

Original Research Article

Prevalence and risk factors of hypertension among adults aged 25-64 years in a rural area of Thrissur in Kerala

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ABSTRACT

Background: Lifestyle changes have fuelled the epidemic of obesity, diabetes, hypertension (HTN), dyslipidemia and cardiovascular diseases. Hypertension is a global public health problem. Even though it can be controlled by early diagnosis, lifestyle modifications and adequate treatment; many remain unaware of their hypertension, especially in rural areas where not many studies have been done. The objective of this study was to determine the prevalence and risk factors of hypertension among adults in rural Kerala.

Methods: A community-based cross-sectional study was conducted from December 2011 to May 2012 in the rural field practice area of Amala Institute of Medical Sciences, Thrissur. 423 adults, aged 25–64 years, were selected by multi-stage sampling. An interview was conducted using a pretested proforma and anthropometric measurements were recorded using standard guidelines. Diagnosis of hypertension was based on Joint National Committee (JNC) VII guidelines that included both new and previously diagnosed cases (on anti-hypertensive treatment) of hypertension (Systolic BP ≥ 140 mmHg and/or Diastolic BP ≥ 90 mmHg).

Results: Among the 155 males and 268 females in this study, the prevalence of HTN was 43.3%, of which 98 (53.6%) were previously diagnosed hypertensives and 85 (46.4%) new HTN cases. In the multivariate analysis, the significant risk factors of HTN were age {Adjusted Odds Ratio (AOR)=2.03, (95% CI=1.48-2.79), $p=0.001$ }, male sex {AOR=3.65, (95% CI=1.55-8.62) $p=0.001$ }, central obesity or waist-hip ratio {AOR=23.78, (95% CI=4.47-126.42), $p=0.001$ }, sedentary lifestyle {AOR=2.96, (95% CI=1.48-5.90), $p=0.001$ }, high salt intake {AOR=37.37, (95% CI=18.04-77.45), $p=0.001$ } and current smoking {AOR=3.25, (95% CI=1.15-9.24), $p=0.001$ }.

Conclusions: In this study, the prevalence of hypertension was 43.3%. Pre-hypertension was found among 26.5% of the study population. The risk factors associated with HTN were male gender, increasing age, central obesity, sedentary lifestyle, excess salt intake and current smoking.

Keywords: Hypertension, Prevalence, Risk factors, Rural Kerala

INTRODUCTION

Lifestyles of populations across the world have changed dramatically in the 20th century. This epidemiological transition has been brought about by developments in science and technology that now affect every facet of

human existence. Most human societies have moved from agrarian diets and active lives to fast foods and sedentary habits. Combined with increasing tobacco use, these changes have fuelled the epidemic of obesity, diabetes, hypertension, cardiovascular diseases (CVD) and dyslipidemia.¹ Hypertension (HTN) is a global public

health issue, due to its increasing prevalence and sequelae of debilitating strokes, chronic heart and kidney disease or death due to fatal heart attacks. The World Health Organization (WHO)'s theme for World Health Day theme in 2013 was "The Control of Hypertension". It affects more than one in three adults worldwide and is controllable if diagnosed and treated early.²

Being the most common CVD, HTN affects nearly 26% of the population worldwide. It exhibits the "iceberg phenomenon", where the unknown morbidity exceeds the known morbidity.³⁻⁵ Globally CVD accounts for nearly one third of the total 57 million deaths. Of these, the complications of hypertension account for 9.4 million deaths worldwide every year.^{6,7} HTN is directly responsible for 51% of deaths due to stroke and 45% of all coronary heart disease deaths. The number of hypertensives rose from 600 million in 1980 to one billion in 2008.⁸ In India, HTN has emerged as an important health problem. By controlling HTN, 300,000 of the 1.5 million annual deaths from CVDs can be prevented. The prevalence of HTN is increasing rapidly among Indian urban and even rural population.⁹

In Kerala, there is not much of a divide between urban and rural lifestyles. In a study in 1993, the prevalence of hypertension was reported to be 17.9% among rural adults.¹⁰ There is a misconception that people with HTN generally experience symptoms, but most people with hypertension do not manifest any symptoms. Early diagnosis is therefore very important in HTN control, as it is one of the most treatable causes of mortality and morbidity. HTN is a serious warning sign that significant lifestyle changes are required. It is an "iceberg disease" and a silent killer and it is important that everyone should be aware of their blood pressure in order to take remedial measures to minimize the risk of heart attack, heart failure, stroke and kidney failure.¹¹

