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ORIGINAL ARTICLE

High prevalence and low awareness, treatment and control of hypertension in Asian Indian women

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Hypertension is an important public health problem in India. To determine its prevalence, awareness, treatment and control among women, we performed a nationwide study. Population-based studies among women aged 35–70 years were performed in four urban and five rural locations. Stratified sampling was performed and we enrolled 4608 (rural 2604 and urban 2004) of the targeted 8000 (57%). Demographic details, medical history, diet, physical activity, anthropometry and blood pressure (BP) were recorded. Descriptive statistics are reported. Logistic regression was performed to determine the association of hypertension and its awareness, treatment and control with socioeconomic factors. Age-adjusted prevalence of hypertension (known or BP $\geqslant$140/$\geqslant$90 mm Hg) was observed in 1672 women (39.2%) (rural 746, 31.5%; urban 926, 48.2%). Significant determinants of hypertension were urban location, greater literacy, high dietary fat, low fibre intake, obesity and truncal obesity ($P<0.01$). Hypertension awareness was noted in 727 women (42.8%), more in urban (529, 56.8%) than in rural (198, 24.6%). Of these, 38.6% of the women were on treatment (urban 35.7, rural 46.5) and of those treated, controlled blood pressure (<140 and <90 mm Hg) was observed in 21.5% (urban 28.3 vs 10.2). Among hypertensive subjects, treatment was noted in 18.3% (rural 13.1, urban 22.5) and control in 3.9% (rural 1.3, urban 5.9). A significant determinant of low awareness, treatment and control was rural location (multivariate-adjusted $P<0.05$). There is a high prevalence of hypertension in middle-aged Asian Indian women. Very low awareness, treatment and control status are observed.
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Keywords: low-income countries; cardiovascular diseases; high blood pressure; hypertension control

Introduction

The South Asian region is the most populous in the world, and the emerging burden of cardiovascular diseases (CVD) and risk factors in countries of this region is alarming.[1] In 1990, CVD accounted for 20% of all deaths in this region;[2] coronary heart disease (CHD) was responsible for 60% of these and 40% attributed to stroke. This proportion has increased to 30% and currently almost three million annual deaths are caused by CVD in this region.[3] The Global Burden of Diseases study reported that hypertension is the most important disease-risk factor in this region and is responsible for the largest burden of disease and mortality.[4] Population-based epidemiological studies have reported that prevalence of hypertension has increased by two to five times in the urban and rural regions of India over the past 50 years.[5] Prospective studies from all parts of the world have reported that hypertension is an important cause of mortality, and that higher the blood pressure (BP) greater the mortality.[6,7] Prospective studies in India have also reported a significant correlation of increasing BP with greater CVD mortality.[8,9]

A high level of awareness, treatment and control of hypertension is crucial in reducing BP-related mortality. The population-wide mean systolic BP declined by 3.5 mm Hg over a 35-year period in the high-income countries.[10] This has been attributed to increased awareness and better treatment and control.[11] Periodic national examination surveys in the United States have studied trends of hypertension

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prevalence, awareness, treatment and control rates, and reported a declining prevalence and better awareness, treatment and control.[12] Over a 20-year period from 1988 to 2008, it was reported that prevalence of hypertension has remained stable, while control rates have improved to more than 50%. Similar trends have been reported from many western European countries.[13–16] On the other hand, studies from South Asia have reported escalating trends in hypertension and low levels of treatment and control.[17]

Only a few studies in India have evaluated hypertension awareness, treatment and control[18–29] and none was performed on a national basis.[5] Regional studies have reported variable awareness from less than 10% in rural subjects to more than 60% among the highly educated subjects.[21,22] To identify level of hypertension prevalence and awareness, treatment and control status, we performed a nationwide epidemiological study. This study has been performed among middle-aged women in rural and urban locations using standardized methodology.[30] Study among women is important because hypertension prevalence is greater than men,[12] there is low awareness and treatment status among this group,[12] and, importantly, increasing hypertension awareness among women can have a transformational influence on diet and other lifestyle behaviours of the family that have a direct impact on hypertension and other CVD risk factors in the society.[31]

