

The Socio-Demography, Clinical Characteristics and The Prevalence of Cardiovascular Risk Factors among A Group Of Elderly Hypertensive Patients Followed up at A Tertiary Care Hospital in Sri Lanka

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ABSTRACT

Background : Hypertension is one of the most prevalent risk factors for myocardial infarction, strokes, congestive cardiac failure and chronic kidney disease (CKD) and its prevalence is significantly higher in the elderly population.

Objectives : To assess the demography, various presentations and the prevalence of risk factors among elderly hypertensive patients followed up in a tertiary care hospital in Sri Lanka.

Materials and Methods : This was a cross sectional descriptive study involving 250 patients whose age was 60 years or above on antihypertensives for at least 6 months.

Results : Approximately 65.2% of the study population was female. The mean age was 70.17. Dizziness and chest pain were the most prevalent symptoms. The mean age at first detection was 58.17 years. Mean SBP and DBP were 128.5mmHg and 81.14mmHg respectively. The prevalence of alcohol consumption and smoking among men were 70.1% and 72.4% respectively. Approximately 54.7% were either overweight or obese. Approximately 81.6% females and 41.4% males had a waist circumference of more than the risk level with p-value < 0.05. Approximately 36% had diabetes mellitus and 27.6% of the patients had at least one parent and 36.8% had at least one sibling diagnosed with hypertension. Approximately 61.3% of the patients had adequate levels of physical activity while 31.8% had IHD, 11.5% had stroke and 3.8% had CKD.

Conclusion : Dizziness and chest pain were the most disturbing symptoms while abdominal obesity among females, and alcohol consumption and smoking among males were the major risk factors in elderly hypertensive patients

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Background

Hypertension is one of the most prevalent and important modifiable cardiovascular risk factors for myocardial infarction, strokes, congestive cardiac failure, renal insufficiency and peripheral vascular disease (1,2,3). Hypertension in the elderly, i.e. systolic blood pressure (SBP) 140 or above and diastolic blood pressure (DBP) 90 or above in patients aged 60 years or more is considered to be a major factor that increases the mortality and morbidity in the elderly population (4,5).

Until recently, elderly subjects were excluded from treatment studies, despite the fact that they are at high risk for complications or death from hypertension-related diseases. However, the benefits of antihypertensive drug therapy for older persons have been clearly established. Results from trials and meta-analyses have shown that antihypertensive drug treatment for older hypertensive persons confers highly significant and clinically relevant reductions in cardiovascular morbidity and mortality rates. Nevertheless, a considerable percentage of older persons with hypertension are not detected or are not adequately treated for hypertension.(6)

Hypertension in the elderly is important in many ways. The aging population has become a major concern for the whole world. The number of people aged 65 or above, mainly in the developing countries of the world is expected to increase from an estimated 524 million in 2010 to nearly 1.5 billion in 2050 (7). Systolic blood pressure (SBP) tends to increase with age (8,9). The pathophysiology behind this would be the arterial stiffness, intimal hyperplasia and non-compliance of the vasculature (9,10,11). Therefore, the prevalence of hypertension among the elderly population appears to be higher compared to the younger age groups. The prevalence of other chronic diseases and their risk

factors, diabetes mellitus, dyslipidemia (12,13), being overweight and obesity too is higher in the elderly (14). In addition, the elderly are more likely to have been exposed to certain life style risk factors for hypertension such as poor dietary habits, lack of physical activity, smoking and alcohol consumption simply due to their age (15).

Hypertension is considered a silent killer. This is due to the fact that most of the patients remain asymptomatic and are usually diagnosed at screenings, as an incidental finding or when presenting with a complication of this disease (5,16). However, there are some warning symptoms which may suggest hypertension; headache, dizziness, nose bleed etc., but patients may easily ignore them. Complications of chronic uncontrolled hypertension vary from chronic conditions like cardiovascular disease or chronic kidney disease to acute hypertensive emergencies like aortic dissection or hypertensive encephalopathy (17,18).

The situation in Sri Lanka is not too behind the rest of the world. In the year 2000, every tenth person was aged and this proportion is projected to rise up to 22% by 2030 (19). The prevalence of hypertension for men was 23.4% and 23.58% for women in 2014 and it is on average about a quarter of all Sri Lankans. It is projected to increase to 34.1% in 2020 making it a major burden on the country.(20)

The aim of this study is to describe the demography, major and minor presenting symptoms, prevalence of modifiable and non modifiable risk factors, associations between physical activity, lifestyle factors and the control of hypertension and the prevalence of major complications of hypertension in a group of elderly hypertensive patients.

