***	119.26***	82.96***	39.88***	51.88***	64.91***	309.95***

<i>Alcohol Consumption</i>							
No	28.1 (27.4-28.7)	22.8 (22.0-23.6)	23.3 (22.6-24.0)	27.8 (26.8-28.8)	28.8 (27.9-29.7)	28.1 (27.2-29.1)	26.4 (26.1-26.7)
Yes	43.1 (41.8-44.5)	32.0 (30.7-33.4)	33.0 (31.0-35.0)	38.0 (36.2-39.8)	40.6 (39.3-42.0)	39.4 (38.2-40.7)	38.4 (37.8-39.0)
χ^2 Value, <i>p</i> -value	430.12***	136.96***	98.01***	101.81***	212.36***	199.87***	1291.70***
<i>Waist Circumference</i>							
<i>F</i> < 80 cm, <i>M</i> < 90 cm	24.7 (24.0-25.3)	22.1 (21.4-22.9)	20.9 (20.2-21.5)	27.3 (26.4-28.2)	26.3 (25.4-27.1)	29.5 (28.7-30.3)	24.9 (24.6-25.2)
<i>F</i> > 80 cm, <i>M</i> > 90 cm	51.0 (49.7-52.2)	44.9 (42.9-47.0)	43.6 (41.7-45.4)	51.1 (48.5-53.8)	48.4 (46.9-49.9)	54.6 (52.3-57.0)	48.9 (48.2-49.6)
χ^2 Value, <i>p</i> -value	1478.76***	506.49***	644.29***	324.60***	678.68***	436.55***	4133.57**
<i>Waist-to-Hip Ratio</i>							
<i>F</i> < 0.80, <i>M</i> < 0.90	24.0 (23.2-24.9)	20.1 (19.2-21.1)	20.4 (19.6-21.2)	25.2 (24.2-26.4)	24.6 (23.7-25.6)	28.6 (27.7-29.6)	23.8 (23.4-24.2)
<i>F</i> > 0.80, <i>M</i> > 0.90	36.5 (35.7-37.3)	30.7 (29.7-31.8)	30.2 (29.1-31.3)	37.7 (36.3-39.1)	41.3 (40.2-42.4)	38.0 (36.8-39.3)	35.7 (35.2-36.1)
χ^2 Value, <i>p</i> -value	434.93***	208.47***	216.43***	185.13***	461.90***	138.80***	1610.63**
<i>High Blood Glucose</i>							
No	28.4 (27.8-29.0)	22.9 (22.2-23.7)	22.2 (21.5-22.8)	28.0 (27.1-28.9)	28.3 (27.5-29.1)	29.5 (28.7-30.3)	26.6 (26.3-26.9)
Yes	48.9 (47.0-50.9)	38.1 (36.1-40.3)	40.7 (38.4-43.1)	43.6 (40.7-46.5)	51.6 (49.6-53.7)	46.0 (43.8-48.3)	45.3 (44.4-46.3)
χ^2 Value, <i>p</i> -value	453.75***	215.39***	292.46***	114.17***	477.72***	205.71***	1745.06***

Note: Data are presented as prevalence (%) with 95% confidence intervals. DSW = Divorced, Separated, Widowed, *F* = Females, *M* = Males. * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$

Table 2. Prevalence of Hypertension According to Demographic, Socioeconomic, Behavioural, and Metabolic Characteristics Across Regions Among Indian Females

