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ORIGINAL ARTICLE

Linkages between occupation and elevated blood pressure among men in India: a cross-sectional study

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Abstract

Objectives The study aims to examine the linkages between occupation and elevated blood pressure among men aged 25–54 years in India.

Methods The study is based on the National Family Health Survey India, 2015–16. Age-standardized prevalence rates, χ^2 tests and multivariable ordered logistic regression models were used to fulfill the study objectives.

Results In India, more than five out of hundred men of age group 25–54 years are suffering from moderately or severely elevated blood pressure levels. The findings depict an occupation wise inequality in the elevated blood pressure levels. Men belonging to professional-managerial-technical (PR = 6.42 per 100 men) and sales (PR = 6.10 per 100 men) occupational groups are facing a much higher burden. From the fitted multivariable ordered logistic models, we found that highly educated-unemployed and married-unemployed men were found to be at higher risk of elevated blood pressure levels.

Conclusions The study found linkages between the occupation of men and elevated blood pressure levels in India. Urgent attention is needed to the vulnerable occupational groups like professional-technical-managerial, clerical, and sales with a special focus to the unemployed cohort of the country.

Keywords Occupation · Elderly · Blood pressure · Non-communicable diseases · India

Introduction

According to the World Health Organization (WHO), "blood pressure" is the force exerted by circulating blood against the walls of the body's arteries. A higher level of blood pressure in the human body is termed as "elevated blood pressure" or "Hypertension" (WHO 2019). Hypertension is a major public health concern worldwide because of its higher incidence rates and affiliated risks of heart, brain, kidney, and other diseases (Kearney et al. 2005). It is the major but modifiable risk factor for coronary artery disease, heart failure, cerebrovascular disease, cardiovascular diseases (CVD)-related mortality, chronic renal failure, and healthcare expenditures (Devi et al. 2013; Le et al. 2011; WHO 2019).

An estimated 1.13 billion people are affected by hypertension, globally, most (two-thirds) of which live in low-and-middle-income countries (LIMICs) (WHO 2013). It is the major cause of premature deaths worldwide (WHO 2013), and is ranked third as a cause of disability-adjusted life-years (DALYs) (Kearney et al. 2005). India is no exception to this, where the considerable burden of hypertension is significantly emerging as per the country-level estimates (DHS 2018). According to a nationally representative Demographic and Health Survey (DHS), prevalence of hypertensive men is around 14 percent, whereas, among women, it is around 9 percent (DHS 2018).

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A study led by Anchala et al. (2014) suggests that hypertension is attributed to 57 percent of all stroke deaths and 24 percent of all coronary heart disease deaths in India. The etiology of elevated blood pressure includes both genetic and environmental factors, including demographic, family history, obesity, diet, sedentary lifestyle, psychological, tobacco, and alcohol consumption (Liu et al. 2017). While existing literature claims that the management of elevated blood pressure is getting better, a huge gap still exists in understanding the factors that explain the variability in the etiology of hypertension. Some authors investigated the linkages of psychological factors and mental disorders with hypertension; nevertheless, the association is sometimes blurred and debatable (Kessler et al. 2005; Ventura and Lavie 2016). Some studies more specifically tried to link job insecurity, strain, and control (job quality), satisfaction, wages, work, hours, and perceived dissatisfaction with elevated blood pressure. There is an established biological relationship between stress and elevated blood pressure. Stress may cause changes in blood pressure by increasing cholesterol blood levels, triglycerides, hematocrit, fibrinogen, and blood fluidity. Some studies also found an association between job strain and arterial stiffness in working men, but not in women (Nomura et al. 2005; Nordstrom et al. 2001). A recent review by Cuffee et al. (2014) found how unemployment, extended work hours, job instability, low wages, job strain, and sleep disorders were associated with the risk of elevated blood pressure.

Occupation structure in India has been categorized into three kinds, namely primary, secondary, and tertiary (Banu 2014). Agriculture, animal husbandry, forestry, fishery, etc. are collectively known as "primary" activities. Manufacturing industries, both small and large scale, are known as "secondary" activities. Transport, communications, banking and finance, and services are "tertiary activities" (Banu 2014). Agricultural workforce share declined in the country from 74.0 percent in 1972–73 to about 53.2 percent in 2009–10. On the other hand, the share of employment in industry increased from 11.2 percent in 1972–73 to 14.9 percent in 1993–94 and further to 21.5 percent in 2009–10. Also, the share of services in total employment increased from 14.6 percent in 1972–73 to 25.4 percent in 2009–10 (Banu 2014). The above-mentioned pattern of occupational transitions may affect the occurrence of chronic diseases including elevated blood pressure.

Existing studies have also shown pieces of evidence about the occupation as one of the key determinants of noncommunicable diseases (NCDs) (Babu et al. 2013; Hazarika et al. 2002; Gupta et al. 2012). Unfortunately, such studies conducted in small area level and thus, the nationally representative estimates on linkages between elevated blood pressure and different occupational groups of the men are scarce. Such estimates can play a key role in achieving national and global targets like Sustainable Development Goals (SDG) to reduce the burden of a modifiable condition like elevated blood pressure. However, a recently published study has exhibited an increased risk of major NCDs for the legislator/senior official/professional and craft/machine-related occupation groups in India (Patel et al. 2019). But Patel et al. (2019) have displayed such inferences based on the self-reported data, which may highlight reporting bias on the issue. However, in our study, we overcome such issues by utilizing a recently published country representative "biomarker" data, which will add novelty to the issue.