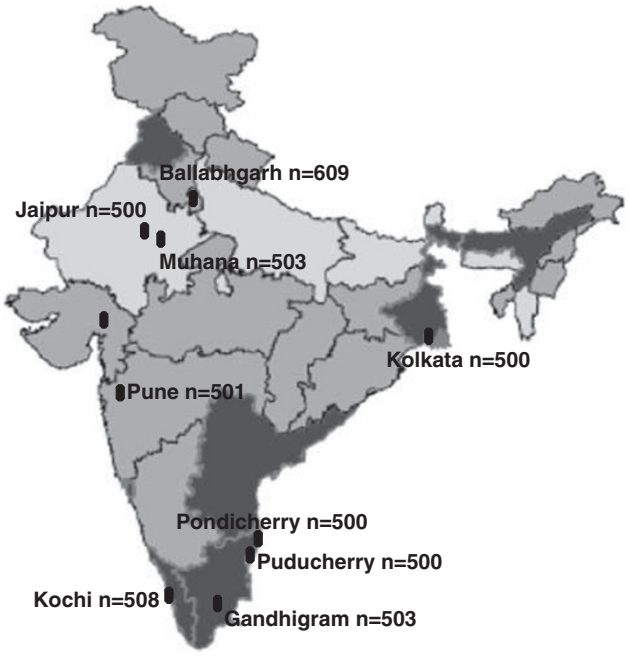

Figure 1 Study locations in different regions of India superimposed on the cardiovascular mortality atlas for women. There is significant enrolment from high-mortality areas (>240/100 000 deaths annually, dark red), moderate-mortality areas (160–240/100 000 deaths annually, pink) and low-mortality areas (<160/100 000 deaths annually, light pink). Urban locations are black, while rural locations are in blue. A full colour version of this figure is available at the *Journal of Human Hypertension* journal online.

Materials and methods

A multisite study was initiated by investigators from different regions of the country and funding obtained from the Science and Society Division, Department of Science and Technology (DST), Government of India, New Delhi.[30] Selection of sites was performed by DST based on a national perspective and previous performance of the principal investigators, which included investigators and sites who successfully applied for the peer-reviewed grant. Thus, the selection of sites and investigators was purposive and not random. A central institutional review board approved the study, and ethical clearance was obtained from each study site. Written informed consent was obtained from each participant. The study was performed at four urban and five rural locations in the years 2004–2007 (Figure 1). A proforma was prepared, which obtained information regarding social, demographic, diet, physical activity, anthropometric and biochemical variables. Investigators from each site were centrally trained to ensure uniformity in sampling methodology, questionnaire administration, physical examination and measurements, and biochemical estimations.

Sampling

Sampling involved a systematic stratified strategy at each study site. Details have been reported earlier.[30] To ensure uniformity in data collection, each site was instructed to identify low and low-middle social status locations in the urban and rural areas. Rural areas were defined according to the Government of India guidelines and include small hamlets and conglomerations having less than 5000 subjects. We evaluated middle-aged women, aged 35–70 years, at all locations. This strategy has been used in previous studies and recommended by the World Health Organization (WHO).[32] The response rate at each site varied from 50 to 70% and was similar in rural and urban locations.

