

# Factors associated with uncontrolled hypertension in patients attending a medical clinic of a tertiary care hospital in Sri Lanka

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## Abstract

**Objectives:** Uncontrolled hypertension is common. Objective of this study was to describe factors associated with uncontrolled hypertension in a group of patients on treatment for hypertension.

**Method:** A cross-sectional descriptive study was conducted in a medical clinic of a tertiary care hospital in Sri Lanka. Consecutive patients on treatment for hypertension had two readings of blood pressure (BP) 1-2 minutes apart and lower of the two was taken, as the current BP. All patients not achieving a systolic BP of <140mmHg and/or a diastolic BP of <90 mmHg, were recruited. Socio-demographic and clinical data were collected by an interviewer-administered questionnaire. Level of adherence to medications was assessed by Voils two-part measure of medication non-adherence.

**Results:** 260 patients were studied (women: 61.2%; mean age: 64.9±9.5years). Mean systolic and diastolic BP were 160.5±16.3mmHg and 91±11.1mmHg, respectively. Mean duration of treatment was 8.5±7.2years. Mean number of anti-hypertensive medications per patient was 2.1±0.8. 70.4% were non-adherent to medications. 13.5% were on concomitant medications known to increase BP. 89.2% had one or more non-medication related factor contributing to uncontrolled BP. 64.6% lacked adequate physical activity. 45% had BMI ≥25kg/m<sup>2</sup>. Self-reported salt consumption was high among 13.1%. 38.5% admitted adding salt to rice cooked at home. 31.5% had inadequate sleep duration. 43.8% reported snoring during sleep. 8.9% of men

reported excess and/or binge consumption of alcohol. 6.9% had chronic kidney disease. Clinician inertia was identified as the cause in 4.6%. True resistant hypertension was observed only in 2.7%.

**Conclusion:** In the study population, majority had correctable factors associated with uncontrolled hypertension. Non-adherence to medications was a major problem. Among the others the main contributing factors were inadequate physical activity, obesity, inadequate sleep and excess salt consumption. True resistant hypertension was seen only in a small proportion.


**Key words:** uncontrolled hypertension. factors associated, anti-hypertensive medications, non-adherence, Sri Lanka

## Introduction

Hypertension is the main preventable cause for cardiovascular disease and all-cause-death worldwide.<sup>1,2</sup> It is defined as having a systolic blood pressure (SBP) of ≥ 140mmHg and/or diastolic blood pressure (DBP) of ≥ 90mmHg.<sup>1,2</sup> Recent trends show that the estimated prevalence of hypertension is higher in low- and middle-income countries (LMIC) than in high-income countries (HIC) with an estimated 349 million with hypertension in HIC and 1.04 billion in LMICs.<sup>3</sup> Compared to HIC, LMIC show low levels of awareness, treatment and control rates.<sup>1</sup> Prevalence of hypertension in Sri Lanka is reported to be 24%-30%<sup>4-6</sup> and it is more than 50% among those who are aged 60 years or more.<sup>4</sup>

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Hypertension is a major risk factor for ischaemic and haemorrhagic stroke, coronary artery disease, heart failure, sudden death, peripheral artery disease, chronic kidney disease and cognitive decline<sup>7,8</sup> and it has been found to be the leading global contributor to premature death.<sup>9</sup> Blood pressure reduction achieved by treatment for hypertension is consistently found to be associated with reduced morbidity and mortality.<sup>10-12</sup> The recommended essential requirement for the target blood pressure reduction in all patients is <140/90 mmHg.<sup>1,2</sup> A lower target (<130/80mmHg but not <120/70mmHg) is recommended as the optimal management in those < 65 years and in specific groups.<sup>1,2</sup>

Uncontrolled blood pressure is defined as failure of achieving the blood pressure target. It increases the health care expenditure of a country while increasing morbidity and mortality. Evidence indicate that uncontrolled hypertension is a common global problem.<sup>3</sup> In Sri Lanka, in community-based studies 56.5% - 83% have been observed to have uncontrolled hypertension.<sup>5,6,13</sup> In a clinic-based study in Sri Lanka 41% were detected to have uncontrolled blood pressure.<sup>14</sup>