The present study is restricted to men belonging to 25–54 years of age. Men in Indian society mostly drive the burden of major NCDs, including elevated blood pressure and also most of the economic activities. Additionally, the population of age 25 and above is considered to be the key working population, i.e., the main productive age-group in India. Also, National Family Health Survey (NFHS)-4 does not collect information on men above 54 years of age. Thus, considering all the aforementioned points, the present study aims to (i) examine the linkages between occupation and elevated blood pressure in India among men aged 25–54 years (ii) understand the role of socioeconomic and demographic characteristics on the elevated blood pressure levels of men across different occupational groups.

Methods

Data source, study design, and population

The study is entirely based on the data from the fourth round of the National Family Health Survey (NFHS-4), 2015–16, which is freely available on the DHS website (DHS 2018). DHS follows all the standard ethical considerations while collecting data. NFHS-4 was conducted under the stewardship of the Ministry of Health and Family Welfare (MoHFW), Government of India. Biomarker questionnaire covered measurements of height, weight, and hemoglobin for children, and in addition, blood pressure and random blood glucose for women age 15–49 years and men age 15–54 years.

Blood pressure was measured using an Omron Pressure Monitor to determine the prevalence of hypertension for both eligible men and women (IIPS 2017; DHS 2018). A total of 6,01,509 households were selected, and among them, a total of 6,99,686 eligible women (4,99,627 married) of age 15–49 years and 1,12,122 eligible men (62,091 married) of age 15–54 years were interviewed across the 640 districts (28 States and 8 UTs) of the country. We

dropped all the prescribed medication cases when having normal blood pressure from the final sample. After eliminating the outliers and truncating to 25–54 years, the sample size was restricted to 73,876 eligible men. A detailed description (study design, sampling frame, coverage, etc.) about the NFHS-4 data is described in the public repositories (DHS 2018; IIPS 2017).

Measurements

Outcome variable

The present study utilized elevated blood pressure (BP) as the outcome variable. For each respondent, BP measurements were taken three times with an interval of five minutes. We first computed the average systolic and diastolic BP. Then, a "blood pressure" variable was computed (with six distinct categories of BP levels) as suggested by the NFHS-4 (IIPS 2017) which is described in Table 1. Further, we transformed the "blood pressure" variable (with six distinct categories) into three broader groups of BP based on their severity level, namely, "optimal BP", "mildly high-mildly elevated BP" and "moderately and severely elevated BP".

Explanatory variables

The key explanatory variable here is the "occupation of the respondent" and it was categorized as "0 = Unemployed", "1 = Professional-technical-managerial-clerical", "2 = Sales", "3 = Agricultural", "4 = Services", "5 = Skilled and Unskilled". Other socio-demographic and behavioral variables are men's age ("1 = 25–29 years"; "2 = 30–34 years"; "3 = 35–39 years"; "4 = 40–45 years"; "5 = 45–49 years"), place of residence ("1 = Urban"; "2 = Rural"), educational status ("0 = No education"; "1 = Up to primary"; "2 = Above primary and below secondary"; "3 = Above secondary and below higher secondary"; "4 = Higher education"), religion ("1 = Hindu"; "2 = Muslim"; "3 = Others"), caste groups ("1 = Schedule Castes (SC)"; "2 = Schedule Tribes (ST)"; "3 = Other backward Classes (OBC)"), marital status ("0 = Never married"; "1 = Ever married"), household wealth quintiles ("1 = Poorest"; "2 = Poorer"; "3 = Middle"; "4 = Richer"; "5 = Richest"), and smoking/alcohol consumption ("0 = None"; "1 = Only smokes"; "2 = Only drinks"; "3 = Smokes and drinks together"). Here 'caste' represents the stratified social structure which divides the Indian society into rigid hierarchical groups based on the work of the population (Bloomberg 2019). In this study, the social group (caste) has been categorized into three categories, namely Scheduled Caste/Tribes (SC/STs), Other Backward Classes (OBC), and Non-SC/ST-and-non-OBC. SC/ST and OBC groups are the historically most disadvantaged social groups in India (Bloomberg 2019).

Statistical analyses

Age-adjusted prevalence rates of different blood pressure levels based on the information collected on the eligible men were measured in this study. To compute the adjusted rates, Census 2011's population age-structure was utilized as the *standard population* (Puri et al. 2020). Age-wise proportions of the standard population were utilized as the weights to generate the age-standardized estimates of the prevalence of different groups of blood pressure among eligible men in India.