Questionnaire, physical examination and biochemical estimations

The questionnaire was designed to collect information on demographic data, family income, educational level, history of chronic illnesses such as coronary heart disease, hypertension, diabetes or high cholesterol, and smoking or tobacco intake. Dietary history was enquired using 2-day 24-h recalls.[33] Physical activity was enquired using a previously validated instrument that provides details of all the day-long activity.[34] In Indian women, the prevalence of leisure-time physical activity is low but household chores and work-related physical activity could be substantial. This questionnaire captures all these physical activity domains and is

more useful for low-income countries such as India. Physical examination was performed to assess height, weight, waist and hip size, and BP using techniques recommended by the WHO.[35] All the study investigators were centrally trained in measurement techniques for uniformity. Standardized tape measures and weighing machines that were periodically calibrated were used. Body mass index (BMI) was calculated as weight (kg) divided by squared height (m). Waist-to-hip ratio (WHR) was calculated. Sitting blood pressure was measured using a calibrated digital sphygmomanometer supplied centrally (Omron model SDX, Omron Inc., USA) after a 5-min rest. Three readings were obtained at 2-min intervals and the average of the readings was taken as usual BP. Fasting blood sample for measurement of glucose and total cholesterol was obtained from all the study participants.

Diagnostic criteria

Hypertension was diagnosed when the systolic or diastolic BP was $\geqslant 140$ and/or $\geqslant 90$ mm Hg on multiple single-day measurements, or when the subject was known to be hypertensive and on medications.[12] Women who were told that they were hypertensive but had normal measured BP and were not on any medical treatment were not included in the hypertension group. Women who smoked tobacco as bidis, cigarettes or other forms currently were classified as current smokers; ex-smokers were women who had given up the smoking after at least one year of smoking and had stopped more than a month ago, while other tobacco users were included in the non-smoked tobacco use category. Educational status was classified according to the number of years of formal education into three categories: <10 years, 10–15 years and >15 years. Physical activity was determined using work-time, commute-time or leisure-time activities. Persons engaged in >30 min of continuous activity >5 times per week were classified as moderately active, and >60 min as highly active. Daily visible dietary fat intake was determined and classified into low or high depending upon a daily fat intake of >20 g. Green vegetables and fruit intake of $\geqslant 3$ servings was considered adequate. Overweight was defined as BMI $\geqslant 23\,kg\,m^{-2}$ and obesity was defined as BMI $\geqslant 25\,kg\,m^{-2}$ as suggested by the WHO for South Asians.[35] Truncal obesity was defined by waist:hip ratio of >0.9 and waist circumference >90 cm. Other risk factors were diagnosed using standard definitions reported before.[30]

Statistical analyses

All the case report forms were transferred to the study management office in Delhi. The data were entered in a customised database using SPSS program (SPSS Inc., Chicago, IL, USA). At random, 10% of the double entry was checked for errors. All the analyses were performed using SPSS version 10.0. Age-adjusted mean levels of different demographic, lifestyle and physical variables were determined and these variables are reported as mean $\pm$ 1 s.d. The prevalence rates are reported as percent. Age adjustment was performed using the direct method and 2001 Indian census female population was used as standard. To determine the association of hypertension with lifestyle risk factors, logistic regression analysis was performed before and after age adjustment, and odds ratios (ORs) and 95% confidence intervals (CI) are reported. To determine associations of awareness, treatment and control, ORs were determined after adjustment of location and age. Multivariate analysis after adjustment for location, age, educational status, high-fat diet, low fibre intake, obesity and truncal obesity was also performed. P values <0.05 were considered significant.

Results

A total of 4624 women aged 35–70 years were evaluated at different study sites (Figure 1). Details of BP were available for 4608 (rural 2604, urban 2004) (response 57.6%). Various demographic and lifestyle variables are shown in Table 1. There is a high prevalence of low educational status and low spouse education. Majority of women belonged to low middle and lower socioeconomic classes. There is low physical activity, high dietary intake of sodium and fats, low intake of dietary fiber and tobacco use is not uncommon.

