



# Knowledge and perceptions about hypertension among neo- and settled-migrants in Delhi, India

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## Summary

**Background:** Hypertension has emerged as a major public health problem in developing countries. Despite an increasing prevalence of hypertension in India, people's knowledge and perceptions, which are vital during interventions to bring behavioural change, are not known widely.

**Methods:** Data pertaining to blood pressure, height, weight; socio-demographic details and knowledge and perceptions on hypertension were obtained from a total of 453 individuals (227 neo-migrants and 226 settled-migrants) aged 20 years and above.

**Results:** Around 62% of respondents had heard of blood pressure. This awareness was comparatively more among women and settled-migrants. Less than half of the respondents considered hypertension a serious condition, and a considerable proportion did not perceive that hypertension leads to other diseases. With regard to prevention and control, more than one third suggested lessening tension and anger followed by reducing salt intake/dietary changes, and a very small proportion mentioned that exercise would help. Regarding treatment, three fourths of the respondents considered that hypertension can be treated, mostly by medicines and only 10% considered lifestyle changes along with medicines. Thus, in these communities, more than a half possessed the knowledge, less than a half perceived that hypertension can be prevented, and less than a half of these followed at least one of the lifestyle changes mentioned by them.

**Conclusion:** Despite the higher prevalence of hypertension, knowledge about hypertension was only moderate and comprehensive knowledge was lacking, with the 'rule of halves' still valid in these migrant populations. The study underscores the

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importance of increasing public health knowledge and awareness in preventing and controlling hypertension along with the provision of primary health care services with an emphasis on hypertension and related cardiovascular diseases for these socio-economically disadvantaged communities.

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## Introduction

Hypertension has become a significant problem and contributor to cardiovascular diseases (CVD) in many developing countries [1,2]. Over the last 30 years, there has been an increase in the prevalence and incidence of stroke in India, for which hypertension is one of the principal risk factors [3,4]. The socio-economically disadvantaged communities such as those with migrants are vulnerable to hypertension [5–7]. Hypertension presents a major area of intervention because it is a frequent condition that is amenable to control through both non-pharmacological lifestyle changes and pharmacological treatment [8]. Though well defined preventive strategies through lifestyle and dietary modifications are available for hypertension, it is not clear whether the public has access to this knowledge and services. An insight into the communities' knowledge and perceptions on hypertension is important as prevention requires a life-long adoption of healthy lifestyles. Also, it is essential to gather such information from different communities in order to develop community-specific information, education and communication (IEC) and appropriate strategies to bring about behavioural change. Aubert et al. [8] emphasized the need to gather epidemiological and knowledge, attitude and practices (KAP) data on hypertension. With this rationale and given the paucity of such studies from India, we aimed to focus on knowledge and perceptions on various issues related to hypertension among migrants in Delhi, India.

## Methods

### Study area

Delhi, the national capital of India has been experiencing a great inflow of migrants from neighbouring states. The population of Delhi was 13,782,976 in 2001 [9], and in 2006, the population increased by 285,000 as result of migration with an additional 215,000 as a result of natural population growth [10]. Rapid developmental

activities and opportunities in the city have attracted people and continue to act as a pulling force, particularly for those from the low socio-economic strata. Thus many migrants have settled in Delhi and each day new people join the city. In this study, neo-migrants are defined as those who have migrated to the city of Delhi from rural villages within the last two years, this being their first migration. The settled-migrants are those who have migrated and resided in Delhi for at least 10 years. The settled-migrants were selected from a resettlement colony while the neo-migrants were selected from different slums and work sites. Resettlement colonies are mainly composed of low socio-economic groups, and their residence is legal. Slums are semi-legal squatter settlements and are mainly inhabited by those who have not been able to attain economic stability and are socially marginalized. Generally, neo-migrants find a place to stay either by setting up huts with cheap/waste material or by paying small rents in the slums.