A bivariate analysis followed by an array of χ^2 tests were conducted to examine the association between the key explanatory variable "occupation" and other selected socioeconomic and demographic characteristics with the different levels of blood pressure. Further, a set of

Table 1 The blood pressure matrix based on the systolic and diastolic blood pressure labels according to NFHS-4 (India, 2015–16)

Average systolic (mm Hg)	Average diastolic (mm Hg)					
	< 80	< 85	85–89	90–99	100–109	> = 110
< 120	1	2	3	4	5	6
< 130	2	2	3	4	5	6
130–139	3	3	3	4	5	6
140–159	4	4	4	4	5	6
160–179	5	5	5	5	5	6
> = 180	6	6	6	6	6	6

National Family Health Survey-4 (NFHS-4), India, 2015–16

1 = Normal (Optimal); 2 = Normal (Mildly High); 3 = Normal (Moderately High); 4 = Abnormal (Mildly Elevated); 5 = Abnormal (Moderately Elevated); 6 = Abnormal (Severely Elevated)

BP Blood pressure

multivariable ordinal logistic regression models were fitted to examine the impact of the selected explanatory variable and other sociodemographic variables on elevated blood pressure. Since the outcome variable is measured in ordinal scale with three categories, namely, "optimal BP", "mildly high-mildly elevated BP," and "moderately and severely elevated BP"; an ordinal logistic regression model was fitted. Before fitting the models, other key assumptions were also checked.

Stata version 14 (StataCorp^{TM}, Texas) and MS Excel were used for the analysis. All the estimates computed in this study are derived by applying appropriate sampling weights provided by the survey itself (DHS 2018). In addition, a STROBE checklist has been attached as an Electronic Supplementary Material (ESM) file (1 ESM file).

Results

Table 2 represents the distribution of the background characteristics like age, residence, education, religion, caste, occupation, marital status, wealth index, smoking, and drinking habits of 73,876 men in India. Among the surveyed men of age group 25–54 years, mostly (26 percent) belonged to 45–54 years, more than 60 percent belonged to rural areas and nearly half (47 percent) of them had above primary and below secondary level of education. More than 80 percent respondents belonged to Hindu religion, nearly 45 percent belonged to Other Backward Classes (OBC) category, major (around 33 percent) occupation of the surveyed individuals is agriculture only and nearly 90 percent of the surveyed men were ever married. Approximately, half of the respondents belonged to upper wealth quintiles and more than 25 percent of the respondents consumed alcohol only. Majority (nearly 60 percent) of the surveyed individuals neither consumed tobacco nor alcohol.

Figure 1 depicts that as age increases, the prevalence of moderately and severely elevated BP also accelerates among men in India, and it was found to be highest (8.7 per 100 men) among 45–54 years aged men. The occurrence was nearly fourfold (2.2 per 100 men) less in the age group 25–29 years than 45–54 years.

Table 3 explores the selected explanatory variable and sociodemographic characteristics wise age-standardized prevalence (per 100 men) of moderately and severely elevated BP among men of age group 25–54 years in India. P-values from the Chi-square tests are also reported for all the background characteristics, which represent the significance of association with moderately and severely elevated BP. All the variables including the key explanatory variable-occupation showed highly significant association with moderately and severely elevated BP. Age-standardized prevalence of moderately and severely elevated BP among 25–54 years men in India was 5.14 per 100 (95% of CI: 5.09–5.19). It was found to be lower in rural men as compared to their urban counterparts, and it increases as educational status of men shifts from low to high. Among Christian-Jain-Buddhist religion (6.28 per 100 men), Scheduled Tribes (ST) (5.66 per 100 men) and General category (5.58 per 100 men) population, prevalence was found to be higher. It was much higher among men who belonged to professional-technical-managerial-clerical group (6.36 per 100 men), sales (6.11 per 100 men), and unemployed groups (5.75 per 100 men). Prevalence increases as men move from poor to rich wealth quintile. The prevalence was found to be higher among never-married men (5.26 per 100 men). However, prevalence of moderately and severely elevated BP was highest among men those who only drink (6.27 per 100 men) and was relatively higher among those who consumes both tobacco and alcohol (6.48 per 100 men).

Figure 2 displays the occupation-wise age-standardized prevalence rate of elevated BP among men of age 25–54 years in India. Prevalence of moderately and severely elevated BP was found to be higher among professional-technical-managerial-clerical, sales and unemployed groups. Whereas it was least among the men belonging to agricultural occupation group. The prevalence of mildly high and mildly elevated BP was highest among men belonging to the sales and professional-technical-managerial-clerical occupational groups.

Table 4 shows results from multivariable ordered logistic regression models fitted. Findings depict the impact of socioeconomic and demographic characteristics on elevated BP levels. Across all the occupation groups as well as in case of total sample, age shows consistent results, i.e., as age increases, the risk of BP also significantly accelerates. In case of model 1 (total sample), except residence and marital status, all the characteristics were associated with the elevated BP. An increasing pattern of proportional odds had been observed in case of education level. The proportional odds were found to be higher among men belonging to Christian-Jain-Buddhist religion, and Scheduled Tribe (ST) groups. Interestingly, the proportional odds of occurring optimal BP vs mildly high- mildly elevated and moderately and severely elevated BP was significantly greater among all the occupation groups as compared to the agricultural group. The proportional odds were highest among Professional-technical-managerial-clerical, sales, and service sector men after controlling other variables. The proportional odds were found to be more among richer quintile group. In case of smoking and drinking, the proportional odds was very high among those who smoke as well drink and even higher among those who only drink.