Factors contributing to uncontrolled hypertension need to be identified when establishing an appropriate blood pressure control strategy. These factors could be categorized as those related to patients, clinicians and the healthcare system. A key patient-related factor is non-adherence to medications. Nonadherence to antihypertensive treatment is reported to be seen in 10%-80% of hypertensive patients.<sup>1,2,15</sup> Obesity, inadequate physical activity, high salt intake, inadequate sleep, excessive use of alcohol, recreational drug abuse, use of over-the-counter medications are known to cause a rise in blood pressure and undetected secondary causes including obstructive sleep apnoea and chronic kidney disease are some other patient-related factors.<sup>2</sup> Clinician inertia and concomitant prescription of medications causing a rise in blood pressure are main clinician-related factors.<sup>2</sup> Clinician inertia refers to physicians' failure to take appropriate therapeutic action in patients with uncontrolled hypertension. Limitation of resources such as unavailability of medications is a health system related factor.

We planned a study to describe the factors associated with uncontrolled hypertension in a group of patients with inadequate blood pressure control, attending a medical clinic at a tertiary care hospital in Sri Lanka.

## Methods

### Study design and setting

This was a cross sectional descriptive study

conducted at the medical clinic of the University Medical Unit of Colombo South Teaching Hospital, Kalubowila, Sri Lanka. The study was conducted from January to April 2018.

### Study participants

Consecutive sampling was done. Patients on a stable anti-hypertensive regimen for more than 3 months had two readings of blood pressure (BP), 1-2 minutes apart and lower of the two was taken as the current BP. Blood pressure was measured using validated and regularly calibrated electronic sphygmomanometers (Omron HEM-7270) which was the routine practice at the study site. All consenting patients not achieving target BP were recruited to the study. The target was a systolic BP of <140mmHg and a diastolic BP of <90 mmHg.

### Data collection

Socio-demographic and clinical data were collected by an interviewer-administered questionnaire. The details were obtained from clinic records and patient interviews. The questionnaire included details related to current BP, duration of hypertension, severity of hypertension at the time of diagnosis, anti-hypertensive medications, concomitant diseases, concomitant medications including medications prescribed from other clinics and private consultations and self-medication, alcohol consumption, salt consumption, exercise and sleep. Alcohol consumption was considered contributing to inadequate BP control if the weekly consumption was exceeding 14 units and/or if there was binge drinking within the preceding week. Self-rated salt consumption was reported as high, moderate or low. Participants were questioned on addition of salt to rice cooked at home. Regarding physical activity, engagement in moderate to high level of physical activities (defined as: on average 30 minutes per day on at least 5 days of activities like brisk walking, running, cycling, swimming, sweeping the garden, digging, construction work, carrying or lifting heavy weights) was recorded. Inadequate sleep was defined as sleep duration of less than 6 hours in those aged <65 years and less than 5 hours in those aged ≥ 65 years.

Level of adherence to anti-hypertensive medications was assessed by Voils two-part measure of medication non-adherence.<sup>16,17</sup> This tool is a validated self-administered questionnaire specially designed to measure adherence to anti-hypertensive medications. Part 1 is to measure the extent of non-adherence and the part 2 is to assess the reasons for non-adherence.

In part 1, there are 3 questions assessed with a Likert Scale with 5 responses varying from “never” to “always”. The item response category consistent with perfect adherence is assigned a value of 1, and the item response category reflecting most non-adherence is assigned a value of 5. The maximum possible score for a single item is 5 and each item is marked out of 5. Then the scores for the 3 items in the Extent scale is averaged, with higher scores representing greater non-adherence. Voil’s score of 1 is considered as adherence and scores more than 1 is considered as non-adherence. Part 2 is administered when Part 1 indicates non-adherence. In Part 2, there are 24 items to determine the reasons for non-adherence. The tool was translated to Sinhala and Tamil languages and self-administered in each patient’s mother tongue.

Height and weight were measured with standard devices and body mass index (BMI) was calculated.

**Ethical aspects**

Ethical clearance for the study was obtained from Ethics Review Committees of Faculty of Medical Sciences, University of Sri Jayewardenepura and Colombo South Teaching Hospital. Informed written

consent was obtained from all participants prior to recruitment to the study.

