

## **Prevalence and correlates of hypertension among post-menopausal women in India- analysis of data from the LASI study.**

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### **Abstract-**

This study used secondary data from the longitudinal aging study of India with an objective to estimate the prevalence of hypertension among post menopausal women in India and evaluate the associated risk factors.

We extracted data from the first wave of the Longitudinal Ageing Study in India (LASI), which is a nationally and state representative of aging and health. In descriptive analysis weighted prevalence & 95% Confidence Interval (CI) of hypertension with all the social determinants & health status variables were calculated in different age groups. We performed unadjusted and adjusted logistic regression analyses to assess the Odds Ratio with 95% CI.

Approximately half of the Indian post-menopause women suffered from hypertension 51.68% (95% CI: 50.00% - 53.00%). Self-reported prevalence of hypertension among post-menopause women in India is 32.54% which indicates that 19.14% of the women did not aware that they had hypertension prior to the survey. Urban residents, Muslims & other religions, currently not working, and currently not married women had a higher prevalence of hypertension. Compared with women with normal BMI, those who were overweight or obese were more likely to suffer from hypertension. A large difference in the prevalence of hypertension in diabetic vs non-diabetic women (77.44% Vs 47.78%) and also with increased vs normal waist circumference (61.93% vs 41.87%).

We report a significant prevalence of hypertension among pot-menopausal women in India. We found that age, high BMI, abdominal obesity and presence of diabetes were significant risk factors associated with this.

**Keywords-**Post-menopausal, Hypertension, Cross sectional, Risk factors, Survey

**Introduction-**

Cardiovascular diseases (CVD), that include both heart and cerebrovascular disease, are the leading cause of death in across the world and in India. [1] Hypertension is a known major risk factor for CVD[2]. There is some evidence to suggest that Post-menopausal women (Post-MW) are at an increased risk of CVD, mostly attributed to the advanced age. [3] Until 45 years of age, the prevalence of hypertension is usually lower in women than in men, but in case of women increases after menopause [4]. Therefore, while the rates are similar in both sexes between 45 and 54 years of age, after 55 years of age, the prevalence is higher in women [5]. However, because of the effects of aging and other risk factors including body weight and cholesterol on the cardiovascular system, evidence on the relationship between menopausal status and hypertension are inconsistent. While some cross-sectional studies reported that Post-MW were at greater risk of being hypertensive, independent of age/body mass index (BMI)[6,7], other studies found no significant association after adjusting for age [8,9]. Although it is recognized that the prevalence of hypertension in Indian women is high, awareness is low, and limited studies have been done in India exploring the relationship between menopausal status and hypertension.

As hypertension is an important preventable contributors to disease and death [11], a better understanding of its risk during menopause is required for improving management strategies and quality of life. With this background the following study used secondary data from the longitudinal aging study of India with an objective to estimate the prevalence of hypertension among post menopausal women in India and evaluate the associated risk factors.

**Methods****Data**

We extracted data from the first wave of the Longitudinal Ageing Study in India (LASI), which is a nationally and state representative of aging and health. LASI is the world's largest and the only one of its types in India. Its primary purpose is to produce genuine, trustworthy, and ongoing scientific data on India's older adult population's health, social, mental, and economic well-being. The Ministry of Health and Family Welfare (MoHFW) of the Government of India is responsible for LASI. In collaboration with the Harvard T.H.Chan School of Public Health (HSPH) and the University of Southern California (USC), the International Institute for Population Sciences (IIPS) in Mumbai is the focal institution for implementing LASI. The first wave of the study (n= 72,250) included a nationally representative multi-stage Stratified Cluster Sample of age 45 years or more. In this study, post-menopause women whose age was 45 years or more (n= 24541) were considered.

**Variables**

Hypertension (Yes/No), the outcome variable studied, defined those who were diagnosed with hypertension by any health professional (self-reported) or whose average of the three measured systolic blood pressures exceeded 139 mm Hg or the average of the three measured diastolic blood pressures exceeded 89 mm Hg. Various social determinants & health status covariates included in the study were, 1) Age with three groups (45 – 54 years, 55 – 64 years, 65 or more years), 2) Place of residence (Rural & Urban), 3) Religion (Hindu, Christian, Muslim & Others), 4) Level of education with four groups (No education, Up to primary, Middle school completed & Higher secondary and above), 5) Occupation (Currently working or not), 6) Wealth status (Poor, Middle & Rich), 7) Marital Status (Currently married or not), 8) Physical activity (Physically active or not); its defined by those who were engaged in moderate physical activity (at least 150 minutes throughout the week) or vigorous physical activity (at least 75 minutes throughout the week). 9) Diabetes (Yes/No); those who were diagnosed by health professionals –

self-reported, 10) Body Mass Index (BMI); was calculated by measured weight (Kg)/squared measured height (meters) and classified by underweight (18.5 or less), normal (18.5 – 24.9), overweight (25.0 – 29.9) and obese (30.0 or more), 11) waist circumference (less than 0.85m & 0.58 m or more), 12) Smoking status (Yes/No) & 12) Alcohol consumption (Yes/No).