Table 2 Univariate analysis of background characteristics of the surveyed men (N = 73, 876) of age 25–54 years (India, 2015–16)

Background characteristics	Sample size (N)	[a]Weighted proportion (95% C.I.)
Occupation		
Unemployed	5778	7.83 (7.78–7.90)
Professional-technical-managerial-clerical	7713	10.5 (10.4–10.5)
Sales	8285	11.2 (11.2–11.3)
Agricultural	24,341	33.0 (32.9–33.1)
Services	6192	8.40 (8.33–8.46)
Skilled and unskilled	21,440	29.1 (29.0–29.2)
Age		
25–29 Years	15,502	21.0 (20.9–21.1)
30–34 Years	14,053	19.0 (18.9–19.1)
35–39 Years	13,312	18.0 (17.9–18.1)
40–44 Years	11,638	15.7 (15.7–15.8)
45–54 Years	19,368	26.2 (26.1–26.3)
Residence		
Urban	27,948	37.8 (37.7–37.9)
Rural	45,927	62.2 (62.1–62.3)
Education		
Illiterate	12,589	17.0 (16.9–17.1)
Up to primary	5811	7.87 (7.80–7.93)
Above primary and below secondary	34,479	46.7 (4.66–4.68)
Above secondary and below higher secondary	8874	12.0 (11.9–12.1)
Higher education	12,121	16.4 (16.3–16.5)
Religion		
Hindu	60,831	82.3 (8.23–8.24)
Muslim	8943	12.1 (12.0–12.2)
Others	4101	5.55 (5.50–5.60)
Caste		
SC	14,161	20.3 (20.2–20.4)
ST	6488	9.28 (9.22–9.35)
OBC	31,713	45.4 (45.3–45.5)
Others	17,515	25.1 (25.0–25.2)
Marital status		
Never married	8333	11.3 (11.2–11.3)
Ever married	65,542	88.7 (88.6–88.8)
Wealth quintiles		
Poorest	10,795	14.6 (14.5–14.7)
Poorer	13,467	18.2 (18.1–18.3)
Middle	15,474	20.9 (20.8–21.0)
Richer	16,560	22.4 (22.3–22.5)
Richest	17,577	23.8 (23.7–23.9)
Smoking and drinking		
None	43,292	58.6 (58.5–58.7)
Only smokes	4056	5.49 (5.44–5.54)
Only drinks	19,245	26.0 (25.9–26.1)
Smokes and drinks together	7281	9.86 (9.79–9.92)

'Caste' represents the stratification of society which divides the Indian society into rigid hierarchical groups based on the work of the people

National Family Health Survey-4 (NFHS-4), India, 2015–16

SC Schedule caste; *ST* Schedule tribe, *OBC* Other backward class

[a]Weighted proportion is the sampling distribution (sociodemographic and behavioral variable wise) of the eligible men in this study

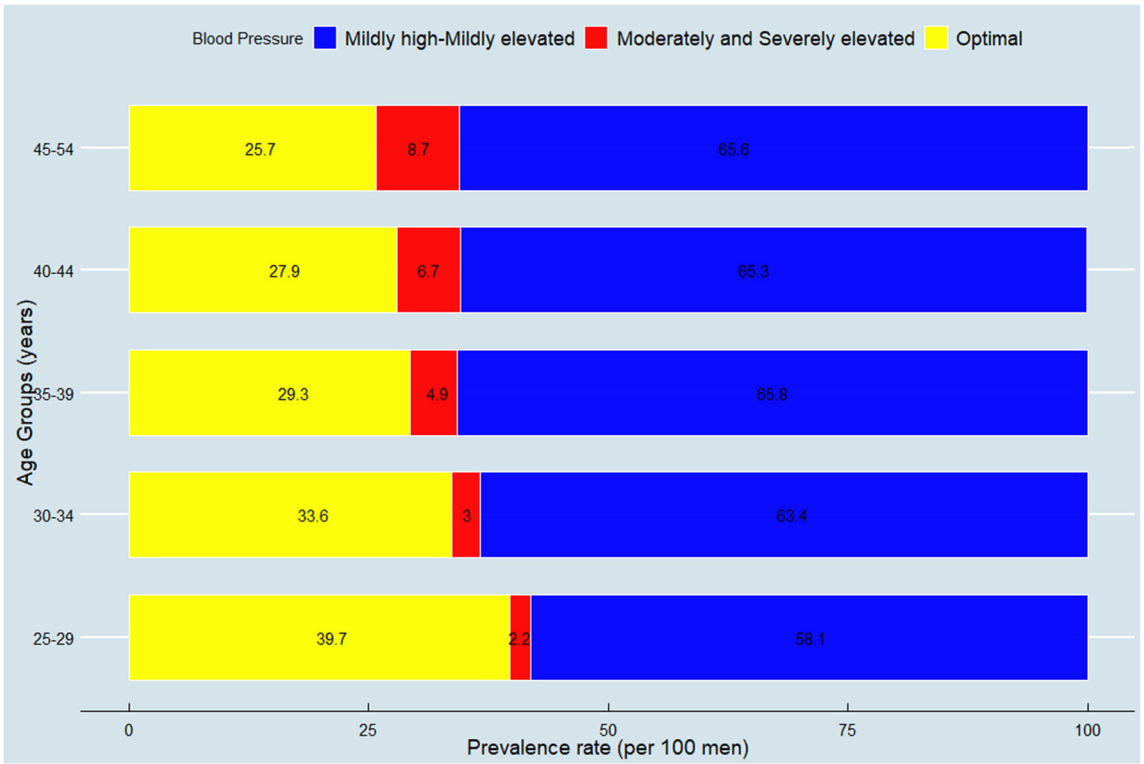

Fig. 1 Age-wise prevalence rate of different blood pressure levels among men of age group 25–54 years (India, 2015–16)