**Statistical analysis**

Statistical analysis was performed using Statistical Package for Social Sciences (SPSS) version 21. Percentages and means were used to describe the characteristics of the study population and prevalence of causes for uncontrolled hypertension. The Chi squared test was used to assess the statistical significance of associations. P values less than 0.05 were considered to be statistically significant.

**Results**

**Characteristics of the study population**

Out of 825 hypertensive patients screened, 260 (31.5%) had uncontrolled hypertension. The mean age of those with uncontrolled hypertension was 64.9±9.5 years. 61.2% were women. 81.2% had more than primary level (i.e. upto grade 5) of education. 47.7% each had diabetes, and coronary artery disease. 45% had BMI ≥25 kg/m<sup>2</sup>. Chronic kidney disease was found in 6.9% (Table 1). 31.9% had 3 or more comorbidities.

**Table 1. Prevalence of Co-morbidities (n=260)**

<i>Co-morbidity</i>	<i>Prevalence %</i>	<i>Number of comorbidities</i>	<i>Frequency %</i>
Diabetes mellitus	47.7	0	5.4
Coronary artery disease	47.7	1	24.6
BMI ≥ 25 kg/m <sup>2</sup>	45	3	24.2
Dyslipidemia	18.8	4	5.8
Asthma	18.5	5	1.5
COPD	4.6	6	0
Stroke	8.1	7	0.4
Chronic kidney disease	6.9		
Heart failure	6.5		
Hypothyroidism	5.8		
Hyperthyroidism	1.5		

BMI=Body Mass Index;  
COPD=Chronic Obstructive Pulmonary Disease

### Level of blood pressure control and antihypertensive medication use

The mean systolic and diastolic blood pressures of the study population were  $160.5 \pm 16.3$  mmHg and  $91 \pm 11.1$  mmHg, respectively. 46.9% had BP in the range of Grade 2 hypertension.

The mean duration of treatment for hypertension was  $8.5 \pm 7.2$  years. The mean number of anti-hypertensive medications per patient was  $2.1 \pm 0.8$ . 32.7% were on 3 or more antihypertensive medications. Losartan, enalapril, amlodipine and hydrochlorothiazide were the most commonly used antihypertensive medications (Table 2). The most frequently used single drug was a Renin Angiotensin System (RAS) blocker (20.8%). The most frequently used two-drug combinations were combination of a RAS blocker and a calcium channel blocker (CCB) (19.2%)

and combination of a RAS blocker and a beta blocker (18.5%). The most frequently used three drug combination was a RAS blocker, a CCB and a thiazide diuretic (8.5%). The most frequently used fourth drug was an alpha blocker ( $n=7$ ). No patient received spironolactone.

### Non-adherence to anti-hypertensive medications

Based on the Voils Score, 183/260 (70.4%) were non-adherent to anti-hypertensive medications. (i.e Voils score  $> 1$ ) The mean Voils score was 2 out of 5 (SD=0.9). There was no significant association between non-adherence to anti-hypertensive medications and gender, age, level of education, number of anti-hypertensive medications used, mean duration of treatment, number of comorbidities or presence of specific co-morbidities (Table 3).

**Table 2. Antihypertensive medications (n=260)**

<i>Antihypertensive medication</i>	<i>Usage %</i>	<i>Number of medications</i>	<i>Usage n (%)</i>
Losartan	50	1	62 (23.8)
Enalapril	26.9	2	113 (43.5)
Amlodipine	23.5	3	73 (28.1)
Hydrochlorothiazide	23.5	4	11 (4.2)
Atenolol	20.8	5	1 (0.4)
Captopril	15.4		
Carvedilol	13.1		
Diltiazem	11.9		
Prazosin	12.3		
Nifedipine	10.8		
Bisoprolol	2.3		
Verapamil	0.8		
Metoprolol	0.4		
Methyl Dopa	0.4		

**Table 3. Association between non-adherence to anti-hypertensive medications and socio-demographic and clinical characteristics (n=260)**