There is a paucity of studies on HTN among the rural Indian population. Most people living in the remote rural areas of our country have inadequate access to health care, and rarely seek healthcare unless they fall seriously ill, due to a considerable lack of awareness in the community regarding HTN. A community based HTN study could therefore improve HTN detection among the rural population.¹² It was in this context that the present study on the prevalence and associated risk factors of HTN among adults in the age group 25-64 years, was conducted in 2011 – 2012 to facilitate early detection of HTN in rural Kerala.

Objectives

1. To assess the prevalence of hypertension among adults aged 25–64 years, in Varandarapilly Panchayat, a rural area of Thrissur district in Kerala state.
2. To estimate the associated risk factors.

METHODS

Study design

The present study was a community-based cross-sectional study.

Study setting

It was conducted in Varandarapilly Panchayat, rural Thrissur in the rural field practice area of Department of Community Medicine, Amala Institute of Medical Sciences.

Study period

This study was conducted from September 2011 - September 2013. Data was collected during a period of six months (January 2012 - June 2012).

Study subjects

Adult household members of both sexes, aged 25 – 64 years residing in Varandarapilly Panchayat.

Inclusion criteria

Adults aged 25 – 64 years, residing in Varandarapilly Panchayat and willing to participate in the study.

Exclusion criteria

Acutely ill subjects, pregnant women, and those with abdominal tumours, hernia and /or ascitis.

Sample size

The sample size of 423 study subjects was calculated as for a cross-sectional study ($N = 4pq/d^2$), where p (prevalence of hypertension was taken as 21.4 % as found in the study by Kaur et al, to obtain the true prevalence of HTN at an allowable error of 20 percent at 95% CI and assuming a 15% non-response rate.¹¹

Sampling Method

The study subjects were chosen by Multi-stage sampling.

First stage: Simple random sampling of 3 wards out of 22 wards in Varandarapilly Panchayat.

Second stage: Systematic random sampling of houses in the 3 selected wards.

Third stage: Simple random sampling of adult study subjects from the selected households to obtain a total of 423 study subjects.

Data collection tools

A detailed history was obtained by interview using a pretested and semi-structured questionnaire, to collect data on socio-demographic factors, co-morbidities, lifestyle and anthropometric measurements of height, weight, body mass index (BMI), waist circumference, and waist-hip ratio (WHR) were assessed using standard guidelines.⁷

Blood pressure measurements

BP was measured twice (10 minutes apart) for each study subject, with a calibrated mercury sphygmomanometer using standard guidelines.⁸ It was measured to the nearest 2 mm Hg and the average of two readings was taken as the mean BP. Korotkoff's heart sounds heard in the 1st and 5th phase were recorded as systolic and diastolic BP respectively.

HTN definition

HTN was defined as sustained elevation of systolic BP ≥ 140 mmHg and /or diastolic BP ≥ 90 mmHg, and also included study subjects who were on antihypertensive medication (JNC 7).¹³

Study variables

Socio-demographic details

Age, sex, religion, education, occupation, marital status and per-capita income (according to B.G. Prasad) were recorded.

Life-style factors

Included type of diet, salt intake, fat intake, history of smoking, alcohol and physical activity.

Co-morbidities

History of diabetes / dyslipidemia.

Anthropometry

Height, weight, waist circumference and hip circumference were recorded to calculate BMI and central obesity (WHR).

Blood Pressure (BP)

Systolic BP (SBP) and Diastolic BP (DBP) were recorded as per standard guideline.

Data analysis

Data was collected, coded and entered in Microsoft Excel sheet, re-checked and analysed using SPSS statistical

software version 16. The risk factors associated with HTN was assessed by means of odds ratio, Chi-square test, ANOVA and Logistic regression.

Ethical considerations

Clearance was obtained from the Institutional Research Committee and the Institutional Ethics Committee of our Institute. Informed and written consent was obtained from the Panchayat as well as each of the study participants, willing to participate in the study. Strict confidentiality was maintained so that the information obtained would not be used for purposes other than stated. Hypertensive subjects were referred to the nearest primary health centre for appropriate management. All participants were advised on the need for regular check-up of BP and lifestyle modifications.