In case of model 2 (unemployed group), the risk of elevated BP was more among men who had higher education and among those who belonged to Christian–Jain–Buddhist religious and Scheduled Tribes (ST) group. Also, it was more among richer wealth quintile, ever married group and highest among those who consumed smoke as well as alcohol.

Moreover, in case of model 3 (professional-technical-managerial-clerical occupation group), after adjusting for other effect, Other Backward Castes (OBC) population showed protective impact on the elevated BP. Richer wealth quintile showed similar impact on the elevated BP like unemployed group. Interestingly, in this group, odds were higher among those whose lifestyle behavioral factors solely included alcohol consumption.

Consistent findings can be observed in case of model 4 (sales group). Here, also the odds of elevated BP were found to be higher for the Scheduled Tribes (STs). Model 5 depicts that men, those who belonged to rural areas, showed lower risk of elevated BP. On the other hand, minor religious and caste group showed significant risk of elevated BP. Wealth status and alcohol–smoking consumption status showed similar effect which is consistent with model 1 and model 2. Model 6 depicts that except for age and education, the remaining socioeconomic and demographic characteristics showed insignificant impact. Model 7 (for skilled and unskilled workers) examines that odds of elevated BP was more among men belonging to rural areas as compared to their urban counterparts. Moreover, other significant socioeconomic and demographic characteristics showed similar output which was more or less consistent with the other models.

Discussion

The present investigation found linkages between occupation and elevated blood pressure levels among men aged 25–54 years in India. Further, the study enables to understand the role of socioeconomic and demographic characteristics of men belonging to different occupational groups on the elevated blood pressure levels. We have found a high burden of elevated blood pressure (prevalence more than five per 100 men) in the country among men.

The study findings hints the presence of occupation-wise disparities in the burden of elevated blood pressure in India. The age-standardized prevalence of moderately and severely elevated blood pressure is much higher among individuals from professional-technical-managerial-clerical, sales, and unemployed occupational groups. Further, the fitted multivariable model (model1) shows a higher risk of elevated blood pressure for the same occupational groups, namely professional-technical-managerial-clerical, sales, and unemployed. Men belonging to the above

Table 3 Background characteristics-wise age-standardized prevalence (per 100 men) of elevated blood pressure among men of age 25–54 years (India, 2015–16)

Background characteristics	Prevalence of Moderately and severely elevated BP (per 100 men)
Occupation	**χ^2 test *p* value = 0.000*** **
Unemployed	5.75 (5.56–5.95)
Professional-technical-managerial-clerical	6.36 (6.19–6.53)
Sales	6.11 (5.95–6.28)
Agricultural	4.01 (3.93–4.09)
Services	5.57 (5.40–5.75)
Skilled and unskilled manual	5.42 (5.32–5.51)
Residence	**χ^2 test *p* value = 0.000*** **
Urban	6.00 (5.91–6.09)
Rural	4.62 (4.56–4.68)
Education	**χ^2 test *p* value = 0.000*** **
Illiterate	3.69 (3.59–3.79)
Up to primary	5.09 (4.92–5.26)
Above primary and below secondary	5.37 (5.30–5.45)
Above secondary and below higher secondary	5.78 (5.62–5.94)
Higher education	5.67 (5.54–5.81)
Religion	**χ^2 test *p* value = 0.000*** **
Hindu	5.15 (5.09–5.20)
Muslim	4.57 (4.43–4.71)
Others	6.28 (6.06–6.52)
Caste	**χ^2 test *p* value = 0.000*** **
SC	5.22 (5.10–5.33)
ST	5.66 (5.49–5.84)
OBC	4.93 (4.86–5.01)
Others	5.58 (5.48–5.69)
Marital status	**χ^2 test *p* value = 0.000*** **
Never married	5.26 (4.98–5.56)
Ever married	5.08 (5.03–5.13)
Wealth quintiles	**χ^2 test *p* value = 0.000*** **
Poorest	3.22 (3.11–3.32)
Poorer	4.04 (3.94–4.15)
Middle	5.77 (5.66–5.89)
Richer	6.28 (6.17–6.40)
Richest	5.58 (5.48–5.69)
Smoking and drinking	**χ^2 test *p* value = 0.000*** **
None	4.43 (4.37–4.49)
Only smokes	4.79 (4.59–5.00)
Only drinks	6.27 (6.17–6.38)
Smokes and drinks together	6.48 (6.30–6.67)
India	**5.14 (5.09–5.19)**

'Caste' represents the stratification of society which divides the Indian society into rigid hierarchical groups based on the work of the people