Mean systolic and diastolic BP values in the study population are shown in Table 2. There is an age-associated escalation in mean systolic BP in both rural and urban subjects. The mean systolic BP is similar in younger women aged 35–39 years, but with increasing age there is greater escalation in both systolic and diastolic BP among the urban women as compared with the rural. Age-adjusted prevalence of hypertension is 39.2%. Age-specific prevalence of hypertension in urban and rural women is shown in Figure 2. Lower prevalence is noted in rural women as compared with the urban at all age groups (Table 3). Age-adjusted prevalence of isolated systolic hypertension and isolated diastolic hypertension is shown in Table 3. The prevalence of isolated systolic hypertension increases with age, while that of isolated diastolic hypertension does not change significantly.

Significant lifestyle determinants of hypertension prevalence are urban residence (age-adjusted OR 2.06, 95% confidence interval 1.81–2.35), high dietary intake of fat (1.07, 1.06–1.08), low intake of fibre (1.41, 1.24–1.60), high waist size (3.01, 2.57–3.53) and obesity (3.13, 2.72–3.59), and an inverse association is observed with low educational status (0.62, 0.54–0.71), low spouse education (0.68, 0.57–0.80) and smoking/tobacco use (0.74, 0.63–0.83).

Table 1 Lifestyle, anthropometric and biochemical variables in rural and urban women

Variables	*Rural* (n = *2613*)	*Urban* (n = *2005*)	*Total* (n = *4618*)	χ^2 *test for urban–rural difference* (P *value*)
Age groups				
35–39	777 (29.7)	476 (23.7)	1253 (27.1)	39.379 (<0.001)
40–49	820 (31.4)	704 (35.1)	1524 (33.0)	
50–59	608 (23.3)	478 (23.8)	1086 (23.5)	
60–69	328 (12.6)	233 (11.6)	561 (12.1)	
70	80 (3.1)	114 (5.7)	194 (4.2)	
Educational status				
Illiterate	1662 (63.6)	590 (29.4)	2250 (48.7)	666.804 (<0.001)
1–5 years	468 (17.9)	415 (20.7)	883 (19.1)	
6–10 years	410 (15.7)	674 (33.6)	1084 (23.5)	
>10 years	74 (2.8)	326 (16.3)	400 (8.7)	
Smoking/tobacco use				
Current use	871 (39.3)	326 (18.9)	1197 (30.4)	200.339 (<0.001)
Past use	40 (1.8)	17 (1.0)	57 (1.4)	
Fat intake				
⩾30 en%	2447 (93.6)	1876 (93.4)	4323 (93.6)	0.092 (0.762)
Desirable (<30 en%)	166 (6.4)	132 (6.6)	298 (6.4)	
Sodium intake				
<2500 mg per day	2137 (81.8)	1754 (87.4)	3891 (84.2)	24.456 (<0.001)
>2500 mg per day	476 (18.2)	254 (12.6)	730 (15.8)	
Total fibre intake				
Low (<25 g per day)	1688 (64.6)	674 (33.6)	2362 (51.1)	437.651 (<0.001)
Desirable (⩾25 g per day)	925 (35.4)	1334 (66.4)	2259 (48.9)	
Regular physical activity				
Low (<1.4 PAL per day)	1535 (59.5)	1387 (70.1)	2922 (63.2)	66.594 (<0.001)
Moderate (1.4–1.6 PAL per day)	495 (19.2)	337 (17.0)	832 (18.2)	
High (>1.6 PAL per day)	549 (21.3)	256 (12.9)	805 (17.7)	

Abbreviation: PAL, physical activity level.