RESULTS

Socio-demography

In this cross-sectional study to determine the prevalence of HTN and associated risk factors among adults of Varandarapilly Panchayat, in rural Thrissur, there were 423 adults of age range 25 to 64 years, with mean age of 45.24 ± 12.4 years. Gender-wise, there were 155 (36.6%) males and 268 (63.4%) females. Majority were Muslims (45.4%). Most of the study subjects (96.7%) were married. Educational status showed that 46 of them had no formal schooling.

Occupation

Among the 423 study population, more than half (56.5%) were unemployed. Socio-economic status (SES) as per modified B.G. Prasad classification showed that the majority (43.3%) belonged to Class IV (upper lower) (Table 1).

HTN status

Of the 423 study subjects, there were 183 hypertensives, as per JNC 7 classification.¹³ The prevalence of HTN was 43.3% (95% CI = 38.5 – 48.1%). Those with pre-HTN constituted 112 (26.5%) of the participants, and the rest 128 (30.2%) were normotensives. Among the hypertensives, 98 (53.6%) were previously diagnosed cases of HTN while 85 (46.4%) were new cases detected in this study. Among the 85 newly detected hypertensives, those with stage 1 HTN (140 to 159 / 90 to 99 mm Hg) and stage 2 HTN (≥ 160 / ≥ 100 mm Hg) comprised of 60 (70.58%) and 25 (29.42%) study subjects respectively. Those with both Systolic and high diastolic HTN comprised of 51 (60%) of the new cases of HTN. The mean systolic BP was $126.43 (\pm 20.29)$ mm Hg while the mean DBP was $81.85 (\pm 10.92)$ mm Hg (Table 2).

Table 1: Socio-demographic characteristics of study subjects: (N=423).

	Category	Number	Percentage
Age group in years	25-34	112	26.5%
	35-44	96	22.7%
	45-54	95	22.5%
	55-64	120	28.3%
Gender	Male	155	36.6%
	Female	268	63.4%
Marital Status	Married	409	96.7%
	Not married	14	3.3%
Religion	Hindus	113	25.5%
	Muslims	192	45.4%
	Christians	118	29.1%
Education	Illiterate	46	10.9%
	Literate	377	89.1%
Occupation	Unemployed	239	56.5%
	Employed	184	43.5%
Socio-economic Status (SES) - per capita income (Modified B. G. Prasad)	High Class (I)	14	3.3%
	Upper middle-Class II	52	12.3%
	Lower middle-Class III	52	12.3%
	Upper lower-Class IV	183	43.3%
	Low-Class V	122	28.8%

Table 2: Prevalence and category of hypertension among study subjects.

Category of Hypertension	Number	Percentage
A. By JNC VII classification of HTN (n = 423)		
Normotensives	128	30.2%
Pre-hypertensives	112	26.5%
Hypertensives	183	43.3%
B. By new and old cases of HTN (n = 183)		
Newly diagnosed cases	85	20.3%
Previously diagnosed cases	98	22.9%
C. By Systolic and / or diastolic HTN (n = 183)		
Both SBP and DBP high (SBP/ DBP $\geq 140/ \geq 90$ mm Hg)	51	60%
Only SBP high (SBP/ DBP $\geq 140/ < 90$ mm Hg)	6	7.1%
Only DBP high (SBP/ DBP $< 140/ \geq 90$ mm Hg)	28	32.9%
D. Hypertension by staging (n= 85)		
Stage 1 (BP=140-159/ 90-99 mm Hg)	60	70.58%
Stage 2 (BP= $\geq 160/ \geq 100$ mm Hg)	25	29.42%

Univariate analysis

In the univariate analysis, the association between risk factors and HTN was studied.

Age

The prevalence of HTN was found to increase with age, and this association between HTN and age was found to be statistically significant ($p = 0.001$).

Gender

The prevalence of HTN was higher in males (51.6%) and

this difference was found to be statistically significant ($p = 0.008$).

Salt intake

Excess daily intake (≥ 6 gm) of salt was found to be significantly associated with HTN ($p = 0.001$).

Diabetes

The prevalence of HTN was higher in diabetics as compared to non-diabetics and this difference in the prevalence of HTN was statistically significant ($p = 0.0004$).