National Family Health Survey-4 (NFHS-4), India, 2015–16

BP Blood pressure, *SC* Schedule caste, *ST* Schedule tribe, *OBC* Other backward class

''***' significant at 1% level of significance

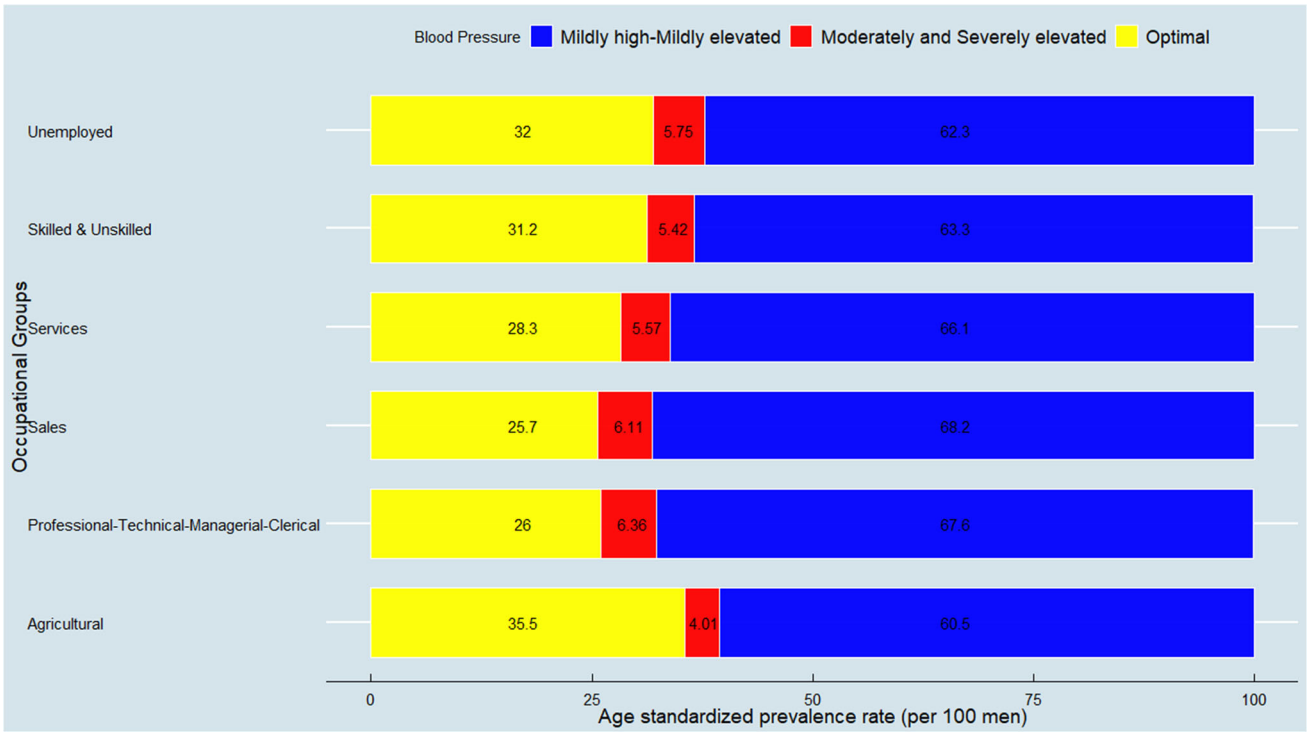

Fig. 2 Occupation-wise age-standardized prevalence rate of different blood pressure levels among men of age group 25–54 years (India, 2015–16)

occupational groups have higher chances of leading a sedentary lifestyle, risky behavioral patterns including improper dietary intake, psychosocial job and unemployment stress. Thus, they can be more vulnerable to the effects of toxic physical, chemical, or biological agents in the environment (House et al. 1979). Interestingly, findings highlight that the likelihood of elevated blood pressure levels is significantly higher among highly educated-unemployed, and married-unemployed men. Accelerated economic crisis, job insecurity and high unemployment rate in India can play a potential role for the higher risk of elevated blood pressure levels among those vulnerable occupational groups. After studying for so many years, spending lot of money, if individuals are not getting job means it could increase huge psychosocial stress due to familial and societal pressure leading toward elevated BP burden. In addition, the unemployed population group includes disabled individuals, which may also suffer from different discrimination related stress or depression leading toward chronic NCDs including hypertension (Wandera et al. 2015). Greiner et al. claimed that blood pressure during work or during leisure time is significantly elevated with either high job strain, measured as a combination of high job demands and low control, or with one of its components and also with high effort-reward imbalance at work (Greiner et al. 2004). In addition to that, House et al. revealed that psychosocial as well as physical and chemical forms of occupational stress may impair the well being, health, and related outcomes (House et al. 1979).