Females	Hypertension % (95% CI)						
Variables	Northern Region	Eastern Region	Western Region	Central Region	Southern Region	Northeast Region	Total
<i>Age</i>							
15 - 24 Years	9.6 (9.4-9.9)	8.0 (7.7-8.3)	7.5 (7.3-7.8)	9.4 (9.0-9.8)	7.8 (7.5-8.1)	9.5 (9.2-9.9)	8.7 (8.6-8.9)
25 - 34 Years	18.9 (18.5-19.2)	16.2 (15.8-16.7)	14.1 (13.7-14.5)	17.9 (17.4-18.4)	15.8 (15.4-16.3)	19.0 (18.6-19.5)	17.1 (17.0-17.3)
35 - 44 Years	29.5 (29.0-30.1)	25.0 (24.3-25.7)	22.4 (21.8-23.1)	27.4 (26.5-28.3)	25.1 (24.5-25.8)	27.9 (27.2-28.3)	26.5 (26.2-26.8)
45 - 49 Years	39.0 (38.5-39.5)	34.6 (34.0-35.2)	31.7 (31.1-32.2)	37.9 (37.2-38.7)	38.2 (37.7-38.8)	37.4 (36.8-38.0)	36.6 (36.4-36.9)
χ^2 Value, <i>p</i> -value	13417.31***	7339.66***	6469.88***	5053.16***	8654.30***	6265.09***	46969.37***
<i>Residence</i>							
Rural	20.8 (20.6-21.0)	18.2 (18.0-18.5)	16.9 (16.7-17.2)	20.7 (20.3-21.0)	20.7 (20.4-21.0)	21.5 (21.2-21.8)	19.8 (19.7-19.9)
Urban	24.5 (24.1-24.9)	21.5 (20.9-22.1)	18.9 (18.4-19.3)	22.0 (21.4-22.7)	23.6 (23.2-24.0)	23.6 (23.0-24.2)	22.6 (22.4-22.8)
χ^2 Value, <i>p</i> -value	263.31***	107.89***	55.23***	12.49***	118.74***	40.36***	565.55***
<i>Current Marital Status</i>							
Never in Union	9.7 (9.5-10.0)	8.4 (8.0-8.7)	7.7 (7.4-8.0)	9.7 (9.2-10.1)	8.3 (8.0-8.7)	11.3 (10.9-11.7)	9.3 (9.1-9.4)
Married	26.6 (26.4-26.9)	21.5 (21.2-21.8)	20.3 (20.0-20.5)	24.7 (24.3-25.1)	24.5 (24.2-24.8)	25.8 (25.4-26.1)	24.0 (23.9-24.2)
DSW	34.5 (33.3-35.8)	30.4 (29.0-31.8)	27.4 (26.1-28.7)	31.7 (30.0-33.4)	31.8 (30.7-32.8)	29.2 (28.0-30.5)	31.0 (30.4-31.5)
χ^2 Value, <i>p</i> -value	6760.75***	2551.13***	2421.10***	2036.22***	3072.49***	2487.92***	18795.06***
<i>Level of Education</i>							
No education	28.2 (27.8-28.7)	23.0 (22.6-23.5)	23.2 (22.7-23.7)	28.9 (28.3-29.5)	28.5 (27.9-29.1)	30.0 (29.3-30.8)	26.6 (26.4-26.8)
Primary	26.5 (25.8-27.1)	21.9 (21.2-22.6)	21.1 (20.4-21.8)	25.5 (24.6-26.4)	28.7 (27.8-29.5)	25.3 (24.6-26.0)	24.7 (24.4-25.0)
Secondary	19.3 (19.1-19.6)	15.7 (15.4-16.0)	15.0 (14.7-15.3)	15.9 (15.5-16.3)	19.9 (19.5-20.2)	19.4 (19.1-19.7)	17.8 (17.7-18.0)
Higher	17.3 (16.9-17.7)	16.3 (15.5-17.0)	13.6 (13.0-14.2)	16.0 (15.1-16.8)	15.4 (14.9-15.9)	18.8 (18.0-19.6)	16.3 (16.0-16.5)
χ^2 Value, <i>p</i> -value	1898.88***	847.93***	1064.29***	1478.21***	1438.78***	951.59***	6866.68***
<i>Currently Working</i>							