### Study participants

This investigation is a cross-sectional prevalence study with an appropriate sampling strategy. The sample size was estimated according to a standard method [11]. With a confidence level of 95% and an absolute precision of 10% on either side of the true value of the difference between the proportions, the estimated sample size was 193 in each group. For selecting settled-migrants, five blocks of a resettlement colony were selected randomly. In each block, four streets from four directions were selected. On each street, two random points were chosen, and from each random point five individuals were selected. The neo-migrants were selected from three slums and two construction work sites where they work. In each slum, community leaders and members were contacted to identify the newly migrated individuals as these slums were inhabited not only by neo-migrants but also the local population. The identified individuals, who were aged 20 years and above were contacted, and considered for the study after confirming that they migrated within two years from rural villages and that this

was their first migration. Due to the non-availability of neo-migrants during the day time at their residence, we visited their work places based on information given by community members. At work sites the selection criteria were confirmed. Thus, a total of 226 settled-migrants (100 men and 126 women) and 227 neo-migrants (121 men and 106 women) were sampled. The institutional ethics committee approved the study protocol. The purpose of the study was explained, and consent was obtained from all the participants prior to data collection. None of the participants declined to participate, hence the response rate was 100%.

## Data

Three blood pressure readings were taken in a sitting position using a mercury sphygmomanometer as per standard procedure [12]. The mean of the three readings was used for data analysis. Hypertension was defined as a systolic blood pressure  $\geq 140$  mmHg or a diastolic blood pressure  $\geq 90$  mmHg or self reported use of antihypertensive medication. In addition, height and weight were measured following a standard methodology [13]. Socio-demographic details were also collected. The measurements were taken by trained project staff and data were validated by a periodic repeat measurement by the first author. Awareness of hypertension was defined as self reporting of any prior diagnosis of hypertension by a health care provider. Each participant was asked whether he/she had heard of blood pressure. Those who had heard of blood pressure were queried on knowledge, perceptions and practices related to cause, consequences as well as prevention and control of hypertension using a pre-tested interview protocol. Initially the interview was prepared in English and translated to Hindi, the local language of Delhi. The translated version was then reviewed for linguistic reliability and correctness. Later, the protocol was piloted with some hypertensive and non-hypertensive people in a slum, which was not included in this study, to check appropriateness, clarity and the flow of questions. The responses were validated by the first author periodically interviewing the same respondents.

The interview protocol consisted of both closed-ended and open-ended questions. The responses to open-ended questions were narrative and were categorized during analysis. Percentages were calculated and  $\chi^2$  was used as a test of significance of difference. A value of  $p$  less than 0.05 was taken as the minimum level of significance. SPSS v 13.0 (SPSS Inc., Chicago, IL, USA) was used for analyses.

## Results

### Characteristics of the study participants

Table 1 presents some general characteristics of the study participants. Compared to settled-migrants, the majority of neo-migrants were in a younger age group, did not have formal education and had a monthly income up to INR 3000. The majority of settled-migrants were overweight or obese. The majority of neo-migrants had either a normal energy intake or were in chronic energy deficiency. The prevalence of hypertension was comparatively higher among settled-migrants. In both groups the majority falls into a pre-hypertension category.

### Awareness and understanding of hypertension

The term blood pressure instead of hypertension is commonly used by people. They mean that if a person 'has blood pressure/BP', he/she is hypertensive. People were also aware of low blood pressure and specifically mentioned that 'blood pressure/BP is low'. Though a term for blood pressure exists in Hindi (i.e. *rakta chaap*), it is not in popular usage as people use the English phrase, *blood pressure*. Knowledge of hypertension i.e., whether one heard of blood pressure varied between 33% (hypertensive neo-migrant men) and 91% (hypertensive settled-migrant women) (Table 2). A higher proportion of settled-migrants and women possessed knowledge on hypertension compared to neo-migrants and men, respectively. However, knowledge did not differ based on the hypertension status. With further probing of the people who had heard of blood pressure, around 5% settled-migrants and 14% neo-migrants could not explain its meaning. A majority (51% neo-migrants, 71% settled-migrants) stated that blood pressure can be low or high. Some people further explained that it is due to changes in the blood volume and flow (speed). For around 18% of neo-migrants and 13% settled-migrants, hypertension means dizziness; and some stated that hypertension means anxiety/palpitation. Other explanations such as: 'to be checked during pregnancy', 'shortness of breath', 'occurs in middle/old age', 'that affects nerves of body and brain', 'excessive sweating' and 'tingling sensation' were offered. One respondent, a normotensive settled-migrant woman stated that hypertension is a problem related to the heart and two settled-migrants explained it in terms of numbers '*normal BP is 120/80*'.