Consistent with the findings of existing literature, our study also identifies that the blood pressure risk increases with men's biological age, educational attainment, and wealth. The potential reason is that blood vessels naturally 'harden' with age, losing their elasticity; thus, when men become older, they become prone to elevated blood pressure levels. However, the interesting part is that the disease is affecting not only the older people in India; the younger men (prevalence is more than five per 100 men) are burdened as well. Age is a non-modifiable predictor of elevated blood pressure, and due to demographic transition in the country, the share of elderly population is increasing. This issue has a potential threat to accelerate the burden of hypertensive cases in the country. Changes in lifestyle pattern including physical inactivity, sleeping problem, risky behaviors including consumption of alcohol and tobacco, and nutritional transition among the population belonging to urbanized areas, higher educational status, and richer wealth might explain this pattern. Some of the literature examined that the lifestyle factors (like obesity, excessive alcohol consumption and physical inactivity) is related with the elevated blood pressure (Hamano et al. 2012; Grotto et al. 2008; Chobanian et al. 2003).

Consistent with the literature (Hamano et al. 2012; Grotto et al. 2008; Chobanian et al. 2003), our study

Table 4 Multivariable ordered logistic regression model output showing the influence of sociodemographic characteristics on elevated BP among men of age 25–54 years (India, 2015–16)

Background characteristics	Model 1: total sample (AOR ± SE)	Model 2: unemployed (AOR ± SE)	Model 3: professional-technical-managerial-clerical (AOR ± SE)	Model 4: sales (AOR ± SE)	Model 5: agricultural (AOR ± SE)	Model 6: services (AOR ± SE)	Model 7: skilled and unskilled (AOR ± SE)
Occupation							
Agricultural (Ref.)	1.00						
Professional-technical-managerial-clerical	1.29 (0.07)***						
Sales	1.38 (0.06)***						
Unemployed	1.11 (0.05)*						
Services	1.22 (0.06)***						
Skilled and unskilled	1.17 (0.03)***						
Age							
25–29 years (Ref.)	1.00	1.00	1.00	1.00	1.00	1.00	1.00
30–34 years	1.32 (0.05)***	1.33 (0.16)*	1.08 (0.14)	1.63 (0.19)***	1.28 (0.07)***	1.64 (0.24)***	1.26 (0.08)***
35–39 years	1.69 (0.07)***	1.71 (0.23)***	1.69 (0.24)***	1.94 (0.25)***	1.50 (0.09)***	2.11 (0.30)***	1.71 (0.13)***
40–44 years	1.90 (0.08)***	1.69 (0.25)***	1.95 (0.31)***	2.29 (0.30)***	1.72 (0.10)***	2.10 (0.36)***	1.96 (0.16)***
45–54 years	2.24 (0.09)***	2.52 (0.33)***	2.81 (0.39)***	2.63 (0.36)***	1.93 (0.11)***	2.92 (0.42)***	2.13 (0.17)***
Residence							
Urban (Ref.)	1.00	1.00		1.00	1.00		1.00
Rural	1.01 (0.03)	0.99 (0.09)		0.96 (0.08)	0.77 (0.06)***		1.11 (0.06)*
Education							
Illiterate (Ref.)	1.00	1.00			1.00	1.00	1.00
Up to primary	1.07 (0.05)	1.22 (0.23)			1.02 (0.07)	1.24 (0.37)	1.05 (0.09)
Above primary and below secondary	1.08 (0.04)*	1.06 (0.13)			1.07 (0.05)	1.30 (0.20)*	1.01 (0.06)
Above secondary and below higher secondary	1.17 (0.06)***	1.42 (0.20)			1.20 (0.08)***	1.55 (0.31)*	0.96 (0.09)
Higher education	1.16 (0.06)***	1.43 (0.23)*			1.07 (0.09)	1.40 (0.25)*	1.04 (0.13)
Religion							
Hindu (Ref.)	1.00	1.00		1.00	1.00	1.00	1.00
Muslim	0.94 (0.04)	0.86 (0.12)		0.90 (0.09)	1.03 (0.08)	0.83 (0.13)	0.85 (0.06)*
Others	1.14 (0.06)*	0.90 (0.17)		1.06 (0.18)	1.16 (0.09)*	1.18 (0.23)	1.30 (0.13)***

Table 4 (continued)