Material and Method

Study Design and Setting

This was a cross sectional descriptive study conducted at the Hypertension Clinic and the Professorial Medical Wards (Wards 7 and 8) of the Teaching Hospital Peradeniya, Sri Lanka on the patients who are followed up for chronic hypertension.

Criteria for Eligibility

Patients aged above 60 years, who had already been diagnosed as hypertensive and attending the

weekly hypertension clinic or admitted to Medical Ward were randomly recruited.

The exclusion criteria were patients who had been diagnosed with hypertension within 6 months, amputees, plastered patients in whom blood pressure measurement and anthropometric measurements could not be carried out. Individuals with neurological disorders that may interfere with their understanding of the questions regarding the survey interview were also excluded.

Ethical clearance was obtained from the Ethical Review Committee of the Faculty of Medicine, University of Peradeniya, Sri Lanka.

Sample Size

All hypertensive patients aged 60 years and above who presented to the Teaching Hospital Peradeniya from August 2015 to December 2015.

Study Instrument, Data Collection and Variables

Demographic data, details of risk factors including family history of hypertension, alcohol consumption, smoking and level of physical activity and dietary habits were collected using an interviewer administered questionnaire. Brief physical examination including blood pressure measurement was conducted by the investigators using standard techniques (21). Height was measured as the maximum distance from the heels to the uppermost position of the head, with the individual standing barefoot wearing light clothing and in full inspiration using Harpenden stadiometer (Chasmors Ltd., London, UK) to the nearest 0.1cm. Body weight was measured using a weighing scale to the nearest 0.1kg. Results of routine investigations were recorded.

Data Analysis Method

Data were entered in a password protected computer using Microsoft Excel and was analyzed using SPSS 20. Mono variate analysis was conducted to describe the study population and bivariate analysis was conducted to look for associations between the variables.

Results

Among the 250 study population, majority were

females (65.2%). Mean age was 70.17 +/- 7.38 with minimum of 60 years and maximum of 94. Approximately 51.6% of the patients were under 70 years of age (Table 1). More than 90% of the patients were Sinhalese Buddhists followed by Moors. Majority of the females were widowed (Table 2).

It is a common belief that hypertension does cause symptoms. When such symptoms are experienced most think it is due to elevated blood pressure. Majority of the patients complained of or had dizziness as the foremost symptom and a majority of the patients had chest pain as a minor symptom (Table 3).

There was no significant difference in male and female groups in regard to the mean age at first detection of hypertension and current mean SBP (Table 4). Mean SBP and pulse pressure showed a peak in the 70 – 74 age group while the mean DBP continuously decreased with age (Table 5).

The prevalence of risk factors among the study group including consumption of alcohol, smoking, family history and the prevalence of co-existing diabetes mellitus were analyzed. A majority of the patients neither consumed alcohol nor smoked and this was probably due to the fact that the majority of the group was female. However, from the 87 males who participated in the study, 61(70.1%) consumed alcohol and 63(72.4%) were smokers. Diabetes mellitus was prevalent in 36% of the patients. (Table 6).

Approximately 27.6% had at least one parent with hypertension while 36.8% had at least one sibling with hypertension (Table 7).

Patients were categorized according to Body mass index (BMI) categories in accordance with the standard BMI cutoffs for Asians i.e., 18.5-underweight, 18.5-23 – normal, 23.1-27.5 – Overweight and >27.5 – obese (22). The majority of them (54.7%) were either overweight or obese. Mean BMI was 24.16kg/m². Mean waist circumference was higher in females and 81.6% of females were above the risk level for South Asians. Their general activity levels are categorized according to the American Heart Association recommendations for adults i.e. 150min of moderate activity per week (23). The majority (61.3%) had adequate levels of physical activity (Table 8).