**Table 1** General characteristics of the study groups.

	Neo-migrants		Settled-migrants	
	% Male (n = 121)	% Female (n = 106)	% Male (n = 100)	% Female (n = 126)
<i>Age group</i>				
20–29 years	51.2	60.4	16.0	9.7
30–39 years	33.1	26.4	43.0	54.8
40–49 years	12.4	11.3	27.0	27.8
50 years and above	3.3	1.9	14.0	8.7
<i>Education</i>				
No education	57.0	67.9	9.0	42.1
1–5 years	5.8	11.3	11.0	18.3
6–10 years	29.8	18.9	51.0	33.3
11–15 years	7.4	1.9	29.0	6.4
<i>Income per month (in INR<sup>a</sup>)</i>				
Up to 3000	61.8	43.4	11.0	25.4
3001–6000	37.2	46.2	34.0	34.9
6001 and above	10.7	10.4	55.0	36.5
<i>Categories of BMI</i>				
CED (BMI < 18.5)	28.9	41.5	3.0	2.4
Normal (18.5–24.9)	65.3	54.7	37.0	42.9
Over weight (25.0–29.9)	5.8	3.8	39.0	39.7
Obese ( $\geq 30.0$ )	0.0	0.0	21.0	15.1
<i>Prevalence of hypertension</i>				
Normal	25.6	37.7	13.0	23.8
Prehypertension	57.0	47.2	62.0	59.5
Hypertension	17.4	15.1	25.0	16.7

<sup>a</sup> Indian Rupee (INR)  $\approx$  US\$ 0.025; BMI = body mass index; CED = chronic energy deficiency.

### Perceptions on the seriousness of hypertension

Around 58% (neo-migrants) and 70% (settled-migrants), of those who had heard of hypertension, expressed that hypertension is a serious problem (Table 3). Those who had replied that hypertension is a serious problem were probed further on 'why it has been considered as serious?' Around 10% of them expressed that any ailment is serious, so too hypertension. In addition, some other explanations were offered. Neo-migrants and settled-migrants differed in their perceptions.

### Knowledge on reasons for hypertension

A majority (49% neo- and 61% settled-migrants), who had heard of hypertension, highlighted tensions/anger as the reason for hypertension (Table 4). A settled-migrant woman expressed, 'Now-a-days people get angry and quarrel over small things; this type of behaviour is responsible for rising blood pressure'. Overweight and high salt intake were among the other reasons but were

quoted by fewer people. Poverty and poor diet were seen as probable reasons by neo-migrants (7%). Some respondents explained that poor people are prone to all types of diseases, as they are subjected to the tensions of getting work and survival. Personal habits such as smoking and drinking were identified as risk factors by a few settled-migrants, in addition to a few other reasons.

### Knowledge and perceptions on consequences of hypertension

Around 58% of the settled- and only 18% of the neo-migrants perceived that hypertension leads to other diseases, and the difference between the two groups was significant (Table 5). Only 50% of hypertensives and 43% of normotensives perceived that hypertension leads to other diseases. When asked to name the conditions due to hypertension, a majority of neo-migrants (44%) and settled-migrants (61%) informed that hypertension leads to a heart problem/heart attack. A considerable proportion of respondents informed that it leads to brain haemorrhage and related problems. In

**Table 2** Knowledge of hypertension among neo- and settled-migrants by sex and hypertension status.

Population	Heard of hypertension	OR (95% CI)
	Number (%)	
<i>Neo-migrants</i>		
Men		
Normal (n = 100)	37 (37.0)	0.85 (0.28–2.52)
Hypertensive (n = 21)	7 (33.3)	
Total (n = 121)	44 (36.4)	
Women		
Normal (n = 90)	46 (51.1)	0.96 (0.29–3.12)
Hypertensive (n = 16)	8 (50.0)	
Total (n = 106)	54 (50.9)	
<i>Settled-migrants</i>		
Men		
Normal (n = 75)	54 (72.0)	1.56 (0.47–5.45)
Hypertensive (n = 25)	20 (80.0)	
Total (n = 100)	74 (74.0)	
Women		
Normal (n = 105)	91 (86.7)	1.46 (0.28–10.16)
Hypertensive (n = 21)	19 (90.5)	
Total (n = 126)	110 (87.3)	
<i>Both migrant groups</i>		
Men		
Normal (n = 175)	91 (52.0)	1.31 (0.65–2.67)
Hypertensive (n = 46)	27 (58.7)	
Total (n = 221)	118 (53.4)	
Women		
Normal (n = 195)	137 (70.3)	1.14 (0.49–2.71)
Hypertensive (n = 37)	27 (73.0)	
Total (n = 232)	164 (70.7)	
Both sexes		
Normal (n = 370)	228 (61.6)	1.16 (0.69–1.97)
Hypertensive (n = 83)	54 (65.1)	
Total (n = 453)	282 (62.2)	

OR = odds ratio, CI = confidence interval.

the respondents' words, brain haemorrhage is 'if blood pressure becomes very high, brain cells swell and burst'. In addition to these, many other problems were mentioned as consequences of hypertension.

