

Co-Factors of Hypertension and Decomposition of Inequalities in its Prevalence in India: Evidence from NFHS-4

Abstract

Hypertension still remains one of the most important preventable contributors to adult mortality and morbidity and a major public health challenge worldwide. Studying regional and rural-urban differences in prevalence and assessment of the contributions of different indicators is essential in determining the drivers of this condition. The 2015-16 National Family Health Survey data has been used for the study. Bivariate analysis, multinomial regression analysis, concentration indices and decomposition of concentration indices assessing contribution of factors has been undertaken in the present study. An overall concentration index of 0.003 has been found for hypertensive population, which shows its concentration among the richer wealth quintiles. The contribution of factors like age 45 to 49 years, years of schooling between 5 to 9 years are factors that are important contributors to inequality in hypertension occurrence. Studies should be conducted to find approaches to prevent or delay the onset of the condition.

Extended Abstract

Introduction

Increasing life expectancy puts the health issues of the middle-aged and the elderly population into focus. Hypertension or high blood pressure still remains one of the most important preventable contributors to adult mortality and morbidity and a major public health challenge worldwide¹. The WHO rates it as one of the most important causes of premature death worldwide². Hypertension in south Asia has been ranked second only to child underweight for age, w.r.t. attributable deaths and disease burden, according to the Global and Regional Burden of Disease and Risk Factors study (2001)³. Almost 75 percent of hypertensive population, roughly amounting to 639 million people worldwide, lives in developing countries, battling limited health resources as well as low awareness about the condition itself⁴. The past four decades have seen the prevalence of hypertension rising at a rate, which is equivalent to or more than that of developed countries. The prevalence varies between and within regions in developing countries too⁵. Study of risk factors can help explain the reason for some populations facing a higher risk of developing the disease as compared to others. Risk factors may be genetic, behavioural, or of an environmental origin, or may occur as the result of a medical disorder and they may be reversible, irreversible, or may occur in combination with other disorders⁶. It is majorly affected by environmental and lifestyle factors, rather than racial differences⁷. Genetic inclination to develop hypertension is aided by biosocial factors like weight gain, high salt intake, anxiety, depression, psychosocial stress, and excess alcohol disposition, which are necessary to cause the disease⁸. Body Mass Index (BMI) has also been found to be the most powerful predictor of this condition⁹. Moreover, continuing urbanization and sedentary lifestyles will cause obese population to increase, thereby, increasing the hypertensive population too. Studies should be conducted to find reasons for the

increasing prevalence and poor control of the disease, and even approaches to prevent or delay the onset of the condition. Studying regional and rural-urban differences in prevalence as well as assessment of the contributions of different indicators may be essential in determining the drivers of this condition.

Data and Methods

The 2015-16 National Family Health Survey (NFHS-4), the fourth in the NFHS series, provides information on population, health, and nutrition for India and each state and union territory. The clinical, anthropometric, and biochemical (CAB) component of NFHS-4 is designed to provide vital estimates of the prevalence of malnutrition, anemia, hypertension, HIV, and high blood glucose levels through a series of biomarker tests and measurements.

Bivariate analysis has been used for studying the demographic, socio-economic and behavioral characteristics of the population as categorized by their blood pressure status. Dependent variable used was hypertension occurrence (yes or no), the indicators used were age (35-39 yr, 40-44 yr and 45-49 yr), caste (SC/ST, OBC and non-SC/ST/OBC), years of schooling (no education, 1-5 yr, 5-9 yr, 10 or more years), place of residence (urban, rural), religion (Hindu, Muslim, others), regions (north, east, south, west, north-east, central), number of children ever born (none, one or two, more than 3), junk food consumption frequency (none, occasionally, daily), poultry consumption frequency (none, daily, occasionally), occupation (not employed, service, manual/agricultural) and tobacco consumption (yes or no).

Multinomial regression analysis and bivariate analysis have been utilized to study the co-factors of hypertension with the aforementioned indicators.

The aforementioned indicators have been used for assessing their contributions to the concentration indices.