### **Statistical analysis**

In descriptive analysis weighted prevalence & 95% Confidence Interval (CI) of hypertension with all the social determinants & health status variables were calculated in different age groups. We performed unadjusted and adjusted logistic regression analyses to assess the Odds Ratio with 95% CI. The variables included in the unadjusted regression analysis were age, wealth status, physical activity, diabetes, BMI, tobacco status, and alcohol consumption. The covariates found with a statistically significant association with hypertension were included in the multivariate logistic regression analysis. Statistical analyses were performed using R Software (V.4.1.2).

### **Results**

Approximately half of the Indian post-menopause women suffered from hypertension 51.68% (95% CI: 50.00% - 53.00%). Self-reported prevalence of hypertension among post-menopause women in India is 32.54% which indicates that 19.14% of the women did not aware that they had hypertension prior to the survey (Graph 1). Table 1 shows that social determinants such as urban residents, Muslims & other religions, currently not working, and currently not married women had a higher prevalence of hypertension. There was an approximately 10% jump in the prevalence of those who had no education to had minimum primary education and there was not much difference in prevalence from primary education to higher educational attainment. As moved from poor to rich wealth group there was an increasing trend in the prevalence of hypertension (poor; 48.11%, middle; 52.11 & rich; 55.44%). Compared with women with normal BMI, those who were overweight or obese were more likely to suffer from hypertension. A large difference in the prevalence of hypertension in diabetic vs non-diabetic women (77.44% Vs 47.78%) and also with increased vs normal waist circumference (61.93% vs 41.87%). Among the physically active group vs non-active group, the prevalence of hypertension was moreover similar (46.65% Vs 44.98%) Among other lifestyle factors such as women smokers, and alcohol users were less likely to report hypertension.

Table 2 shows the unadjusted and adjusted logistic regression results. The results found that excepting alcohol consumption all other covariates were statistically associated with the prevalence of hypertension. In the unadjusted model, moving from the lower age group to the highest age group there was an increased odds of hypertension among women: ranging from 1.53 (95% CI: 1.44, 1.63) to 2.31 (2.17, 2.47) and the odds were almost similar after adjusting the model. Also, the same trend was shown in the unadjusted and adjusted model of wealth index: ranging from UOR; 1.16 (95% CI: 1.08, 1.24) to .34 (95% CI: 1.26, 1.41) and BMI: UOR 1.54 (95% CI: 1.43, 1.66) to 3.88 (95% CI: 3.48, 4.34). There were 3.54 (95% CI: 3.26, 3.86) increasing odds of hypertension among diabetic women as compared to non-diabetic women and it was reduced by 2.54 (95% CI: 2.21, 2.94) after adjustment of the model. Among physically not active women there was a slight increase in hypertension as compared to physically active women. A decrease in odds of hypertension was reflected in smoking status and alcohol consumption; in which smoking was statistically associated whereas alcohol is not associated with hypertension.

Graph 1: Prevalence of hypertension among post-menopause women in India

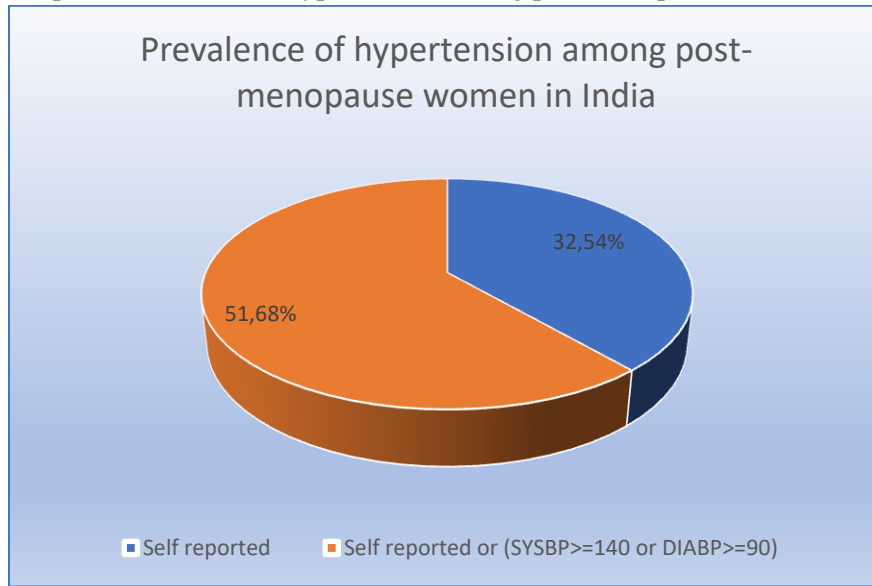


Table 1: Prevalence of hypertension with various social determinants and health outcomes among post-menopause women in India