**Perceptions on who is prone to hypertension**

In order to have an insight into peoples' perceptions, we asked who is prone to hypertension? A considerable proportion of the neo-migrants (41%) compared to settled-migrants (15%) indicated that anybody can get hypertension (Table 6). Around 29% of settled-migrants and 14% of neo-migrants considered tense and short tempered people as prone to hypertension. Around 17% of settled-migrants and only one of the neo-migrants informed that over weight/obese individuals get hypertension. Several other perceptions were also reported.

**Knowledge on treatment and prevention/control of hypertension**

Table 7 presents the perceptions regarding treatment and preventive aspects of hypertension. About 3/4 of the people, who had heard of hypertension, indicated that hypertension can be treated. Among them, around 96% mentioned that it can be treated by medicines, and a few considered lifestyle changes in terms of dietary changes/low salt, yoga (a system of exercises practiced as part of the Hindu discipline to promote control of the body and mind)/exercise along with medicines. Around 5% considered options other than medicines such as reducing tensions in day-to-day life and a low salt diet.

Regarding prevention, less than half of those who had heard of hypertension indicated that hypertension can be prevented. Around half of

**Table 3** Perceptions on the seriousness of hypertension among those who had heard of hypertension.

Hypertension is a serious health problem	Neo-migrants (n = 98)	Settled-migrants (n = 184)	Normotensives (n = 228)	Hypertensives (n = 54)
No	11 (11.2)	14 (7.6)	21 (9.2)	4 (7.4)
Cannot say/no response	30 (30.6)	40 (21.7)	57 (25.0)	13 (24.1)
Yes	57 (58.2)	130 (70.7)	150 (65.8)	37 (68.5)
<i>If yes, why?<sup>a</sup></i>				
Any ailment is serious and thus health is affected	7 (12.3)	12 (9.2)	15 (10.0)	4 (10.8)
Hypertension is considered serious	—	3 (2.3)	3 (2.0)	0 (0.0)
As it leads to anxiety	11 (19.3)	3 (2.3)	12 (8.0)	2 (5.4)
As it leads to anger	23 (40.4)	3 (2.3)	22 (14.7)	4 (10.8)
As it is dangerous/fatal	7 (12.3)	50 (38.5)	41 (47.1)	16 (43.2)
As it leads to dizziness	15 (26.3)	10 (7.7)	18 (12.0)	7 (18.9)
Leads to weakness/hampers work	14 (24.6)	10 (7.7)	19 (12.7)	5 (13.5)
One can faint	—	10 (7.7)	8 (5.3)	2 (5.4)
Headache	6 (10.5)	8 (6.2)	11 (7.3)	3 (8.1)
May lead to some other problem	—	49 (37.7)	40 (26.7)	9 (24.3)
Loss of body water/dry throat	—	4 (3.1)	3 (2.0)	1 (2.7)
Remains for a long time	—	1 (0.8)	1 (0.7)	0 (0.0)
Could not offer any explanation	3 (5.3)	—	1 (0.7)	2 (5.4)

<sup>a</sup> Multiple responses were given. Figures in parentheses indicate percentages.