Table 3: Association between probable risk factors and HTN (univariate analysis).

Category	Hypertensives Number (%)	Normotensives Number (%)	Significance
A. Age			
25-34	23 (20.5%)	89 (79.5%)	$\chi^2 = 61.98$ df = 3 p = 0.001
35-44	30 (31.3%)	66 (68.7%)	
45-54	48 (50.5%)	47 (49.5%)	
55-64	82 (68.3%)	38 (31.7%)	
B. Sex			
Male	80 (51.6%)	75 (48.4%)	OR=1.71 (1.15 – 2.55) p = 0.008
Female	103 (38.4%)	165 (61.6%)	
C. H/o salt intake			
High (≥ 6 gms)	169 (76.8%)	51 (23.2%)	OR=44.74 (23.9-83.72) p = 0.001
Normal	14 (6.9%)	189 (93.1%)	
D. H/o Diabetes			
Yes	49 (64.5%)	27 (35.5%)	OR=2.87 (1.71 – 4.82) p = 0.001
No	154 (58.6%)	213 (61.4%)	
E. H/o dyslipidemia			
Yes	60 (62.5%)	36 (37.5%)	OR=2.76 (1.73-4.42) p = 0.0008
No	123 (37.6%)	204 (37.6%)	
F. Physical activity			
Yes	143 (51.1%)	137 (48.9%)	OR=2.69 (1.74 – 4.15) P = 0.001
No	40 (28%)	103 (72%)	
G. General obesity (BMI)			
Overweight/obese	140 (50.2%)	139 (49.8%)	2.37 (1.54 – 3.63) p = 0.0002
Normal weight	43 (29.9%)	101 (70.1%)	
H. Central obesity: Waist-Hip Ratio (WHR)			
High	181 (53.7%)	156 (46.3%)	OR=48.73 (11.8 – 201.3) p = 0.0001
Normal	2 (2.3%)	84 (97.7%)	
I. Smoking			
Yes	33 (55%)	27 (45%)	OR=1.73 (1.01 – 3.00) P = 0.001
No	150 (41.3%)	213 (58.7%)	
J. Alcohol			
Yes	31 (56.4%)	24 (43.6%)	OR=1.84 (1.04 – 3.20) p = 0.001
No	152 (41.35%)	216 (58.7%)	

Table 4: Determinants of hypertension (multivariate analysis).

Risk Factors	Cut-offs	Adjusted Odds ratio (OR)	Adjusted OR 95% CI	p value
Age	35-64 years Vs 25 -34 years	2.032	1.48 - 2.79	0.001
Sex	Male Vs female	3.65	1.55 - 8.62	0.003
Salt intake	Excess Vs normal	37.37	18.03 - 77.4	0.001
Alcohol	Current Vs past/never	0.63	0.22 – 1.83	0.401
Smoking	Current Vs past/ never	3.25	1.15- 9.24	0.027
H/o Diabetes	Diabetic Vs non-diabetic	1.07	0.45 – 2.56	0.866
H/o dyslipidemia	High Vs normal	1.17	0.54 – 2.54	0.692
Physical activity	Sedentary Vs Active	2.96	1.48 – 5.90	0.002
Body Mass Index	High Vs low/normal	0.994	0.67- 1.47	0.978
Waist Hip Ratio	High Vs low/normal	23.78	4.47 – 126. 42	0.001

Dyslipidemia

The risk of HTN was 2.76 (95% CI=1.73 – 4.42) times more in those with a history of dyslipidemia and this was found to be statistically significant (p =0.0008).

Physical activity

The risk of HTN was 2.69 times higher among the sedentary study subjects and this association between

sedentary lifestyle and HTN was statistically significant ($p = 0.001$).

Generalized obesity

In this study, being overweight ($\text{BMI} \geq 23 \text{ kg/m}^2$) and/or obese ($\text{BMI} \geq 25 \text{ kg/m}^2$) was associated with 2.7 times the risk of HTN (95% CI = 1.54 – 3.63) and this association was statistically significant ($p=0.0002$).

Central obesity

Excess waist-hip ratio (WHR) and waist circumference (WC) were associated with HTN and this association was found to be statistically significant ($p = 0.001$).

Smoking

It was found that the risk of HTN was 1.73 times more among current tobacco smokers as compared to those who did not smoke and this difference was found to be statistically significant ($p = 0.001$).