No	21.1 (20.5-21.6)	18.0 (17.3-18.6)	15.8 (15.1-16.5)	19.7 (18.8-20.7)	21.9 (21.1-22.7)	21.8 (21.1-22.6)	19.3 (19.0-19.5)
Yes	23.5 (22.3-24.6)	21.2 (19.9-22.6)	19.3 (18.0-20.2)	23.0 (21.6-24.5)	24.0 (22.9-25.1)	25.8 (24.5-27.2)	22.5 (22.0-23.0)
χ^2 Value, <i>p</i> -value	13.87***	18.75***	30.85***	14.03***	9.63***	26.73***	135.25***
<i>Wealth Index</i>							
Lower	20.2 (19.9-20.5)	17.4 (16.5-17.2)	16.4 (16.1-16.8)	20.6 (20.1-21.0)	20.0 (19.6-20.4)	21.0 (20.6-21.5)	19.3 (19.1-19.4)
Middle	21.3 (20.9-21.7)	18.2 (17.7-18.7)	17.6 (17.1-18.1)	20.0 (19.4-20.7)	21.8 (21.3-21.9)	21.6 (21.0-22.2)	20.2 (20.0-20.4)
High	23.7 (23.4-24.1)	20.6 (20.2-20.9)	18.8 (18.4-19.2)	21.9 (21.4-22.5)	23.7 (23.3-24.1)	23.0 (22.5-23.4)	22.1 (21.9-22.3)
χ^2 Value, <i>p</i> -value	256.566***	142.61***	77.89***	25.16***	163.83***	42.49***	646.24***
<i>Dietary Pattern</i>							
Vegetarian	20.7 (20.4-21.0)	18.4 (18.2-18.7)	18.3 (17.9-18.7)	21.4 (21.0-21.8)	21.9 (21.6-22.2)	21.6 (21.4-21.9)	20.5 (20.4-20.7)
Non-vegetarian	22.4 (22.2-22.7)	20.7 (20.1-21.3)	17.1 (16.8-17.3)	20.5 (20.0-20.9)	20.8 (20.2-21.4)	27.2 (25.9-28.5)	20.5 (20.4-20.6)
χ^2 Value, <i>p</i> -value	73.81***	46.88***	24.33***	8.52**	10.67***	73.22***	0.04, <i>p</i> >0.05
<i>Tobacco Use</i>							
No	21.6 (21.5-21.8)	18.2 (18.0-18.4)	17.3 (17.1-17.5)	20.4 (20.1-20.7)	21.5 (21.1-21.8)	21.3 (21.1-21.6)	20.2 (20.1-20.3)
Yes	26.1 (24.6-27.5)	29.2 (28.0-30.4)	20.9 (19.8-22.0)	27.2 (26.1-28.4)	28.1 (26.4-29.8)	23.9 (23.3-24.5)	25.1 (24.7-25.5)
χ^2 Value, <i>p</i> -value	38.99***	168.61***	45.40***	151.94***	68.21***	60.83***	605.93***
<i>Alcohol Consumption</i>							
No	21.7 (21.5-21.9)	18.6 (18.4-18.8)	17.5 (17.3-17.7)	20.7 (20.3-21.0)	21.5 (21.3-21.8)	21.1 (20.9-21.4)	20.3 (20.2-20.4)
Yes	28.7 (24.4-33.4)	31.1 (29.0-33.4)	24.3 (19.2-30.0)	32.2 (30.1-34.4)	30.2 (28.1-32.4)	31.3 (30.3-32.4)	31.1 (30.3-31.9)
χ^2 Value, <i>p</i> -value	11.02***	168.61***	7.62**	140.62***	77.56***	391.48***	893.11***
<i>Waist Circumference</i>							
<i>F</i> < 80 cm, <i>M</i> < 90 cm	13.6 (13.4-13.8)	13.6 (13.3-13.8)	12.9 (12.6-13.1)	16.9 (16.6-17.2)	14.0 (13.7-14.3)	16.4 (16.1-16.7)	14.4 (14.1-14.5)
<i>F</i> > 80 cm, <i>M</i> > 90 cm	31.2 (30.9-31.6)	29.2 (28.8-29.7)	27.1 (26.6-27.5)	32.9 (32.2-33.6)	30.1 (29.7-30.5)	30.2 (29.7-30.6)	30.3 (30.1-30.5)

χ^2 Value, <i>p</i> -value	8059.28***	3851.97***	6251.34***	2034.56***	3935.67***	2651.27***	23031.2***
<i>Waist-to-Hip Ratio</i>							
F < 0.80, M < 0.90	13.3 (12.9-13.7)	12.1 (11.6-12.6)	13.6 (13.2-14.0)	16.7 (16.2-17.3)	14.9 (14.5-15.3)	16.1 (15.5-16.7)	14.3 (14.3-14.5)
F > 0.80, M > 0.90	23.5 (23.3-23.7)	20.0 (19.7-20.3)	19.1 (18.8-19.3)	22.7 (22.4-23.1)	23.9 (23.6-24.2)	22.3 (22.0-22.6)	22.1 (22.0-22.3)
χ^2 Value, <i>p</i> -value	1516.61***	569.94***	446.12***	311.71***	934.39***	286.25***	3814.29***
<i>High Blood Glucose</i>							
No	20.4 (20.2-20.6)	17.4 (17.2-17.7)	16.4 (16.2-16.7)	20.0 (19.7-20.3)	19.5 (19.3-19.8)	20.5 (20.2-20.8)	19.1 (19.0-19.2)
Yes	37.0 (36.2-37.8)	30.6 (29.8-31.5)	30.6 (29.6-31.6)	33.2 (31.8-34.5)	38.8 (37.9-39.7)	35.4 (34.4-36.4)	34.7 (34.3-35.1)
χ^2 Value, <i>p</i> -value	2132.60***	1139.68***	1029.86***	466.97***	2247.41***	1044.00***	7984***

Note: Data are presented as prevalence (%) with 95% confidence intervals. DSW = Divorced, Separated, Widowed, F = Females, M = Males. * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$

Table 3. Adjusted Odds Ratios (AORs) for Factors Associated with Hypertension Across Regions Among Indian Males