Socio-economic inequalities in cancer occurrence were quantified with the concentration index and subsequently decomposed into associated factors using decomposition analysis. A concentration index (CI) provides a measure of socioeconomic inequality in a health variable. It ranges from -1 to +1⁴: a value close to zero indicating near equality, a value near -1 indicating greater concentration of the health variable among the poor (pro-poor) while a value increasing to +1 indicating greater concentration amongst the wealthier groups (pro-rich). The CI is calculated as twice the area between the concentration curve and the line of perfect equality, or as twice the weighted covariance between the outcome (in our case, cancer occurrence and non-occurrence) and the fractional rank in the wealth distribution divided by the health variable mean¹⁰.

$$CI = \frac{2}{\mu} cov_w(h_i r_i)$$

where, CI is the concentration index; h is cancer occurrence; r is the fractional rank of the individual i in terms of wealth (SES) distribution; μ is the weighted mean value of the cancer occurrence variable; and, cov_w is the weighted covariance. As shown by Wagstaff et al.⁵, the CI can be visualized as the sum of the contribution to inequality of an array of factors, ranging from socio-economic, socio-demographic to geographical and policy indicators (the ‘deterministic’ or explained component), as well as an unexplained residual component. The original decomposition method

assumes an underlying Ordinary Least Squares (OLS) regression model⁵. Decomposition analyses can also be undertaken with dichotomous outcomes (like hypertension occurrence, in this case) if based on a linear approximation of the model^{11,12}.

Results

Table 1 gives the prevalence of hypertension among females in the age group of 15-49 years in India classified by their blood pressure categories. 15 percent of women in age group 45 to 49 years, 12 percent of non-socially deprived ethnicity, 10.9 percent of women with 10 or more years of schooling, 11 percent of those with daily junk food consumption are constituting the hypertensive population among women. Overall Indian data shows 50 percent of women in the non-hypertensive category, 37 percent in the pre-hypertensive state and 11.5 percent women in the hypertensive category.

Table 2 shows the multinomial regression model assessing the association between three different levels of blood pressure (BP) – namely, normal (<120 mmHg), pre-hypertensive (120 mmHg - 139 mmHg) and hypertensive (>140 mmHg), with demographic, socio-economic and behavioral characteristics for females. Among the female hypertensive population, it has been found that a higher age, rural place of residence, higher wealth quintile, years of schooling equal to or more than 10 years, being unemployed and belonging from the non-socially deprived group are the factors likely to place a person in the hypertensive population group. The multinomial logit for females with regular consumption of poultry items relative to non-consumers is 0.7 units higher for being hypertensive as compared to non-hypertensive females.

Table 3 shows the concentration indices for hypertension for different demographic characteristics. An overall concentration index of 0.003 has been found for hypertensive population, which shows concentration of the health variable among the richer wealth quintiles. Among women with 10 or more years of schooling, those with urban places of residence, or those who consume tobacco in any form (smoke, chew) it is concentrated among the quintiles with lower socio-economic status. For women with years of schooling less than 10 years, those from the socially deprived sections of the society, those with rural places of residence and those with no tobacco use, the concentration of the health variable is among those who hail from the richer wealth quintiles.

Table 4 shows the decomposition analysis of the concentration index for different indicators. It is apparent from the results that the contribution of factors like age in the range of 45 to 49 years, years of schooling between 5 to 9 years, and belonging from the northern region of India are factors that are important contributors to the concentration index, explaining significant amount of the inequality prevalent in the occurrence of hypertension.

Tables

Table 1: Socio- economic and demographic characteristics of women, NFHS 4 (2015-16) classified by blood pressure categories

Demographic, socio-economic and behavioral	Non-hypertensive		Pre-hypertensive		Hypertensive	
	Frequency	%	Frequency	%	Frequency	%