Variables	Age (in years)			
	45 – 54 (n = 7003)	55– 64 (n = 9189)	65 & above (n = 8322)	Total (n = 24514)
<b>Residence</b>				
Rural	37.46 (35.47, 39.44)	45.84 (44.00, 47.68)	56.16 (54.14, 58.22)	47.38 (46.23, 48.53)
Urban	48.54 (39.67, 57.40)	60.24 (56.47, 64.00)	70.95 (65.73, 76.17)	60.83 (56.70, 64.95)
<b>Religion</b>				
Hindu	40.94 (37.57, 44.32)	48.70 (46.74, 50.65)	59.75 (56.93, 62.40)	50.71 (48.90, 52.52)
Muslim	48.61 (39.44, 57.78)	56.56 (51.84, 61.39)	68.13 (62.40, 73.87)	58.39 (54.79, 61.98)
Christian	24.39 (2.68, 46.10)	48.26 (40.97, 55.54)	65.83 (58.59, 73.08)	45.44 (30.62, 60.26)
Others	45.40 (36.93, 53.87)	63.36 (56.09, 70.63)	65.02 (57.23, 72.82)	59.40 (54.75, 64.06)
<b>Level of education</b>				
No Education	38.52 (36.10, 40.94)	46.55 (44.43, 48.66)	56.34 (54.32, 64.61)	48.80 (47.48, 50.11)
Up to primary	44.66 (39.82, 49.50)	54.94 (51.53, 58.36)	69.49 (64.61, 74.37)	56.45 (53.90, 58.99)
Middle school completed	40.93 (34.82, 47.04)	59.37 (52.89, 65.85)	83.99 (71.02, 96.96)	58.95 (50.36, 67.54)

Higher secondary and above	46.39 (28.68, 64.09)	59.12 (51.55, 66.69)	76.74 (65.34, 88.15)	57.66 (48.19, 67.14)
Occupation				
Currently working	36.01(33.45, 38.56)	45.21 (42.12, 48.31)	49.94 (45.07, 54.81)	42.51 (40.60, 44.43)
Not working	48.78 (43.28, 54.27)	53.33 (50.11, 56.55)	58.67 (55.59, 61.75)	55.52 (53.39, 57.65)
Wealth				
Poor	36.04 (33.11, 38.97)	46.73 (44.30, 49.17)	57.73 (54.91, 60.54)	48.11 (46.48, 49.73)
Middle	43.82 (33.63, 54.02)	49.94 (46.66, 53.23)	60.82 (57.09, 64.54)	52.11 (48.95, 55.26)
Rich	45.08 (39.44, 50.72)	54.12 (50.88, 57.36)	64.80 (59.83, 69.77)	55.44 (52.46, 58.42)
Marital Status				
Currently married	40.49 (36.84, 44.15)	48.09 (46.00, 50.19)	57.14 (54.01, 60.26)	47.36 (45.68, 49.03)
Never married/Widowed/Divorced/separated	43.77 (35.49, 52.05)	54.87 (51.71, 58.03)	63.08 (59.85, 66.31)	58.00 (55.30, 60.70)
Physical activity				
Physically active	38.31 (35.63, 41.00)	45.87 (43.01, 48.74)	59.96 (53.86, 66.06)	46.65 (44.25, 49.05)
Physically not active	32.78 (22.13, 43.42)	52.04 (46.53, 58.02)	52.13 (43.14, 61.13)	44.98 (38.84, 51.12)
Diabetes				
Yes	66.17 (60.56, 73.78)	75.15 (70.80, 79.49)	83.77 (77.56, 90.00)	77.44 (73.69, 81.20)
No	38.76 (35.18, 42.34)	45.97 (44.22, 47.72)	56.81 (54.77, 58.84)	47.78 (46.37, 49.20)
BMI				
Underweight (<18.5)	24.39 (20.62, 28.16)	32.02 (28.60, 35.45)	45.77 (41.70, 49.84)	37.24 (34.76, 39.73)
Normal (18.5 – 24.9)	34.19 (30.83, 37.55)	45.09 (42.95, 47.24)	59.43 (56.87, 61.98)	47.46 (45.77, 49.15)
Overweight (25.0 – 29.9)	53.30 (45.28, 61.32)	63.01 (58.99, 67.01)	75.01 (68.94, 81.07)	63.27 (57.00, 67.57)
Obese (30 & above)	62.13 (54.27, 69.98)	69.64 (62.93, 76.35)	81.84 (70.54, 93.13)	70.81 (65.55, 76.08)
Waist Circumference				