<i>Characteristic</i>	<i>Non-adherent %</i>	<i>p value*</i>
Overall	<b>70.4</b>	
Gender: Men Women	67.3 72.3	0.389
Age: <60 years ≥60 years	66.2 72	0.365
Education: Up to Grade 5 Grade 6 to O/L A/L or more	79.2 71.2 57.1	0.069
Number of anti-hypertensive medications: 1 2 3 4 5	71 71.7 68.5 63.6 100	0.926
Duration of hypertension: <5 yrs 5 to 10 yrs >10 yrs	75.2 69.8 65.2	0.305
Number of co-morbidities: <3 ≥3	70.8 60	0.463
Diabetes mellitus: Yes No	71.8 69.1	0.639
Dyslipidaemia: Yes No	69.4 70.6	0.865
Chronic kidney disease: Yes No	55.6 71.5	0.153
Coronary artery disease: Yes No	72.6 68.4	0.459
Heart failure: Yes No	58.8 71.2	0.280
Stroke: Yes No	61.9 71.1	0.375
BMI ≥25 kg/m <sup>2</sup> : Yes No	68.4 72	0.521

\*p value with Chi square test; BMI = Body Mass Index

Among the 24 reasons given in the part 2 of Voils measure of medication non-adherence, the most commonly reported reason was "I was busy" (46.5%) followed by "I forgot" (44.2%). 22.7%

mentioned having to take the medications too many times as a reason. 18.1% felt they didn't need the medications. Side effects was a reason in 13.1% (Table 4).

**Table 4. Reasons for non-adherence (n=183)**

<i>Reason for non-adherence</i>	<i>Frequency %</i>
I was busy	46.5
I forgot	44.2
I was supposed to take them too many times	22.7
I came home late	18.1
I felt I didn't need them	18.1
The time to take them was between my meals	15.8
Medication caused some side effects	13.1
I felt well	12.7
I was with friends or family members	11.9
I was in a public place	11.9
I didn't want to	11.9
I was travelling	11.9
I did not have any symptoms of high BP	11.5
I was afraid the medication would interact with other medication I take	9.2
They make me need to urinate very often	7.3
I worried about taking them for the rest of my life	6.9
I ran out of medication	6.2
I was going on a long journey by car/bus/plane	6.2
I had other medication to take	5.8
I was afraid of becoming dependent on them	5.8
My BP was too low	4.6
They cost a lot of money	2.3
I was afraid they may affect my sexual performance	1.2
I was feeling too ill to take them	0.8

**Use of concomitant medications causing uncontrolled hypertension**

13.5% (n=35) of the study population were on concomitant medications known to increase BP. 7.3% were on non-steroidal anti-inflammatory drugs (NSAID) and 5.4% were on amitriptyline. Use of concomitant medications was significantly higher in women compared to men (17% vs 7.9%, p=0.037). The main source of the prescription of concomitant medications was the same medical clinic (42.9%). The other sources included other clinics (28.6%), private sector consultations (14.3%) and self-medication (11.4%).

**Non-medication related causes for uncontrolled hypertension**

89.2% of patients had one or more non-medication

related cause contributing to inadequate blood pressure control. 8.9% of men reported excess or binge consumption of alcohol. None of the women consumed alcohol. 64.6% lacked adequate physical activity. BMI was  $\geq 25\text{kg/m}^2$  in 45%. Self-rated salt consumption was high among 13.1%. 38.5% admitted adding salt to rice cooked at home. Sleep duration was inadequate in 31.5%. 43.8% reported snoring during sleep (Table 5). Compared to men, significantly higher proportion of women reported inadequate physical activity (74.2% vs 49.5%, p<0.001). BMI  $\geq 25\text{ kg/m}^2$  was more common among women (52.2% vs 33.7%, p=0.003) and those <60 years of age (59.2% vs 39.7%, p=0.005). Snoring during sleep was more common among those aged <60 years (56.3% vs 39.2%, p=0.013). All 10 patients who reported that the job involves night shifts were men (Table 5).