Alcohol

The risk of HTN was found to be 1.84 times more among current consumers of alcohol as compared to non-alcoholics and this difference was statistically significant ($p = 0.001$) (Table 3).

Multivariate analysis

In the multivariate analysis of the present study, the risk factors that remained significantly associated with HTN (after adjusting for all known risk factors) were age ($p=0.001$), male gender ($p=0.003$), central obesity / excess waist-hip ratio ($p=0.001$), sedentary lifestyle ($p=0.002$), excess salt intake ($p=0.001$) and current smoking ($p=0.027$) (Table 4).

DISCUSSION

The prevalence of HTN was 43.3% (BP $\geq 140/ \geq 90$ mm Hg) in this community-based study among the rural residents of Thrissur district in Kerala aged 25 – 64 years. This included both the newly detected hypertensives and previously diagnosed cases of hypertension. Pre-hypertensives (BP = 120-139/ 80-89 mm Hg) constituted 26.5% of the study population while the rest of the study subjects (30.3%) were normotensives (BP $< 120/ < 80$ mm Hg). The overall prevalence of hypertension in this study was high (43.3%) and the fact that those with pre-hypertension constituted more than one quarter (26.5%) of the study population is an alarming trend.

The prevalence of hypertension shows wide variation in different studies conducted among different age groups of populations under different study settings at different time periods. Moreover the WHO/JNC criteria for HTN cut-offs also vary from time to time and what was

considered as normal blood pressure (systolic BP / diastolic BP = 120-139/ 80-89 mm Hg) previously has now been included as pre-hypertension.¹³ A BP of 140/90 mm Hg which was earlier considered normal is now listed as hypertension.

Of the 85 newly detected cases of HTN in this study, the majority 60 (70.58%) had stage 1 HTN (BP = 140-159/ 90-99 mm Hg) while the rest of the hypertensives (29.42%) had stage 2 (BP = $\geq 160/ \geq 100$ mm Hg) HTN. This finding is comparable with other studies in rural south India, where more of the study subjects had stage 1 hypertension as compared to stage 2 hypertension. In a Kerala study, the prevalence of HTN among 226 urban study subjects was 47%, while those with pre-HTN formed 41.7% of the study population.¹⁵ A similar finding was noted in a study by Yuvaraj et al, stage 1 and stage 2 HTN was seen in 63.32% and 36.68% respectively of the hypertensive study population.¹⁴ In yet another study by Kaur et al among 10,463 subjects in the 24-65 years age group, stage 1 HTN was found in 71% of hypertensives while stage 2 HTN was seen in 20.3% of the hypertensives.¹¹ Due to the above-mentioned factors, the prevalence of HTN would vary from one study to the other.

In our study, the prevalence of hypertension increased from 20.5% in the 25-34 year age group to 68.2% in the 55-64 year age group. This association between hypertension and age was found to be statistically significant ($p = 0.001$). This is a well-established fact and this upward trend in the prevalence of hypertension was consistently seen in all the age groups. Age has been consistently associated with HTN in all studies. A similar finding was also seen in the rural household community study in Tamil Nadu by Kannan et-al among adults in the age group of 30 years and above, where the prevalence of HTN was 25.2% and it showed an upward trend as age advanced, both in males as well as in females ($p=0.001$).¹⁶ This upward trend in HTN with increasing age was also noted by Fikru et al in an urban population based study in Addis Ababa, Ethiopia among 3713 participants between the ages of 25-64 years.¹⁷

The prevalence of hypertension was higher in males (51.6%) as compared to females (38.6%) and this gender-wise difference in hypertension was statistically significant ($p=0.008$). A similar finding was seen in a longitudinal study 'Prolife' spanning over 20 years, and conducted by 'Health Action by People' among 3422 adult subjects in Chemmaruthy Panchayat of Varkala in Thiruvananthapuram district in which 33.5% of the subjects were hypertensive and gender wise, 37.7% of males were affected as compared to 31.5% of females.¹⁸ Men were found to have higher predilection for hypertension than women OR= 1.31 (95% CI 1.13 – 1.52). Yet another study by Mohan et al in "The Chennai urban rural epidemiology study" (CURES) in urban Chennai among 26,001 individuals aged ≥ 20 years assessed the prevalence of hypertension to be 20% and of this, there was a statistically significant difference