Table 1. Distribution of prevalence by gender and age groups

		AGE GROUPS - n (%)					Total
		60-64	65-69	70-74	75-79	>80	
SEX	Female	42 (16.8)	42 (16.8)	37 (14.8)	21 (8.4)	21 (8.4)	163 (65.2)
	Male	21 (8.4)	24 (9.6)	17 (6.8)	18 (7.2)	7 (2.8)	87 (34.8)
Total		63 (25.2)	66 (26.4)	54 (21.6)	39 (15.6)	28 (11.2)	250 (100)

Table 2. Demography variables according to gender

		SEX n (%)		Total
		Female	Male	
ETHNICITY	Sinhala	152 (60.8)	77 (30.8)	229 (91.6)
	Tamil	3 (1.2)	2 (0.8)	5 (2)
	Moor	7 (2.8)	7 (2.8)	14 (5.6)
	Other	1 (0.4)	1 (0.4)	2 (0.8)
RELIGION	Buddhist	152 (60.8)	77 (30.8)	229 (91.6)
	Hindu	1 (0.4)	1 (0.4)	2 (0.8)
	Islam	7 (2.8)	7 (2.8)	14 (5.6)
	Christian	3 (1.2)	1 (0.4)	4 (1.6)
	Other	0 (0)	1 (0.4)	1 (0.4)
MARITAL STATUS	Unmarried	7 (2.8)	1 (0.4)	8 (3.2)
	Married	73 (29.2)	75 (30)	148 (59.2)
	Widowed	80 (32)	11 (4.4)	91 (36.4)
	Divorced / Separated	3 (1.2)	0 (0)	3 (1.2)
Total		163 (65.2)	87 (34.8)	250 (100)

Table 3. Prevalence of patients symptoms

	MAJOR		MINOR		
	SYMPTOMS		SYMPTOMS		
SYMPTOMS BELIEF	n	(%)	n	(%)	
Non	49	-19.6	103	-16.59	
Chest Pain	43	-17.2	150	-24.15	
Headaches	36	-14.4	101	-16.26	
Dizziness	72	-28.8	32	-5.15	
LOC	8	-3.2	56	-9.02	
SOB	10	-4	38	-6.12	
Nosebleed	4	-1.6	99	-15.94	
Body aches	4	-1.6	31	-4.99	
Fatigue	22	-8.8	11	-1.77	

Table 4. Mean Age at First Detection, Current Blood Pressure and Pulse Rate

Sex	Mean Age at First Detection (SD)	Mean Systolic	Mean Diastolic	Mean Pulse Rate (SD)
		BP (SD)	BP (SD)	
Female	57.71 (9.9)	127.44 (36.0)	81.25 (10.9)	76.44 (11.1)
Male	59.31 (10.8)	130.53 (23.9)	80.93 (11.1)	75.87 (11.4)
Total	58.27 (10.2)	128.51 (32.3)	81.14 (10.9)	76.24 (11.1)
p-value	0.242	0.473	0.828	0.702

The association between the prevalence of major cardiovascular diseases with gender and other risk factors among the study group was assessed. Approximately 31.8% of the patients had IHD, 11.5% had a history of stroke and 3.8% had CKD while 53.1% had none of these major diseases (Table 9).

Discussion

According to the census of 2012; the population aged 60 years or more is 12.4% in Sri Lanka and it is expected to reach 24.8% in 2041(24). The prevalence of hypertension and its associated co-morbidities increase with age and it is one of the major factors contributing to the morbidity and mortality of the elderly.

This study was conducted at the Teaching Hospital Peradeniya, Sri Lanka, involving 250 patients who were aged 60 years or more with hypertension for at least six months. A majority of them were females, among them the highest numbers of patients were widowed, and probably so because of their higher life expectancy (25). Previous studies done by Olack et al and Doulougou et al showed being widowed was independently associated with hypertension.(26,27) From the patients who were aged more than 80 years, 21 were female while only 7 were male. Regarding the demographic data, the majority were Sinhalese Buddhists followed by Moors which slightly differs from the general population in Sri Lanka (24). The mean age at first detection of hypertension was 58 years with no significant difference between males and females. The mean SBP and DBP were 128.5 and 81.1 respectively. Katulanda et al (20) reported that there is a significant difference in SBP in females and males considering the general population with higher value in females but we did not observe a significant difference in elderly hypertensive population who were on treatment. Japan which is a super aged society has reported a slight increase in mean SBP with ageing while a decrease of mean DBP causing wide pulse pressure (28). Our study population also showed a similarity with continuous decrement of mean DBP with age (p value-0.066).