**Table 4** Perceptions on the reasons for hypertension among those who had heard of hypertension.

Reasons for hypertension <sup>a</sup>	Neo-migrants (n = 98)	Settled- migrants (n = 184)	Normotensives (n = 228)	Hypertensives (n = 54)
Tensions/anger	48 (49.0)	112 (60.9)	130 (57.0)	30 (55.6)
Diet/over weight	3 (3.1)	17 (9.2)	19 (8.3)	1 (1.8)
Due to high salt	6 (6.1)	2 (1.1)	5 (2.2)	3 (5.6)
Poverty/poor diet	7 (7.1)	1 (0.5)	5 (2.2)	3 (5.6)
Decrease in blood	1 (1.0)	—	1 (0.4)	—
Changed lifestyle	1 (1.0)	—	1 (0.4)	—
Pollution	—	—	1 (0.4)	—
Smoking/drinking	—	8 (4.3)	8 (3.5)	—
Due to diabetes	—	4 (2.2)	3 (1.1)	1 (1.8)
Excess work	—	1 (0.5)	—	1 (1.8)
Due to old age	—	1 (0.5)	1 (0.4)	—
Pregnancy	—	2 (1.1)	1 (0.4)	1 (1.8)
Greed/jealousy	1 (1.0)	2 (1.1)	3 (1.1)	—
Introverts	1 (1.0)	—	1 (0.4)	—
No specific reason	—	4 (2.2)	1 (0.4)	3 (5.6)
Cannot say	26 (26.5)	12 (6.5)	34 (14.9)	4 (7.4)
No response	4 (4.1)	25 (13.6)	22 (9.6)	7 (13.0)

<sup>a</sup> Multiple responses were given. Figures in parentheses indicate percentages.

those who informed that hypertension can be prevented identified lessening tensions/avoiding anger followed by low salt intake/other dietary changes as preventive measures. Exercise and yoga were also considered by some respondents. Differences in these perceptions were apparent between the groups based on migration and hypertension status.

Those who had indicated that hypertension can be prevented were probed to determine whether they were practicing any of the preventive measures mentioned. If the respondent was a known hypertensive, he/she was asked about taking any measures to control hypertension. A relatively higher proportion of settled-migrants compared to neo-migrants were practicing some measures

**Table 5** Perceptions on the consequences of hypertension among those who had heard of hypertension.

Consequences of hypertension	Neo-migrants (n = 98)	Settled-migrants (n = 184)	Normotensives (n = 228)	Hypertensives (n = 54)
No	49(50.0)	19 (10.3)	58 (25.4)	10 (18.5)
Cannot say/no response	31 (31.6)	59 (32.1)	73 (32.0)	17 (31.5)
Yes	18 (18.4)	106 (57.6)	97 (42.5)	27 (50.0)
<i>If yes, why?<sup>a</sup></i>				
Do not know	2 (11.1)	—	1 (1.0)	1 (3.7)
Brain problem	2 (11.1)	36 (34.0)	28 (28.9)	10 (37.0)
Heart problem	8 (44.4)	65 (61.3)	59 (60.8)	14 (51.9)
Paralysis	—	20 (18.9)	13 (13.4)	7 (25.9)
Vision problem	1 (5.6)	—	1 (1.0)	—
Diabetes	1 (5.6)	20 (18.9)	19 (19.6)	2 (7.4)
Body aches	2 (11.1)	—	2 (2.1)	—
Weakness	2 (11.1)	—	2 (2.1)	—
Kidney failure	—	3 (2.8)	2 (2.1)	1 (3.7)
Mental disturbance	—	—	1 (1.0)	—
Some serious problem may occur	—	6 (5.7)	5 (5.2)	1 (3.7)
Cancer	—	6 (5.7)	5 (5.2)	1 (3.7)
Asthma	—	9 (8.5)	8 (8.2)	1 (3.7)
Numbness in limbs	—	1 (0.9)	1 (1.0)	—
Gastric problems	—	1 (0.9)	1 (1.0)	—
Epilepsy	—	4 (3.8)	3 (3.1)	1 (3.7)

<sup>a</sup> Multiple responses were given. Figures in parentheses indicates percentage.