Normal (<0.85)	30.36 (27.24, 33.48)	39.10 (36.96, 41.25)	52.14 (49.62, 54.56)	41.87 (40.23, 43.52)
Increased (>=0.85)	51.98 (47.14, 56.84)	60.83 (58.30, 63.37)	71.61 (67.63, 75.59)	61.93 (59.44, 64.41)
Tobacco				
Yes	43.11 (35.66, 50.57)	46.62 (38.98, 54.27)	54.13 (45.47, 62.79)	48.89 (46.59, 51.00)
No	41.17 (37.75, 44.59)	50.18 (48.41, 51.94)	61.11 (58.66, 63.57)	52.38 (50.42, 54.34)
Alcohol				
Yes	38.93 (34.38, 43.47)	45.18 (41.92, 48.44)	57.07 (53.59, 60.54)	48.20 (43.50, 52.90)
No	41.68 (37.79, 45.58)	51.26 (49.26, 53.26)	62.14 (40.78, 65.06)	51.74 (50.07, 53.42)

Table 2. Univariate and Multivariate logistic regression results of hypertension with different risk factors among post-menopause women in India

Variables	Un-adjusted OR (95% CI)	Adjusted OR (95% CI)
Age (in years)		
45 – 54	1	1
55– 64	1.53 (1.44, 1.63)	1.51 (1.38, 1.66)
65 & above	2.31 (2.17, 2.47)	2.41 (2.17, 2.70)
Wealth		
Poor	1	1
Middle	1.16 (1.08, 1.24)	1.06 (0.95, 1.18)
Rich	1.34 (1.26, 1.41)	1.17 (1.07, 1.28)
Physical activity		
Physically active	1	1
Physically not active	1.13 (1.03, 1.24)	1.03 (0.94, 1.14)
Diabetes		
No	1	1
Yes	3.54 (3.26, 3.86)	2.54 (2.21, 2.94)
BMI		
Underweight (<18.5)	1	1
Normal (18.5 – 24.9)	1.54 (1.43, 1.66)	1.57 (1.39, 1.77)
Overweight (25.0 – 29.9)	2.86 (2.63, 3.12)	2.87 (2.50, 3.31)
Obese (30 & above)	3.88 (3.48, 4.34)	3.56 (2.97, 4.28)
Tobacco		
No	1	1
Yes	0.90 (0.84, 0.96)	1.10 (0.99, 1.21)
Alcohol		
No	1	1
Yes	0.90 (0.79, 1.02)	1.02 (0.90, 1.18)

**Discussion-**

The prevalence of hypertension in women 45 years of age or older is high in India. This has been reported by many studies in localized manner. Similar high prevalence in similar demographic regions have been reported by studies in China as well. [18,19]. This prevalence is higher than the general population, probably owing to the older age group of the participants in this study. Lifestyle and diet plays an important role in hypertension burden and we found a significantly higher prevalence in urban residents as compared to rural. [9,20]

Our study found a highly significant association of hypertension with age. Other studies on changes in BP with menopause after adjustment for age are inconclusive [7,21,22]. These discrepancies may be due to differences in the definition of hypertension and age groups analysed. Interestingly, Geum et al. [6] reported a higher risk of hypertension in women who had menopause recently as compared to those who had menopause a decade ago. [23]

It is widely recognized that as increased body weight is associated with hypertension [24] and our study reported similar findings. However, other studies have reported that this relationship is different in Pre- and Post-MW [25,26]. In contrast to a previous study, here we found a significant relationship between abdominal WHR and hypertension [27].

Smoking and drinking alcohol are known risk factors of hypertension [18], but we did not find any significant association in our study. Such exceptions have been reported in a small number of studies [7,22], including this one. The low prevalence of smoking and alcoholism in Indian women may be the prime cause for this finding. Furthermore, being behavioral taboo, there may be underreporting of these risk factors.

This study has some limitations. As it is a cross-sectional study, the findings cannot provide evidence of causality. The prevalence of hypertension may have been overestimated or underestimated because it was assessed using measurements made on a single day.

In conclusion, we report a significant prevalence of hypertension among post-menopausal women in India. We found that age, high BMI, abdominal obesity and presence of diabetes were significant risk factors associated with this.

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