Table 2 Age-specific mean ± 1 s.d. blood pressure levels in rural and urban women

Age groups	*Mean systolic BP*			*Mean diastolic BP*		
	Rural (n = *2604*)	*Urban* (n = *2004*)	*Total* (n = *4608*)	*Rural* (n = *2604*)	*Urban* (n = *2004*)	*Total* (n = *4608*)
35–39	116.1 ± 14.5	116.4 ± 14.5	116.2 ± 14.5	76.4 ± 9.7	78.0 ± 9.0	77.1 ± 9.4
40–49	121.1 ± 17.4	125.4 ± 18.3	123.1 ± 18.0	78.4 ± 11.3	82.4 ± 10.4	80.2 ± 11.1
50–59	128.1 ± 20.3	131.6 ± 20.5	129.6 ± 20.4	81.2 ± 11.6	83.0 ± 9.9	82.0 ± 10.9
60–69	136.8 ± 24.5	137.1 ± 21.6	136.8 ± 24.5	82.9 ± 12.9	84.5 ± 11.4	83.6 ± 12.3
70	134.1 ± 23.1	144.7 ± 23.1	134.4 ± 23.1	82.4 ± 13.2	86.1 ± 12.1	84.6 ± 12.7
ANOVA trend (*P* value)	350.435 (<0.001)	348.122 (<0.001)	707.701 (<0.001)	108.805 (<0.001)	91.923 (<0.001)	209.863 (<0.001)

Abbreviation: ANOVA, analysis of variance.

Insignificant association is observed with high sodium intake (0.87, 0.73–1.03) and low physical activity (0.70, 0.51–1.10) (Figure 3).

Prevalence of known hypertension is low and history was obtained for 15.8% of the women (urban 26.4%, rural 7.6%) (Table 3). Of the prevalent hypertensive subjects (known plus BP ⩾140/⩾90 mm Hg), only 56.8% of the urban and 24.6% of the rural women were aware of the condition (Table 4). Of the aware hypertensive women, only 38.6% were on drug therapy (rural 46.5%, urban 38.6%). Treatment status increased with age in both the groups. Hypertension control, defined by systolic BP <140 mm Hg and diastolic BP <90 mm Hg, among those on treatment was extremely low, and only 10.2% of the rural and 28.3% of the urban women had controlled BP values. Overall, of the 1672 hypertensive women (rural 746, urban 926), only 18.3% were on treatment (rural 13.1%, urban 22.5%) and control to target was achieved in 3.9% (rural 1.3%, urban 5.9%) ($P<0.05$ for rural–urban difference) (Figure 4).

Significant lifestyle determinants of hypertension awareness, treatment and control were analysed. Rural location was the most important risk factor for awareness, and urban subjects were significantly more likely to be aware of hypertension (age-adjusted OR 3.75, confidence interval 3.05–4.62) and to be on treatment (1.92, 1.47–2.51), and had a greater likelihood for BP control (5.26, 2.47–11.17). Significance of urban–rural difference persisted after multivariate adjustment for age, educational status, dietary fat intake, high waist size and BMI, and multivariate ORs for awareness (2.91, 2.28–3.71), treatment (1.34 (0.98–1.84) and control (4.90, 2.08–11.52) remained significant. Women with higher educational level were also more likely to be aware of hypertension (age-adjusted 1.51, 1.25–1.85, multivariate 0.68, 0.45–1.04), to be on treatment (age-adjusted 2.22, 1.69–2.94, multivariate 1.59, 0.97–2.63) and to be controlled (age-adjusted 2.86, 1.61–5.00, multivariate 1.67, 0.63–4.35).

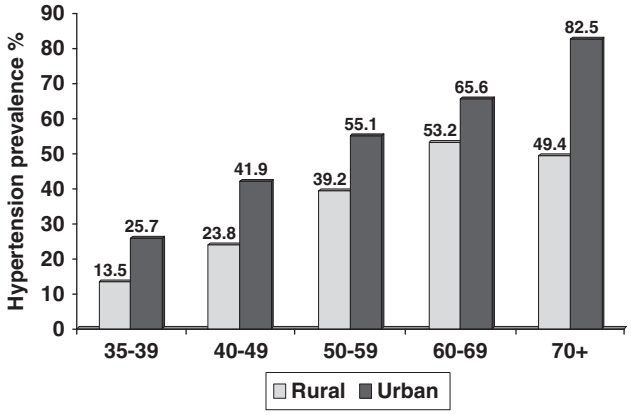

Figure 2 Hypertension prevalence in rural ($n = 2604$) and urban ($n = 2004$) women. The prevalence is significantly greater in urban women at all the age groups. A full colour version of this figure is available at the *Journal of Human Hypertension* journal online.