**Table 6** Perceptions on who are prone to hypertension among those who had heard of hypertension.

Who are prone to hypertension <sup>a</sup>	Neo-migrants (n = 98)	Settled-migrants (n = 184)	Normotensives (n = 228)	Hypertensives (n = 54)
Cannot say/no response	27 (27.6)	19 (10.3)	35 (15.4)	11 (20.4)
Anybody	40 (40.8)	27 (14.7)	52 (22.8)	15 (27.8)
Adults/middle age	1 (1.0)	18 (9.8)	15 (6.6)	4 (7.4)
Old age	—	23 (12.5)	16 (7.0)	7 (13.0)
Tense people	14 (14.3)	53 (28.8)	50 (21.9)	17 (31.5)
Who consume more salt	2 (2.0)	—	1 (0.4)	1 (1.9)
Overweight people	1 (1.0)	31 (16.8)	26 (11.4)	6 (11.1)
Pregnant	2 (2.0)	6 (3.3)	7 (3.1)	1 (1.9)
Poor people	3 (3.1)	—	2 (0.9)	1 (1.9)
Rich people	2 (2.0)	1 (0.5)	1 (0.4)	2 (3.7)
Excited people	1 (1.0)	—	1 (0.4)	—
Weak people	2 (2.0)	—	2 (0.9)	—
City people	3 (3.1)	—	3 (1.3)	—
Smokers/drinkers	—	10 (5.4)	8 (3.5)	2 (3.7)
Diabetics	—	3 (1.6)	3 (1.3)	—
Who thinks more/business people/managers	—	6 (3.3)	6 (2.6)	—
Women	—	3 (1.6)	3 (1.3)	—
Selfish	—	1 (0.5)	1 (0.4)	—
More work	—	2 (1.1)	1 (0.4)	1 (1.9)
Non-vegetarians	—	1 (0.5)	—	1 (1.9)

<sup>a</sup> Multiple responses were given. Figures in parentheses indicates percentage.

to prevent/control hypertension (Table 7). On the whole, around half of those who knew about hypertension perceived that hypertension can be prevented. Among those who knew that hypertension

can be prevented, less than half of them were practicing at least one measure. Some respondents (26% neo-migrants, 11% settled-migrants) informed that they were trying to avoid situations that tend

**Table 7** Perceptions on preventive and treatment aspects of hypertension among those who had heard of hypertension.

	Neo-migrants (n = 98)	Settled-migrants (n = 184)	Normotensives (n = 228)	Hypertensives (n = 54)
<i>Can hypertension be treated?</i>				
No	2 (2.0)	17 (9.2)	16 (7.0)	3 (5.6)
Do not know/no response	15 (15.3)	40 (21.7)	44 (19.3)	11 (20.4)
Yes	81 (82.7)	127 (69.0)	168 (73.7)	40 (74.1)
<i>Treatment options for hypertension<sup>a</sup></i>				
Medicines	80 (98.8)	119 (93.7)	162 (96.4)	37 (92.5)
Medicines + dietary changes	9 (11.1)	6 (4.7)	7 (4.2)	8 (20.0)
Medicines + being happy/lifestyle changes	2 (2.5)	4 (3.1)	4 (2.4)	2 (5.0)
Medicines + yoga/exercise	3 (3.7)	4 (3.1)	5 (3.0)	2 (5.0)
Reducing tensions	—	3 (2.4)	2 (1.2)	1 (2.5)
Low salt diet	—	3 (2.4)	3 (1.8)	—
Treat tensions	—	1 (0.8)	—	1 (2.5)
<i>Can hypertension be prevented?</i>				
No	12 (12.2)	9 (4.9)	16 (7.0)	5 (9.3)
Do not know/no response	41 (41.8)	86 (46.7)	106 (46.5)	21 (38.9)
Yes	45 (45.9)	89 (48.4)	106 (46.5)	28 (51.9)
<i>Measures to prevent hypertension<sup>a</sup></i>				
Lessening tensions/anger	23 (51.1)	48 (53.9)	57 (53.8)	14 (50.0)
Low salt/dietary changes	9 (20.0)	37 (41.6)	38 (35.8)	8 (28.6)
Exercise/yoga	4 (8.9)	7 (7.9)	10 (16.7)	1 (3.7)
Other lifestyle changes/be happy	6 (13.3)	12 (13.5)	12 (11.3)	6 (21.4)
<i>Are you taking any preventive/control measures?</i>				
Yes	19 (42.2)	37 (41.6)	37 (34.9)	19 (67.9)
<i>Practices to prevent hypertension<sup>a</sup></i>				
Avoids anger	5 (26.3)	4 (10.8)	6 (16.2)	3 (15.8)
Low salt diet	6 (31.6)	24 (64.9)	16 (43.2)	14 (73.7)
Other dietary changes	8 (42.1)	16 (43.2)	16 (43.2)	8 (42.1)
Exercise (walk/yoga)	—	8 (21.6)	3 (8.1)	5 (26.3)
Other lifestyle changes/tries to be happy	3 (15.8)	—	2 (0.9)	1 (5.3)

<sup>a</sup> Multiple responses were given. Figures in parentheses indicate percentages.

to raise tensions and anger. Physical activity in terms of walking and yoga are practiced only by settled-migrants (22%), and mainly by hypertensive (26%) rather than normotensive people (8%). Neo-migrants are mainly daily wage labourers and the very nature of their work is heavy physical activity. It was a spontaneous response from the neo-migrants that they were already doing heavy physical activity (manual labour) and that there is no need to take-up additional physical activity for health purposes.