Males	Adjusted Odds Ratio (95% CI)					
Variables	Northern Region	Eastern Region	Western Region	Central Region	Southern Region	Northeast Region
<i>Age</i>						
15 - 24 Years	Ref	Ref	Ref	Ref	Ref	Ref
25 - 34 Years	1.10 (1.01-1.21)*	1.11 (0.98-1.27)	1.27 (1.13-1.44)***	1.48 (1.27-1.72)***	1.39 (1.22-1.59)***	1.38 (1.22-1.56)***
35 - 44 Years	1.34 (1.19-1.50)***	1.33 (1.14-1.55)***	1.37 (1.19-1.58)***	1.80 (1.51-2.15)***	2.01 (1.72-2.35)***	1.70 (1.47-1.96)***
45 - 54 Years	1.73 (1.55-1.92)***	1.62 (1.41-1.87)***	1.98 (1.73-2.25)***	2.38 (2.02-2.81)***	2.57 (2.21-2.98)***	2.20 (1.93-2.52)***
<i>Residence</i>						
Rural	Ref	Ref	Ref	Ref	Ref	Ref
Urban	1.18 (1.10-1.26)***	1.13 (1.02-1.26)*	0.96 (0.87-1.05)	1.10 (0.97-1.25)	1.12 (1.03-1.22)**	1.29 (1.17-1.43)***
<i>Current Marital Status</i>						
Never in Union	Ref	Ref	Ref	Ref	Ref	Ref
Married	1.59 (1.45-1.74)***	1.62 (1.42-1.85)***	1.49 (1.32-1.68)***	1.53 (1.32-1.77)***	1.32 (1.17-1.49)***	1.53 (1.37-1.71)***
DSW	1.82 (1.44-2.32)***	2.44 (1.74-3.43)***	1.69 (1.28-2.23)***	1.82 (1.34-2.48)***	1.69 (1.13-2.35)**	1.69 (1.27-2.25)***
<i>Level of Education</i>						
No education	Ref	Ref	Ref	Ref	Ref	Ref
Primary	1.06 (0.93-1.21)	0.94 (0.82-1.09)	0.97 (0.82-1.14)	1.05 (0.89-1.24)	1.05 (0.89-1.23)	1.02 (0.88-1.19)
Secondary	0.99 (0.90-1.09)	0.99 (0.89-1.11)	0.97 (0.86-1.10)	1.01 (0.88-1.15)	1.14 (1.01-1.29)*	0.97 (0.86-1.10)
Higher	0.99 (0.89-1.11)	0.99 (0.88-1.15)	0.96 (0.83-1.11)	1.08 (0.91-1.28)	1.16 (1.01-1.33)*	0.96 (0.83-1.11)
<i>Currently Working</i>						
No	Ref	Ref	Ref	Ref	Ref	Ref
Yes	1.14 (1.06-1.24)***	1.28 (1.14-1.43)***	1.23 (1.09-1.38)***	1.09 (0.97-1.23)	1.11 (0.99-1.25)	1.16 (1.04-1.29)**
<i>Wealth Index</i>						
Lower	Ref	Ref	Ref	Ref	Ref	Ref
Middle	1.07 (0.99-1.16)	1.10 (0.99-1.23)	0.98 (0.88-1.07)	0.97 (0.86-1.10)	1.00 (0.90-1.10)	1.05 (0.95-1.16)
High	1.08 (1.01-1.16)*	1.09 (0.98-1.20)	1.05 (0.96-1.16)	1.08 (0.96-1.22)	1.03 (0.94-1.13)	1.04 (0.95-1.14)
<i>Dietary Pattern</i>						
Vegetarian	Ref	Ref	Ref	Ref	Ref	Ref