Background characteristics	Model 1: total sample (AOR ± SE)	Model 2: unemployed (AOR ± SE)	Model 3: professional-technical-managerial-clerical (AOR ± SE)	Model 4: sales (AOR ± SE)	Model 5: agricultural (AOR ± SE)	Model 6: services (AOR ± SE)	Model 7: skilled and unskilled (AOR ± SE)
Caste							
SC (Ref.)	1.00	1.00	1.00	1.00	1.00	1.00	
ST	1.17 (0.05)***	1.40 (0.21)*	1.14 (0.19)	1.67 (0.29)***	1.13 (0.07)*	0.83 (0.14)	
OBC	0.90 (0.03)***	1.08 (0.12)	0.79 (0.09)*	1.01 (0.13)	0.84 (0.04)***	0.99 (0.11)	
Others	0.99 (0.04)	1.09 (0.14)	0.83 (0.11)	1.11 (0.15)	0.90 (0.06)*	1.25 (0.19)	
Marital status							
Never married (Ref.)	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ever married	0.97 (0.04)	1.11 (0.12)*	0.87 (0.13)	1.07 (0.11)	0.90 (0.06)	0.85 (0.13)	0.98 (0.08)
Wealth quintiles							
Poorest (Ref.)	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Poorer	1.12 (0.04)***	1.31 (0.17)*	1.74 (0.47)*	1.09 (0.21)	1.07 (0.05)	1.06 (0.18)	1.15 (0.07)*
Middle	1.37 (0.05)***	1.50 (0.21)***	1.78 (0.42)*	1.41 (0.26)*	1.31 (0.07)***	1.16 (0.19)	1.43 (0.09)***
Richer	1.61 (0.07)***	1.91 (0.27)***	2.47 (0.57)***	1.77 (0.32)***	1.52 (0.09)***	1.13 (0.19)	1.63 (0.12)***
Richest	1.61 (0.08)***	1.69 (0.28)***	2.17 (0.48)***	1.68 (0.31)***	1.83 (0.14)***	1.01 (0.17)	1.73 (0.16)***
Smoking and drinking							
None (Ref.)	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Only smokes	0.97 (0.06)	1.20 (0.24)	0.85 (0.14)	0.98 (0.17)	0.89 (0.09)	1.11 (0.21)	0.98 (0.10)
Only drinks	1.21 (0.03)***	1.22 (0.13)*	1.15 (0.12)*	1.06 (0.10)	1.24 (0.05)***	1.15 (0.13)	1.22 (0.07)***
Smokes and drinks together	1.17 (0.05)***	1.38 (0.20)*	1.26 (0.19)	1.43 (0.20)*	1.16 (0.09)*	1.02 (0.14)	1.04 (0.09)
N	69, 760	5, 535	6, 574	7, 182	25, 173	5, 769	20, 663
Cut 1	0.17	0.34	− 0.06	0.12	− 0.31	− 0.05	0.05
Cut 2	3.94	4.02	3.80	4.01	3.45	3.76	3.81

'Caste' represents the stratification of society which divides the Indian society into rigid hierarchical groups based on the work of the people

National Family Health Survey-4 (NFHS-4), India, 2015–16

AOR Adjusted odds ratio, *SE* Standard error, *BP* Blood pressure, *SC* Schedule caste, *ST* Schedule tribe, *OBC* Other backward class

''***' significant at 1% level of significance, ''*' significant at 5% level of significance, rest are insignificant

also reveals that those who solely consume alcohol and those who are exposed to both alcohol and smoking show a higher likelihood of the elevated blood pressure. The study suggests that among the higher educational groups and wealthier men, the risk of elevated blood pressure is more. Poor lifestyle, societal expectation, psychosocial stress (related to job and unemployment) could be the reason of such pattern. However, few studies found that elevated blood pressure is more among socioeconomically deprived population of India due to poor food habits (Kinra et al. 2010; Corsi and Subramanian 2012). To the best of our knowledge, this study is unique to examine the linkages between occupation and elevated blood pressure among men by utilizing the nationally representative "measured blood pressure" data for men. Although recently, by using a self-reported survey data published in 2004–05 and 2011–12, Patel et al. (2019) found higher risk of NCDs among legislator/senior official/professional and craft/machine-related occupation groups in India. Notably, self-reported data is mostly affected by the reporting bias and

thus, researchers may not extract a true estimate of a population issue. However, utilizing a recently published data based on the standard and valid tools for "biomarker" data collection by following proper guidelines, which may reduce the potential measurement error to compute BP and it may increase population representativeness, which adds novelty to this research. Since the study used country representative sample from India, the findings can be generalized to the target population (25–54 years men). Like most of the studies, our study also has some potential limitations. As mentioned before, although the study is entirely dependent on a cross-sectional data source, NFHS-4, it lacks vital data related to job stress, duration of job, time of work, satisfaction about wages, and physical inactivity. Unless a cohort study, containing the missing information is utilized, accurate conclusions about the causality of relationship between occupation and elevated blood pressure cannot be drawn. It would have been better if we could have examined the study hypotheses for elderly men as well, but NFHS-4 collect information up to age 15–54 years only.

Considering the above-mentioned points, the present study comprehensively envelopes the evidences of possible linkages between occupation and elevated blood pressure among men in India. Highly educated unemployed and married unemployed men are more vulnerable and burdened toward elevated blood pressure in India. The government of India must give urgent attention to the vulnerable occupational groups like professional-technical-managerial, clerical, and sales with a special focus to country's unemployed population. Also, different sectors need to support their workers by improving the work environment and social activities to reduce occupational stress to the vulnerable working/non-working groups with a focus to adult population. Urgent need to effectively implement World Health Organization's (WHO) 'Best Buys' interventions through tax increase on alcohol and tobacco, bans on tobacco and alcohol advertising, promotion and sponsorship, health information and warnings, public awareness through mass media on healthy diet, and physical activity may help to fight against this modifiable morbidity condition.

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Compliance with ethical standards

Conflict of interests The authors have declared that they have no competing interests.

Ethical approval The analysis is based on secondary data available in public domain for research; thus, no approval was required from any institutional review board (IRB). However, the principal Investigations have sought approval from the IRB of International Institute for Population Sciences (IIPS), Mumbai, India.

Data availability statement Data is freely available on the Demographic and Health Survey (DHS) website: https://dhsprogram.com/data/dataset/India_Standard-DHS_2015.cfm?flag=1 .

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