## Discussion

The prevalence of hypertension was considerable in both groups of migrants. Though, both groups are at disadvantage compared to the local popula-

tion, settled-migrants are relatively better positioned in resettlement colonies with their own houses and are better integrated with the local culture. On the other hand, neo-migrants stay in unauthorized temporary habitations (slums). Their situation is further exacerbated by work insecurity, unfamiliarity with the geography (particularly sources of health care) and cultural differences. Their situation leads to stress with fewer opportunities to cope. Neo-migrants then are a group in the process of aculturation/urbanization, which contributes to elevated blood pressure levels [5,14]. In addition, they have migrated from rural areas, where the prevalence as well as knowledge and awareness of hypertension are low. Several studies have shown that the prevalence of hypertension increases within a socio-economic gradient [15,16]. However, low socio-economic groups are not exempt from the risk of hypertension [5–7]. In the



present study, 20% of settled-migrants and 16% of neo-migrants were hypertensive, which indicates a serious burden among the total migrant population. An earlier study from Delhi reported 53% of hypertensives were aware of their diagnosis [17]. Mohan et al. [18] reported that only 33% of the hypertensives among an urban population from the South Indian city of Chennai were aware of their condition. Similar findings have been reported in other studies from India [17,19–22] and other countries including Brazil [23], Burkina Faso [24], China [25], Denmark [26], Korea [27], Malaysia [28], Nicaragua [29], Nigeria [30], Portugal [31] and Spain [32]. Studies from the USA reported higher levels of awareness of hypertension [33,34]. This can be attributed in part to ongoing studies and interventions, since improving awareness in the treatment of hypertension is one of the main focuses in the primary prevention of CVDs in the US and many other countries [35–40].

The consequences of hypertension were underestimated by the majority of individuals, particularly neo-migrants. These perceptions likely influence health and treatment seeking behaviour. Ashfaq et al. in Karachi, Pakistan, reported that 56% of patients among squatter settlement dwellers, attending a primary health care institution believed that hypertension could lead to cardiovascular disease [41]. Knowledge about risk factors such as obesity, lack of physical activity and alcoholism was poor. Although a number of settled-migrants knew that obese individuals are at risk of hypertension, no such knowledge was evident among neo-migrants. The relatively better knowledge about hypertension among the settled-migrants might be due to the prevalence of hypertension in their community and also due to access to available health care services. Poor knowledge among neo-migrants could also be attributed to the silent nature of hypertension, the lack of access to health care and a lack of information about hypertension and its consequences.

More than half of the individuals were aware of hypertension, and about a half of them were aware that it can be prevented, of which less than half followed at least one lifestyle change. It can be inferred that the 'rule of halves' is still valid in these migrant populations. Another study in a south Indian urban population likewise found that the 'rule of halves' still applies [42]. Scheltens et al. highlighted the existence of the 'rule of halves' based on data from the Netherlands [43]. Given the considerable prevalence of hypertension with a low level of knowledge, there is a need to strengthen and expand primary health care services to these socio-economically disadvantaged communities. The pri-

mary health care system in India has put more emphasis on IEC and preventive activities related to infectious diseases and family planning and only meagre attempts have been made to prevent CVDs and their risk factors including hypertension. Studies have indicated that measurement of blood pressure, an essential part of the physical examination of any adult, is often neglected in many primary health care centres. It appears that the primary health care system in India is not responding sufficiently to the problem of CVDs [44]. Recently, the Indian government launched a programme including IEC for the prevention and control of diabetes, cardiovascular diseases and stroke [45,46]. However, these activities have yet to reach the communities. Reddy has noted that regardless of the current phase and pace of the epidemiological transition, every developing country will benefit from programs that enable prevention, detection, and treatment of high blood pressure [47]. The findings from studies of this kind are useful in designing community-based strategies to prevent and control hypertension and other CVDs within a primary health care system.

## Conflict of interest statement

The authors declare no conflicts of interest.

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