Non-vegetarian	1.10 (1.04-1.17)**	1.05 (0.92-1.21)	1.04 (0.96-1.12)	0.95 (0.86-1.05)	1.10 (0.98-1.23)	0.98 (0.77-1.25)
<i>Tobacco Use</i>						
No	Ref	Ref	Ref	Ref	Ref	Ref
Yes	0.87 (0.81-0.93)***	1.03 (0.94-1.13)	1.03 (0.95-1.12)	0.95 (0.86-1.04)	0.98 (0.89-1.07)	0.92 (0.85-1.00)
<i>Alcohol Consumption</i>						
No	Ref	Ref	Ref	Ref	Ref	Ref
Yes	1.58 (1.47-1.70)***	1.40 (1.28-1.53)***	1.31 (1.17-1.46)***	1.33 (1.19-1.49)***	1.40 (1.29-1.52)***	1.45 (1.34-1.58)***
<i>Waist Circumference</i>						
F < 80 cm, M < 90 cm	Ref	Ref	Ref	Ref	Ref	Ref
F > 80 cm, M > 90 cm	2.19 (2.04-2.34)***	2.04 (1.83-2.27)***	2.04 (1.85-2.25)***	1.86 (1.63-2.13)***	1.73 (1.58-1.89)***	2.02 (1.80-2.27)***
<i>Waist-to-Hip Ratio</i>						
F < 0.80, M < 0.90	Ref	Ref	Ref	Ref	Ref	Ref
F > 0.80, M > 0.90	1.10 (1.03-1.17)**	1.17 (1.08-1.28)***	1.14 (1.05-1.23)**	1.22 (1.11-1.35)***	1.25 (1.15-1.36)***	1.09 (1.00-1.18)*
<i>High Blood Glucose</i>						
No	Ref	Ref	Ref	Ref	Ref	Ref
Yes	1.67 (1.53-1.83)***	1.48 (1.33-1.65)***	1.82 (1.64-2.03)***	1.52 (1.32-1.73)***	1.83 (1.66-2.01)***	1.58 (1.42-1.75)***

Note: Models were adjusted for age, residence, marital status, education, dietary pattern, smoking, alcohol consumption, high WC, high WHR, and high blood glucose. DSW = Divorced, Separated, Widowed, F = Females, M = Males. * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$

Table 4. Adjusted Odds Ratios (AORs) for Factors Associated with Hypertension Across Regions Among Indian Females

Northern Region		Adjusted Odds Ratio (95% CI)				
(Females)						
Variables	Northern Region	Eastern Region	Western Region	Central Region	Southern Region	Northeast Region
<i>Age</i>						
15 - 24 Years	Ref	Ref	Ref	Ref	Ref	Ref
25 - 34 Years	1.55 (1.37-1.75)***	1.67 (1.42-1.95)***	1.50 (1.26-1.79)***	1.65 (1.34-2.02)***	1.73 (1.45-2.06)***	1.76 (1.52-2.04)***
35 - 44 Years	2.48 (2.16-2.84)***	2.83 (2.37-3.37)***	2.58 (2.13-3.12)***	2.83 (2.26-3.55)***	2.77 (2.30-3.35)***	2.33 (1.97-2.75)***
45 - 49 Years	4.00 (3.51-4.56)***	4.37 (3.70-5.15)***	3.66 (3.06-4.39)***	3.94 (3.17-4.90)***	4.84 (4.04-5.81)***	4.07 (3.36-4.59)***
<i>Residence</i>						
Rural	Ref	Ref	Ref	Ref	Ref	Ref
Urban	1.05 (0.97-1.13)	1.11 (0.99-1.24)	1.11 (0.99-1.24)	1.12 (0.97-1.29)	1.11 (1.01-1.22)*	1.10 (0.99-1.23)
<i>Current Marital Status</i>						
Never in Union	Ref	Ref	Ref	Ref	Ref	Ref
Married	1.25 (1.11-1.42)**	1.03 (0.88-1.22)	1.22 (1.01-1.47)*	1.24 (1.00-1.53)	1.12 (0.93-1.34)	1.13 (0.99-1.30)
DSW	1.41 (1.16-1.72)**	1.22 (0.96-1.55)	1.44 (1.11-1.87)**	1.62 (1.20-2.18)**	1.19 (0.95-1.49)	1.26 (1.02-1.55)*
<i>Education Level</i>						
No education	1.08 (0.96-1.21)	1.15 (0.95-1.39)	1.04 (0.88-1.24)	1.19 (0.94-1.50)	1.32 (1.13-1.53)***	1.34 (1.22-1.61)***
Primary	1.10 (0.97-1.25)	1.15 (0.94-1.41)	1.17 (0.98-1.40)	1.38 (1.09-1.75)**	1.19 (1.00-1.40)*	1.22 (1.02-1.47)*
Secondary	1.07 (0.97-1.18)	1.13 (0.95-1.34)	0.97 (0.84-1.13)	1.10 (0.89-1.35)	1.16 (1.03-1.32)*	1.05 (0.91-1.23)
Higher	Ref	Ref	Ref	Ref	Ref	Ref
<i>Currently Working</i>						
No	1.02 (0.95-1.12)	1.05 (0.95-1.16)	0.92 (0.84-1.01)	1.04 (0.93-1.16)	1.15 (1.05-1.25)**	1.06 (0.97-1.16)
Yes	Ref	Ref	Ref	Ref	Ref	Ref
<i>Wealth Index</i>						
Lower	Ref	Ref	Ref	Ref	Ref	Ref
Middle	1.04 (0.95-1.13)	0.97 (0.86-1.09)	1.03 (0.92-1.16)	1.03 (0.89-1.19)	1.05 (0.95-1.17)	1.07 (0.96-1.19)
High	1.01 (0.94-1.10)	1.09 (0.97-1.21)	1.02 (0.90-1.15)	1.03 (0.90-1.19)	1.08 (0.97-1.20)	1.04 (0.94-1.16)
<i>Dietary Pattern</i>						