Discussion

This study shows a high prevalence of hypertension in Asian Indian women, with significantly greater prevalence in urban as compared with rural women. Significant determinants of hypertension are age,

Table 3 Age-specific prevalence of hypertension, isolated systolic hypertension, isolated diastolic hypertension and known hypertension in rural and urban women

Age groups	*Hypertension (known+BP ⩾140 mm Hg /⩾90 mm Hg)*			*Isolated systolic hypertension (systolic BP ⩾140 mm Hg and diastolic BP <90 mm Hg)*			*Isolated diastolic hypertension (systolic BP <140 mm Hg and diastolic BP ⩾90 mm Hg)*			*Known hypertension (history of hypertension with no damaged organ; known+ BP ⩾140 mm Hg /⩾90 mm Hg)*		
	Rural (n = 2604)	*Urban (n = 2004)*	*Total (n = 4608)*	*Rural (n = 2604)*	*Urban (n = 2004)*	*Total (n = 4608)*	*Rural (n = 2604)*	*Urban (n = 2004)*	*Total (n = 4608)*	*Rural (n = 2604)*	*Urban (n = 2004)*	Total (n = 4608)
35–39	103 (13.5)	122 (25.7)	225 (18.2)	17 (2.2)	13 (2.7)	30 (2.4)	47 (6.1)	33 (6.9)	80 (6.4)	21 (2.7)	21 (2.7)	21 (2.7)
40–49	193 (23.8)	294 (41.9)	487 (32.2)	48 (5.9)	36 (5.1)	84 (5.5)	54 (6.6)	77 (11.0)	131 (8.6)	40 (4.9)	40 (4.9)	40 (4.9)
50–59	237 (39.2)	263 (55.1)	500 (46.3)	72 (11.9)	69 (14.4)	141 (13.0)	52 (8.6)	36 (7.5)	88 (8.1)	70 (11.6)	70 (11.6)	70 (11.6)
60–69	174 (53.2)	152 (65.5)	326 (58.3)	56 (17.2)	46 (19.7)	102 (18.2)	23 (7.1)	17 (7.3)	40 (7.2)	59 (18.0)	59 (18.0)	59 (18.0)
70	39 (49.4)	94 (82.5)	133 (68.9)	13 (16.2)	31 (27.4)	44 (22.8)	5 (6.2)	7 (6.2)	12 (6.2)	8 (10.0)	8 (10.0)	8 (10.0)
Age-adjusted (%)	31.5	48.2	39.2	9.0	10.7	9.8	7.0	8.4	7.6	7.6	7.6	7.6