**Table 5. Non-medication related causes for uncontrolled hypertension**

<i>Non-medication related cause</i>	<i>Overall</i>	<i>Men %</i>	<i>Women %</i>	<i>&lt;60 years %</i>	<i>≥ 60 years %</i>
Alcohol consumption exceeding 14 units per week	2.7	6.9 <b>P &lt;0.001*</b>	0	5.6 P=0.257	1.6
Binge consumption of alcohol within the previous week	0.8	2 <b>P &lt;0.001*</b>	0	1.4 P=0.257	0.5
Inadequate physical activity	64.6	49.5 <b>P &lt;0.001*</b>	74.2	56.3 P=0.087	67.7
BMI $\geq 25\text{ kg/m}^2$	45	33.7 <b>P=0.003*</b>	52.2	59.2 <b>P=0.005*</b>	39.7
Self-reported high salt consumption	13.1	13.9 P=0.459	12.6	14.1 <b>P=0.033*</b>	12.7
Adding salt to rice cooked at home	38.5	39.6 P=0.763	37.7	40.8 P=0.628	37.6
Frequent consumption of food items having high salt content (eg. pickles, chilli paste, fried rice, salted fried chillies, dried fish, canned fish, marmite/vegemite)	11.2	13.9 P=0.290	9.4	11.3 P=0.260	11.1
Inadequate sleep duration	31.5	24.8 P=0.061	35.8	26.8 P=0.310	33.3
Self-reported snoring during sleep	43.8	42.6 P=0.742	44.7	56.3 <b>P=0.013*</b>	39.2
Job involving night shifts	3.8	9.9 <b>P &lt;0.001*</b>	0	7 P=0.100	2.6

All p values are based on Chi Square test; \*p<0.05



### Clinician inertia as a cause for uncontrolled hypertension

Clinician inertia was the cause for uncontrolled hypertension in 12 (4.6%). We defined clinical inertia as absence of any other correctable factor for uncontrolled hypertension and patient being on less than 3 medications.

### Resistant hypertension

Among the 260 participants, 253 (97.3%) had one or more correctable cause for uncontrolled hypertension. Only 7 (2.7%) had true resistant hypertension. One of the patients with true resistant hypertension had secondary resistant hypertension due to chronic kidney disease.

### Discussion

Uncontrolled hypertension was seen in 31.5% of patients on treatment for hypertension at the study site. COBRA-BPS study group reported that 56.5% of patients on treatment for hypertension in a rural community of Sri Lanka had uncontrolled hypertension<sup>13</sup> and it was 67.9% in an urban population in Gampaha district.<sup>6</sup> Uncontrolled hypertension in rural communities in Pakistan and Bangladesh were 52.8% and 70.6% respectively.<sup>13</sup> Prevalence of uncontrolled hypertension in the clinic setting is expected to be lower than the prevalence in the community as those who visit the clinic regularly are likely to be more motivated towards achieving blood pressure control. A previous clinic-based study in Sri Lanka has found 41% to have uncontrolled hypertension.<sup>14</sup> What we observed was lower than that.

We found that among those with uncontrolled hypertension, the great majority (97.3%) had at least one correctable factor. The most common correctable factor was non-adherence to anti-hypertensive medications. 70% of the study population showed nonadherence. This is different to what has been found in a previous study from Sri Lanka where more than 90% were adherent to antihypertensive medications.<sup>14</sup> Globally, nonadherence to medications is seen in 10%-80% of hypertensive patients and it is one of the key factors for poorly controlled hypertension.<sup>18-20</sup> Studies based on the measurement of antihypertensive medication level in blood or urine have shown that low adherence to the prescribed medications is seen in many patients with apparently resistant hypertension.<sup>20,21</sup> The 2018 European Society of Cardiology (ESC) and the European Society of Hypertension (ESH) guidelines for the management of arterial hypertension and 2020 International Society of Hypertension Global Hypertension Practice Guidelines

put strong emphasis on the importance of evaluating treatment adherence as a major cause of poor blood pressure control.<sup>1,2</sup> In the study population we could not find any association between the rate of nonadherence and the sociodemographic or clinical characteristics of the patients though the previous reports indicate that poor adherence is inversely correlated with the number of pills prescribed.<sup>2,18</sup>