indicators						
Age (in years)						
35-39	35,606	58.03	21,400	34.87	4,357	7.10
40-44	38,544	51.11	28,628	37.96	8,246	10.93
45-49	31,864	44.58	28,283	39.57	11,323	15.84
Ethnicity						
Scheduled Caste/Tribe	37,073	50.87	27,198	37.32	8,609	11.81
Other backward Caste	42,787	52.90	29,617	36.61	8,486	10.49
Non-Scheduled Caste/Tribe/Other backward caste	22,008	48.89	17,583	39.06	5,422	12.05
Years of Schooling						
no education	51,291	51.64	36,777	37.03	11,255	11.33
1 to 4	7,840	49.73	5,973	37.89	1,951	12.38
5 to 9	26,400	50.20	19,884	37.81	6,306	11.99
10 or more	20,483	50.48	15,677	38.64	4,414	10.88
Place of residence						
Urban	31,767	50.24	23,939	37.86	7,520	11.89
rural	74,247	51.20	54,372	37.49	16,406	11.31
Religion						
Hindus	82,086	52.35	57,912	36.94	16,790	10.71
Muslim	11,266	46.58	9,584	39.62	3,338	13.80
Others	12,662	46.42	10,815	39.65	3,798	13.92
Region						
South	16,920	53.28	11,545	36.36	3,291	10.36
Northeast	13,270	43.98	11,984	39.72	4,920	16.31
East	18,868	53.15	12,869	36.25	3,764	10.60
North	33,317	49.77	26,214	39.16	7,409	11.07
Central	13,699	52.93	9,435	36.46	2,747	10.61
West	9,940	55.23	6,264	34.80	1,795	9.97
Tobacco use						
No	88,658	50.55	66,714	38.03	20,031	11.42
Yes	17,356	52.84	11,597	35.31	3,895	11.86
Body Mass Index						
Non-obese	1,05,999	50.91	78,301	37.60	23,926	11.49
Obese	6	66.67	3	33.33	0	0.00
Poultry consumption						
Never	30,537	51.80	22,383	37.97	6,036	10.24
Once a week	7,395	48.77	5,804	38.28	1,964	12.95
Daily	68,082	50.76	50,124	37.37	15,926	11.87
Junk food consumption						
Never	2,812	47.81	2,282	38.80	787	13.38
Once a week	14,608	49.21	11,240	37.86	3,838	12.93
Daily	88,594	51.30	64,789	37.52	19,301	11.18
Occupation						
Not employed	11,255	50.77	8,242	37.18	2,670	12.04

Service	2,032	55.50	1,285	35.10	344	9.40
Manual / Agriculture	5,653	55.77	3,521	34.74	962	9.49
Total	1,06,014	50.91	78,311	37.60	23926	11.49

Table 2: Relative Risk Ratios of socio-demographic indicators of hypertension, NFHS 4 (2015-16)

Demographic indicators	Relative Risk Ratio	P>z	[95% Conf.	Interval]
Non-hypertensive	(base outcome)			
Pre-hypertensive				
age				
35-39 yr	1.00			
40-44 yr	1.28	0.00	1.21	1.35
45-49 yr	1.55	0.00	1.47	1.64
Place of residence				
Urban	1.00			
Rural	1.02	0.51	0.96	1.08
years of schooling				
No formal education	1.00			
1 to 4	1.07	0.16	0.98	1.17
5 to 9	1.00	0.97	0.94	1.06
10 or more	0.97	0.42	0.90	1.05
Religion				
Hindus	1.00			
Muslim	1.15	0.00	1.07	1.24
Others	1.17	0.00	1.08	1.26
Wealth quintile				
Poorest	1.00			
poorer	1.02	0.54	0.95	1.11
middle	1.11	0.01	1.03	1.20
richer	1.13	0.00	1.04	1.23
richest	1.23	0.00	1.11	1.35
Caste				
SC/ST	1.00			
OBC	0.96	0.14	0.90	1.01
Non-SC/ST/OBC	1.08	0.02	1.01	1.15
Occupation				
Not employed	1.00			
Service/Office	0.87	0.00	0.81	0.94
Manual/Agricultural	0.90	0.00	0.85	0.95
Tobacco consumption				
No	1.00			
Yes	0.94	0.08	0.88	1.01

Poultry consumption				
Never	1.00			
Once a week	1.12	0.02	1.02	1.23
Daily	1.05	0.07	1.00	1.11
Junk food consumption				
Never	1.00			
Once a week	0.95	0.52	0.82	1.11
Daily	0.95	0.44	0.82	1.09

Table 2 (Cont)