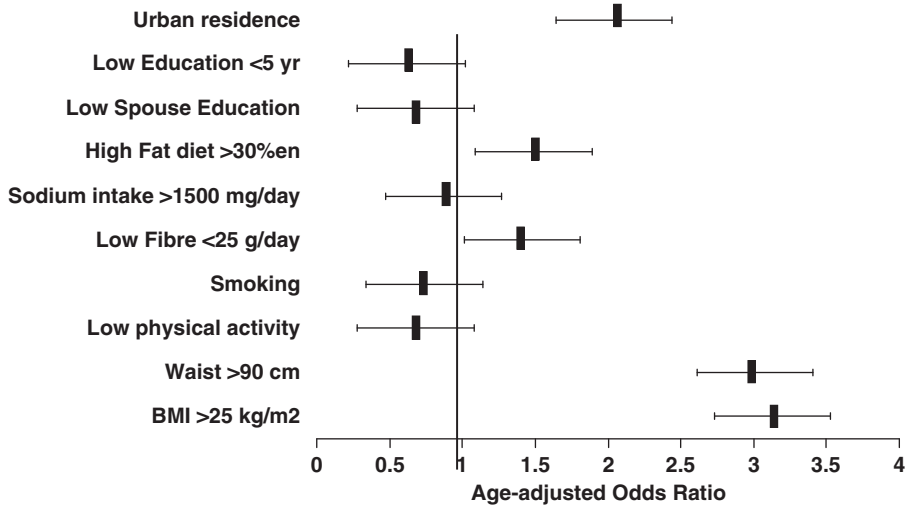

Figure 3 Determinants of hypertension prevalence. Age-adjusted odds ratios show that significant factors are urban residence, high-fat and low-fibre diet, and obesity.

Table 4 Awareness, treatment and control status in rural and urban women

Age groups	*Awareness status (% of prevalent hypertension)*			*Treatment status (% of aware hypertensive subjects)*			*Control status (% of treated hypertensive subjects)*		
	Rural (n = 746)	*Urban (n = 926)*	*Total (n = 1672)*	*Rural (n = 198)*	*Urban (n = 529)*	*Total (n = 727)*	*Rural (n = 98)*	*Urban (n = 208)*	*Total (n = 306)*
35–39	20.4	59.0	41.3	38.1	11.1	17.2	12.5	37.5	25.0
40–49	20.7	49.0	37.8	47.5	36.8	39.1	10.5	22.6	19.4
50–59	29.5	62.7	47.0	51.4	44.8	46.8	13.9	32.4	26.4
60–69	33.9	58.6	45.4	54.2	44.9	48.6	6.3	30.0	19.4
70	20.5	62.8	50.4	37.5	55.9	53.7	—	12.1	11.1
Age-adjusted	24.6	56.8	42.8	46.5	35.7	38.6	10.2	28.3	21.5

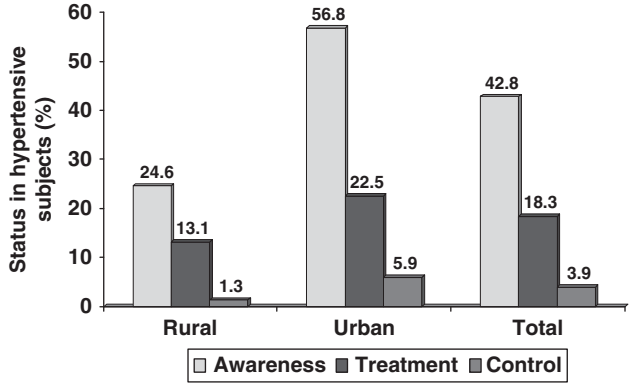

Figure 4 Hypertension awareness, control and treatment status among the subjects with prevalent disease. Less than half are aware of the hypertension, only one in 5 is on treatment and the control rates are very low both in urban and rural women. A full colour version of this figure is available at the *Journal of Human Hypertension* journal online.

urban residence, high dietary fat and low fibre intake, and truncal and generalised obesity. The hypertension awareness, treatment and control status are low, with only half of the urban and a quarter of the rural hypertensive women being aware of their condition; one in five is on treatment and less than 4% are controlled. Rural location is an important determinant of hypertension awareness, treatment and control.