Vegetarian	Ref	Ref	Ref	Ref	Ref	Ref
Non-vegetarian	1.02 (0.96-1.09)	1.04 (0.93-1.16)	0.93 (0.85-1.02)	1.03 (0.92-1.14)	1.08 (0.97-1.19)	1.26 (1.05-1.52)*
<i>Tobacco Use</i>						
No	Ref	Ref	Ref	Ref	Ref	Ref
Yes	0.93 (0.76-1.15)	1.21 (1.03-1.43)*	1.03 (0.86-1.23)	1.06 (0.89-1.30)	1.09 (0.87-1.38)	0.89 (0.81-0.98)*
<i>Alcohol Consumption</i>						
No	Ref	Ref	Ref	Ref	Ref	Ref
Yes	1.35 (0.77-2.36)	2.05 (1.57-2.67)***	1.10 (0.53-2.26)	1.31 (0.99-1.74)	1.30 *(1.00-1.69)	1.44 (1.25-1.66)***
<i>Waist Circumference</i>						
F < 80 cm, M < 90 cm	Ref	Ref	Ref	Ref	Ref	Ref
F > 80 cm, M > 90 cm	1.90 (1.76-2.04)***	1.90 (1.73-2.09)***	1.87 (1.69-2.06)***	1.69 (1.49-1.90)***	1.99 (1.81-2.19)***	1.71 (1.56-1.87)***
<i>Waist-to-Hip Ratio</i>						
F < 0.80, M < 0.90	Ref	Ref	Ref	Ref	Ref	Ref
F > 0.80, M > 0.90	1.09 (0.98-1.21)	1.14 (0.99-1.31)	1.10 (0.98-1.23)	1.16 (1.02-1.32)*	1.04 (0.93-1.16)	1.03 (0.91-1.18)
<i>High Blood Glucose</i>						
No	Ref	Ref	Ref	Ref	Ref	Ref
Yes	1.51 (1.36-1.67)***	1.53 (1.36-1.72)***	1.50 (1.30-1.73)***	1.68 (1.49-1.99)***	1.51 (1.35-1.69)***	1.44 (1.27-1.63)***

Note: Models were adjusted for age, residence, marital status, education, dietary pattern, smoking, alcohol consumption, high WC, high WHR, and high blood glucose. DSW = Divorced, Separated, Widowed, F = Females, M = Males. * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$

Table 5. Regional Sex Differences in Hypertension and Associated Characteristics among Adults in India

Region and Overall Male–Female Difference	Characteristics Associated with Hypertension Among Males Relative to Females	AOR (95% CI)
Northern Region (Male vs Female ^{Ref.} : 2.05*, 95% CI: 1.93–2.18)**	Age ≥35 years	1.80 (1.63–1.99) ***
	Married	2.14 (1.97–2.32) ***
	Divorced/Separated/Widowed	1.83 (1.19–2.78) **
	High waist circumference	2.26 (2.05–2.49) ***
	High blood glucose	2.33 (1.92–2.83) ***
Eastern Region (Male vs Female ^{Ref.} : 1.54*, 95% CI: 1.41–1.68)**	Age ≥35 years	1.20 (1.05–1.37) **
	Alcohol consumption	0.95 (0.70–1.28)
	High waist circumference	1.89 (1.61–2.22) ***
	High blood glucose	1.51 (1.22–1.88) *
Western Region (Male vs Female ^{Ref.} : 1.81, 95% CI: 1.68–1.96)**	Age ≥35 years	1.48 (1.32–1.67) ***
	Divorced/Separated/Widowed	1.96 (1.23–3.12) **
	High waist circumference	1.78 (1.55–2.05) ***
	High blood glucose	1.97 (1.56–2.49) ***
Central Region (Male vs Female ^{Ref.} : 1.85*, 95% CI: 1.69–2.03)**	Age ≥35 years	1.59 (1.21–2.08) ***
	Divorced/Separated/Widowed	1.61 (1.01–2.58) *
	High waist circumference	2.05 (1.69–2.47) ***
	High waist-to-hip ratio	1.98 (1.76–2.22) ***
	High blood glucose	1.54 (1.18–2.26) **
Southern Region (Male vs Female ^{Ref.} : 1.89*, 95% CI: 1.76–2.04)**	Age ≥35 years	1.81 (1.63–2.00) ***
	Urban residence	1.86 (1.70–2.04) ***
	High waist circumference	1.92 (1.72–2.15) ***