The reasons for suboptimal adherence include patient beliefs and behaviours, poor patient-clinician relationship, the complexity and tolerability of medication regimen and deficiencies in the healthcare system such as unavailability of medications.<sup>18</sup> In the study population the two most commonly reported reasons for nonadherence were being busy and forgetting to take the medications. Both were patient related factors. Being busy has emerged as a reason because patients do not consider taking treatment for hypertension as a priority. One fifth of the population reported that they didn't feel that they need medications for hypertension. To improve the situation, better communication between the patient and the clinician is needed. If time is a limiting factor, other health professionals such as clinical pharmacists could contribute. Better communication will improve patients' perception regarding the disease and its treatment which in turn would likely to improve the adherence. For addressing the issue regarding forgetting, measures such as simplifying the drug regimen with single pill combinations and once-daily formulations and synchronizing medications are important. In our study sample the number of medications was not associated with the rate of non-adherence. However, nearly one fourth gave the reason for nonadherence as "I was supposed to take them too many times." The other methods to overcome the problem of forgetting to take the medications include using blister packs, pill boxes, medication calendars or electronic reminders.

Usage of concomitant medications causing increased blood pressure is a well-recognized factor associated with uncontrolled hypertension<sup>1,2,22</sup> and it was seen in a considerable proportion of patients in our study population. More than half of them were on a NSAID. NSAIDs are widely used in clinical practice as analgesics specially in aged populations such as the study population. When analgesia is needed in a patient with hypertension, clinicians need to make a careful evaluation to see whether the pain could be managed without NSAIDs and if NSAIDs are unavoidable they should be prescribed for the minimum required duration. Our study findings highlight that in a patient who fails to achieve adequate control of blood



pressure, clinicians need to pay attention to identify concomitant medications contributing to raised blood pressure and to make appropriate adjustments to the prescription.

In the study population the poor control seemed to be multifactorial in many. While 70% were non-adherent to treatment, almost 90% had one or more non-medication related factor contributing to poor blood pressure control. Two thirds of the population lacked physical activity and it was a bigger problem among women. Obesity was seen in almost half of the study population and it was more common among women which was compatible with having higher rates of inadequate physical activity among them. A considerable proportion had self-declared high salt consumption. 40% admitted adding salt to rice cooked at home. This is a significant source of salt at Sri Lankan households which could be easily prevented by patient education. Sleep related problems were also common. One third had inadequate sleep duration and close to half reported snoring during sleep. The proportions with obesity and snoring were almost similar (45% and 43.8%) suggesting that undetected obstructive sleep apnoea is likely to be a cause for uncontrolled hypertension in a significant proportion of patients in the study population. Obesity and snoring both were more common among the younger age group (age <60 years). Excess or binge consumption of alcohol was found only in a small proportion. However, it was a contributing factor in nearly one tenth of men. Overall, these findings indicate that there is much room for improvement of blood pressure control through intensifying modification of lifestyle factors. Similar findings have been reported from community-based studies in Sri Lanka as well as in other countries.<sup>13,23,26</sup> At the same time attention needs to be paid to identify and rectify secondary causes such as obstructive sleep apnoea.

Chronic kidney disease (CKD) is another secondary cause for uncontrolled hypertension. It was seen in 7% of the population. However true resistant hypertension associated with CKD was seen only in a single patient. Clinician inertia as a factor for poor blood pressure control was not common (less than 5%) in the study population though it was reported to be 28% in a previous study done in Sri Lanka.<sup>14</sup> The overall rate of true resistant hypertension in the study population was less than 3%. It was reported to be 19% in a previous study done at follow-up clinics of the Institute of Cardiology of the National Hospital of Sri Lanka.<sup>14</sup> In that study more than 90% were adherent to treatment and in our study only 30% were adherent to treatment.

Low adherence rate in our study could have been a factor masking the true prevalence of resistant hypertension.

One of the limitations of our study was that the blood pressure was measured at a single visit at the clinic which could have led to an overestimation of the prevalence of uncontrolled hypertension. Logistic reasons prevented us from repeating it over a second visit. For the study purposes two measurements were taken at the single visit and the lower of the two was considered as patient's blood pressure.

## Conclusions

In the study population, majority had correctable factors contributing to uncontrolled hypertension. Non-adherence to medications was a major problem. Among the others the main contributing factors were inadequate physical activity, obesity, inadequate sleep and excess salt consumption. True resistant hypertension was seen only in a small proportion.

## Conflicts of interest

None.

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