The prevalence of hypertension in the present study is greater than that in the previous studies reported from other regions of India.[36] However, the age group evaluated in the present study is more than in the previous studies, and on using comparable age groups the prevalence is not dissimilar. In the Mumbai Cohort Study where subjects evaluated are similar to those in the present study (35–65 years), the age-adjusted prevalence of hypertension in urban populations was 48% in men and 49% in women.[37] This is more than in the present study and shows that the prevalence of hypertension in smaller cities is lower than that in a large metropolitan Indian city. Hypertension prevalence in the United States is reported to be about 26–31% among adults,[12] which is lower than in the present study. However, the prevalence in the age group 40–59 years is reported to be 35–38%, which is similar to the present study. The high prevalence in the present study could be due to the fact that we measured the BP on a single day, although multiple readings were obtained. This methodology is not similar to the US studies where either an individual is known to be hypertensive on treatment or multiple BP measurements are obtained often over a certain period.[38] We also did not correct for the regression-dilution bias, which is important.[39] The white-coat hypertension is also an important contributor to the high prevalence measured using isolated BP measurements.[38] The prevalence of hypertension using the present methodology is reported to be an overestimate by 20–25%, hence the more realistic prevalence in the present study would be lower by this percentage. The urban–rural gradient observed in the present study is also similar to the previous studies from India. However, this urban–rural gradient has reversed in many high-income countries where hypertension is more in the rural subjects.[38] This shows that the societal changes that influence the reversal of gradient[40] have not yet happened in India. We have not studied the macrolevel societal factors that influence the reversal of urban–rural gradient and therefore cannot comment on this aspect. Previous studies in India that have reported on this gradient have focused on individual factors and reported that most of the hypertension determinants, such as dietary calories, fats and salt, as well as obesity, are less in rural subjects.[41] The present study also shows similar findings and shows that these individual-level factors are important. More studies to identify the societal, social and individual level factors that influence this gradient are required.

Awareness, treatment and control status have been reported in a few studies from India.[18–29] The rates of awareness vary from less than $<5\%$ in rural subjects[42] to more than 60% in Mumbai and Kerala.[20–22] It has been said that in India the rule-of-halves[17] is not valid and a quarter to a third of subjects are aware of hypertension.[24] The present study shows that despite the launch of the national cardiovascular diseases control programme, there is a substantial gap in knowledge and action related to hypertension. Better awareness of hypertension and proper treatment can promote overall cardiovascular

health. One study reported declining trends in multiple risk factors associated with increasing awareness of hypertension.[43] The treatment and control status of hypertension is also low, similar to previous studies from India and other low-income countries.[17] There are multiple determinants of these[44,45] and our study, which evaluated only a few of socioeconomic risk factors, found that rural residence is the most important. Educational status of the woman or her spouse was not found to be important, probably because of a high prevalence of illiteracy and low educational status. Studies from India and low-income countries where public health systems are weak have reported that these subjects are loathe to seek treatment and also discontinue the treatments.[17,46] Other determinants of poor treatment and control are related to healthcare providers, availability of chronic care, financial status of the family and other social determinants of health.[47] We have not enquired details of these factors and cannot comment on their significance.

This study has multiple limitations and strengths. Many have been discussed earlier[30] and include biases introduced because of sampling, non-representation of the Indian population, low response rates, measurement techniques and failure to correct for regression dilution.[30] However, as discussed above, many of the limitations are inherent in cross-sectional epidemiological studies and the data are therefore subject to bias. However, as a similar methodology has been used in the earlier Indian studies, the present data are similarly representative. Strengths of the study include the nationwide scope of the study, adequate representation of rural women and the age group studied.

A low awareness of hypertension coupled with low treatment and control status portends a cardiovascular disaster in India and in similar low-income countries of Asia and Africa where hypertension is highly prevalent.[1] Efforts to increase hypertension awareness using population- and individual-based measures and fundamental changes in health systems are required.[4,48] These would help increase the focus on hypertension, which is a neglected disease in this country.

What is known about this topic

- Cardiovascular diseases are the most important cause of death in women in India and hypertension is an important risk factor.
- Increase in hypertension awareness and control can lead to reduction in cardiovascular mortality.

What this study adds

- More than a third of the middle-aged women have high blood pressure, and important associations are with urban location, high-fat and low-fibre diet, obesity, and truncal obesity.
- There is low awareness and treatment and dismal control status. Important determinants of these are rural location and low educational status.

Conflict of interest

The authors declare no conflict of interest.

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