	High blood glucose	1.97 (1.64–2.37)***
	Alcohol consumption	1.56 (1.17–2.08)**
Northeast Region	Age ≥35 years	1.75 (1.56–1.95)***
(Male vs Female ^{Ref.} : 1.79, 95% CI: 1.66–1.93)**	Alcohol consumption	1.56 (1.30–1.88)***
	High waist circumference	2.19 (1.89–2.54)***
	High blood glucose	1.73 (1.40–2.14)***

Note: Adjusted odds ratios (AORs) and 95% confidence intervals (CIs) were estimated from multivariable logistic regression models. The regional heading presents the overall adjusted odds of hypertension among males relative to females (reference category). Listed characteristics represent variables significantly associated with hypertension within each regional model. Models were adjusted for age, residence, marital status, education, dietary pattern, tobacco use, alcohol consumption, waist circumference, waist-to-hip ratio, and blood glucose level. DSW = Divorced, Separated, and Widowed; AOR = Adjusted Odds Ratio; CI = Confidence Interval. * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$.

Figures

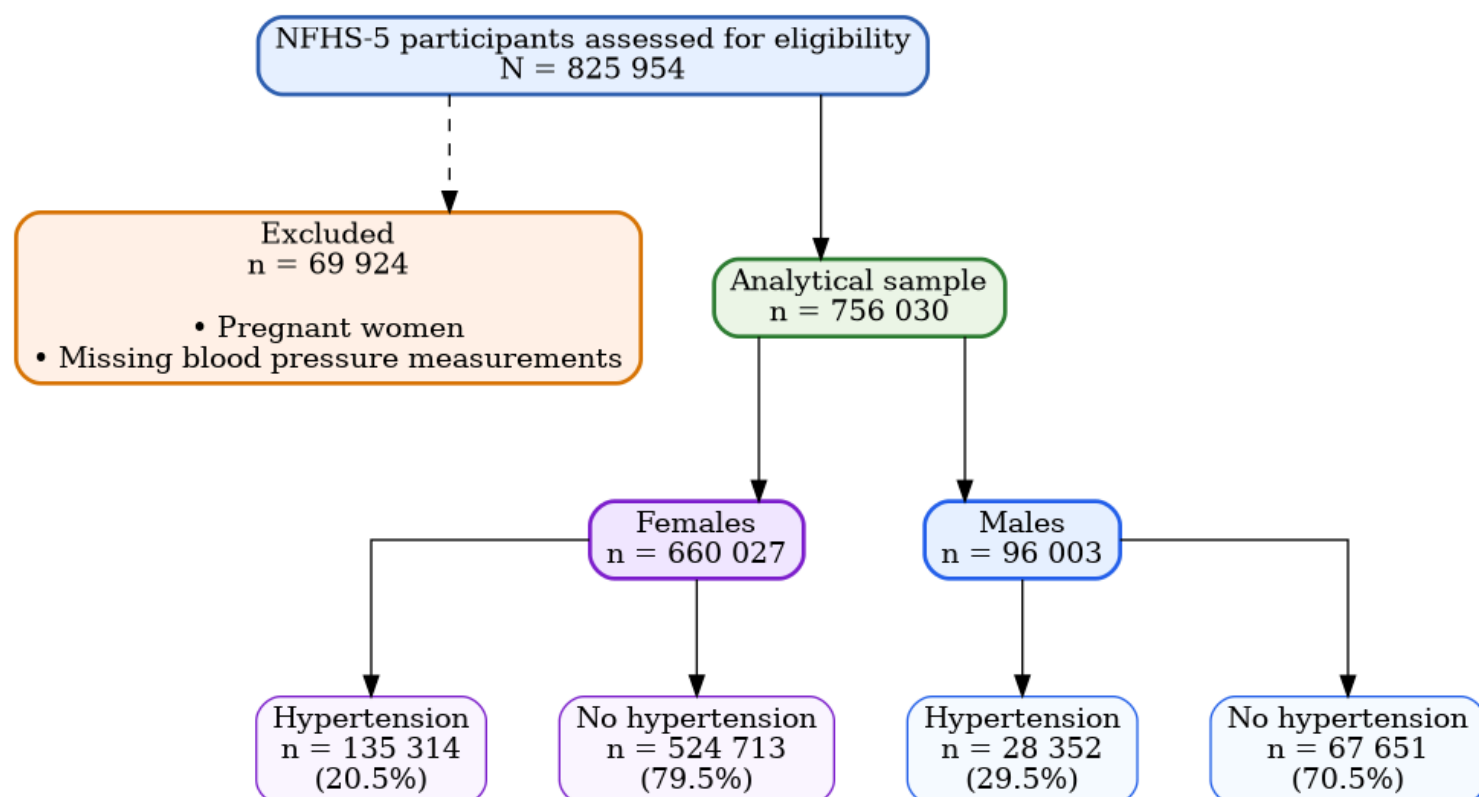


Figure 1

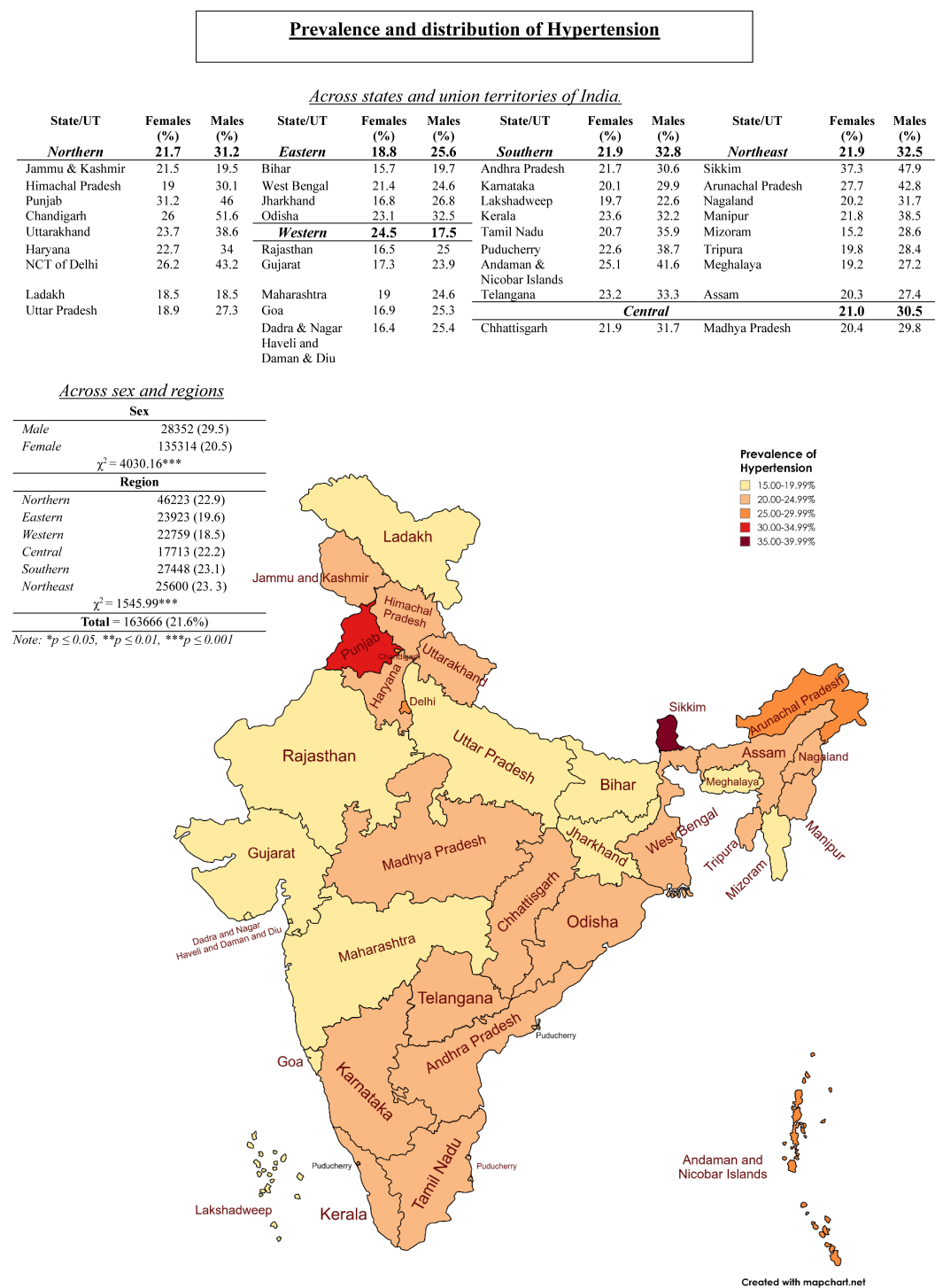


Figure 2

Regional and sex-specific variation in hypertension prevalence among Indian adults, NFHS-5 (2019-21).

Source: Author’s analysis of NFHS-5 (2019–2021) data. Base map generated using MapChart and further edited by the authors using Microsoft Word.

Supplementary Files

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