Demographic indicators	Relative Risk Ratio	P>z	[95% Conf. Int.]	Interval]
Hypertensive				
Age				
35-39 yr	1.00			
40-44 yr	1.80	0.00	1.63	1.98
45-49 yr	3.11	0.00	2.83	3.42
Place of residence				
Urban	1.00			
Rural	1.07	0.11	0.98	1.17
years of schooling				
No formal education				
1 to 4	0.99	0.93	0.86	1.14
5 to 9	1.06	0.23	0.96	1.16
10 or more	1.04	0.52	0.92	1.17
Religion				
Hindus	1.00			
Muslim	1.43	0.00	1.28	1.59
Others	1.38	0.00	1.23	1.53
Wealth quintiles				
Poorest	1.00			
poorer	1.11	0.09	0.98	1.26
middle	1.24	0.00	1.10	1.40
richer	1.37	0.00	1.20	1.56
richest	1.31	0.00	1.13	1.52
Caste				
SC/ST	1.00			
OBC	0.89	0.01	0.81	0.98
Non-SC/ST/OBC	1.08	0.14	0.98	1.19
Occupation				
Not employed	1.00			
Service/Office	0.70	0.00	0.62	0.79
Manual/Agricultural	0.79	0.00	0.72	0.86
Tobacco consumption				

No	1.00			
Yes	0.98	0.67	0.89	1.08
Poultry consumption				
Never	1.00			
Once a week	1.33	0.00	1.15	1.54
Daily	1.25	0.00	1.14	1.36
Junk food consumption				
Never	1.00			
Once a week	0.95	0.65	0.76	1.18
Daily	0.83	0.06	0.68	1.01

Table 3: Concentration Indices and Standard error for hypertension indicators

Indicator		C.I.	S.E.
Overall		0.003	0.001
Education	No education	0.004	0.001
	1-5 yr	0.006	0.002
	5-9 yr	0.005	0.001
	More than 10 yr	-0.001	0.001
Age	35-39	0.000	0.001
	40-44	0.002	0.001
	45-49	0.005	0.001
Caste	Socially deprived	0.002	0.001
	Socially non-deprived	0.003	0.001
POR	Urban	-0.002	0.001
	Rural	0.004	0.001
Religion	Hindu	0.003	0.001
	Muslim	0.000	0.002
	Others	0.001	0.002
Regions	South	0.002	0.001
	NE	0.003	0.003
	East	0.007	0.001
	North	0.007	0.001
	Central	-0.001	0.002
	West	0.005	0.002
Tobacco use	No	0.004	0.001
	Yes	-0.002	0.001
Poultry consumption	Never	0.006	0.001
	Once a week	-0.004	0.002
	Daily	0.002	0.001
Junk food consumption	Never	0.001	0.003
	Once a week	-0.004	0.002
	Daily	0.004	0.001

Table 4: Decomposition of Concentration Index for inequality in hypertension occurrence for women above 35 years of age, NFHS 4 (2015-16)

Demographic indicators	Concentration			%
	Elasticity	Index	Contribution	Contribution
Age = 40-44 yr	0.014	-0.007	0.000	5.72
Age = 45-49 yr	0.031	0.009	0.001	12.30
yr of schooling = 1-5 yr	0.001	-0.112	0.000	0.31
yr of schooling = 5-9 yr	0.004	0.157	0.002	1.42
yr of schooling = 10 yr or more	0.000	0.552	0.001	0.10
religion= muslim	0.002	-0.001	0.000	0.82
religion = non-hindu/muslim	0.001	0.255	0.001	0.35
region = Northeast	0.003	-0.216	-0.003	1.22
region = east	0.003	-0.338	-0.005	1.39
region = north	0.003	0.059	0.001	1.13
region = central	0.001	-0.164	-0.001	0.34
region= west	0.000	0.186	0.000	-0.12
caste= Scheduled caste/tribe	-0.001	-0.244	0.001	-0.31
caste = Other backward caste	-0.004	0.010	0.000	-1.59
BMI category = overweight/Obese	0.000	0.136	0.000	0.00
Tobacco consumption = yes	-0.001	-0.360	0.001	-0.33
Place of residence = rural	-0.005	-0.241	0.005	-2.16
Poultry consumption = occasionally	0.001	0.202	0.001	0.37
Poultry consumption = daily	0.002	-0.084	-0.001	0.67
junk food consumption = occasionally	-0.001	0.027	0.000	-0.22
junk food consumption = daily	-0.011	-0.002	0.000	-4.27
Residual		0.177		
CI		0.003		

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