($p < 0.001$) in the prevalence of HTN in men (23.2%) as compared to that of women (17.1%).¹⁹ This association between hypertension, increasing age and male sex was also seen in the study by Prasanth et al.¹⁸ In contrast, the prevalence of hypertension was found to be significantly associated with age and female sex in a study by Kalavathy et al.²⁰

The association between daily intake of excess salt (>5 gms) and hypertension was found to be statistically significant ($p = 0.001$). A similar finding was seen in another study, the prevalence of hypertension was significantly higher in those who consumed excess dietary salt as compared to those not taking excess salt.²¹ (OR = 6.36, 95%CI 3.46–11.66). Excess dietary salt intake is a well-established risk factor for HTN which is a gateway for all other non-communicable diseases as well. The WHO recommended level of daily intake of salt is equal to or less than 5 gm. In Kerala, on an average, a person consumes 25-35 grams of salt in the daily diet. Salt consumption has increased in India from 10.7 g/person/day in 1971 to 13 g in 1981, 15.8 g in 1991 and 16.9 in 1994 and is an environmental risk factor for HTN.²²

There was a statistically significant association between HTN and central obesity (WC) and this association between HTN and high WHR remained statistically significant ($p = 0.002$) in the multivariate analysis. Similar findings in the association between central obesity and HTN were noted in various studies.^{17,23} In this study, it was found that the risk of hypertension was 1.73 times among current tobacco smokers as compared to those who do not smoke. This difference in the risk of hypertension between current smokers versus past/ never smokers was found to be statistically significant ($p = 0.001$) as was found in various studies.^{17,23,24}

The risk of hypertension was 2.69 times higher among those who were sedentary as compared to those engaged in physical activity and this difference in the prevalence of HTN was found to be statistically significant ($p = 0.001$). This finding is comparable to other studies conducted in India and in other countries.^{17,18-21,23}

In the multivariate analysis of the present study, the risk factors significantly associated with hypertension, were age {AOR = 2.032 (95% CI=1.48 – 2.79) $p = 0.001$ }, male sex {AOR = 3.65 (95% CI=1.55 – 8.62) $p = 0.003$ }, central obesity (excess waist-hip ratio {AOR = 23.78 (95% CI=4.47 – 126.42) $p = 0.001$ }, lack of physical activity {AOR = 2.96 (95% CI=1.48 – 5.9) $p = 0.001$ }, excess salt intake {AOR = 37.37 (95% CI=8.03 - 77.4) $p = 0.001$ }, and current smoking {AOR = 3.25 (95% CI=1.15 – 9.24), $p = 0.027$ }. These findings are similar to those observed in various studies.^{11,12,14,15,17}

CONCLUSION

In this study, the prevalence of HTN in the adult population of rural Kerala was 43.3%. Those with pre-HTN constituted 112 (26.5%) of the participants, and the

rest 128 (30.2%) were normotensives. Among the hypertensives, 98 (53.6%) were previously diagnosed cases of HTN while 85 (46.4%) were new cases detected in this study. Among the 85 newly detected hypertensives, those with stage 1 HTN (140 – 159 / 90 – 99 mm Hg and stage 2 HTN comprised of 60 (70.58%) and 25 (29.42%) study subjects respectively. Of the new cases of HTN, those with both high systolic BP (SBP) and high diastolic BP (DBP) constituted 51 (60%). The risk factors found to be significantly associated with HTN in this study were increasing age, male gender, central obesity (high WHR), current smoking, sedentary lifestyle and excess salt intake. The results of this community-based cross-sectional study point to the multi-factorial aetiology of hypertension.

Recommendations

The increasing trend of HTN in the most productive age group of population is an emerging problem worldwide, but more so in developing countries like India and especially in Kerala. Creating awareness about the harmful effects of sedentary lifestyle, central obesity, use of excess salt and tobacco smoking should be initiated in the community. Mass screening programs to detect hypertension should be conducted as it involves only an accurate measurement of blood pressure and is one of the most feasible, quick, easy, non-invasive and least expensive clinical method and requiring a skilled examiner and a standardized manometer without need for any additional equipment. Screening should also be utilised as an opportunity to emphasize on risk factor modifications for the prevention and control of HTN.

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