Even though hypertension is considered an asymptomatic condition, several studies have been oriented to explore patients' beliefs about hypertension since the seventies.(29) Some studies have not found any relationship between reported symptoms and BP,

arguing that hypertension has no specific symptoms that could be useful to the patient for an estimation of his/her blood pressure(30) Other studies have found that a high percentage of hypertensive patients reported symptoms which they believed that were associated with high blood pressure and consequently used them to estimate their own blood pressure and to make decisions about treatment. This pattern of behavior can be considered as *beliefs about false symptoms* that could interfere with treatment.(31) Beliefs about symptoms associated with hypertension can negatively affect adherence to treatment. Most patients interpret the perception of symptoms as a sign that their BP is high, which could pose the risk of changing their treatment protocol by themselves and vice versa. They interpret the absence of symptoms as a sign that their BP is controlled and this belief was associated with failures in adherence to treatment (32,33) In our study, we inquired about the symptoms which patients have or had in the past and we especially asked for major symptoms which caused hospitalization, to seek medical attention or disturbances of day to day work and minor symptoms which patients may have ignored as they did not interfere with their regular activities. Most of the patients complained of or had dizziness as a major symptom followed by chest pain and headache. Chest pain was the most frequent minor symptom. Significant number of people did not have any symptoms. The original article published by Granados - Gamaz et al shows a pattern between the groups in reporting the symptoms according to time since diagnosis, confirming that a longer history of hypertension is related to a higher probability of belief in symptoms. The percentage of symptomatic patients in the initial assessment is significantly less in the groups with a shorter time since diagnosis, and the bigger the difference in time since diagnosis, the bigger the differences between the groups in relation to the presence of symptoms(29)

In this study, we assessed the prevalence of common modifiable and non modifiable risk factors. Considering the cultural and ethnic situation in Sri Lanka, the number of female patients who smoke or consume alcohol was negligible (smoking 1 in 163 and alcohol consumption 2 in 163), but however from the male patients 70.1% were alcohol consumers and 72.4% were smokers. From the study population 35.6%

Table 5. Mean BP and Pulse Pressure in Different Age Groups

Age Groups	Mean SBP	Mean DBP	Pulse pressure
60-64	128.63	83.23	45.4
65-69	129.03	80.88	48.15
70-74	131.85	81.62	50.23
75-79	124.1	79.19	44.91
>80	126.71	78.81	47.9
Total	128.51	81.14	47.37
significance	0.762	0.066	0.809

Table 6. Prevalence of Cardiovascular Risk Factors

	Alcohol ¹				Smoking ²				Diabetes Mellitus ³				Total	
	Never		Have		Never		Have		DM-		DM+			
Female	161	-64.4	2	-0.8	162	-64.8	1	-0.4	105	-42	58	-23.2	163	-65.2
Male	26	-10.4	61	-24.4	24	-9.6	63	-25.2	55	-22	32	-12.8	87	-34.8
Total	187	-74.8	63	-25.2	186	-74.4	64	-25.6	160	-64	90	-36	250	-100
p-value	1)0.012, 2)0.006, 3)0.809													

Table 7. Family History of Hypertension			
Family History of HTN		n	%
Parents with hypertension	Neither	139	-55.6
	Father	12	-4.8
	Mother	39	-15.6
	Both	18	-7.2
	Not known	38	-15.2
Siblings with hypertension	Non	128	-51.2
	>=one	92	-36.8
	Not known	30	-12

	N	Mean BMI ¹	BMI Categories ² - n (%)				Waist Circumference			Activity ⁴ (min/week)	
		(kg/m ²)	UnderWeight	Normal	Over	Obese	Mean ³ (SD)	Normal ^a n (%)	Risk ^b		
		Weight			n (%)				<150	>150	
Female	163	24.22	10(4.3)	61(26.5)	42 (18.3)	37 (16.1)	90.22 (12.2)	27(16.6)	133(81.6)	62 (25.0)	99 (39.9)
Male	87	24.06	5(2.2)	28(12.2)	31 (13.5)	16 (7.0)	88.14 (10.9)	48(55.2)	36(41.4)	34 (13.7)	53 (21.4)
Total	250	24.16	15(6.5)	89(38.7)	73 (31.7)	53 (23.0)	p-value <0.05			96 (38.7)	152 (61.3)

a-<80cm in female / <90cm in male, b- >80cm in female / >90cm in male
Significance - 1)0.797, 2)0.417 3)0.193 4)0.930

Table 9. Association between Major Cardiovascular Diseases with Gender and Other Risk Factors

		MAJOR DISEASE								Total n	(%)
		None		IHD		Strokes		CKD			
		N	(%)	n	(%)	n	(%)	n	(%)		
Sex¹	Female	82	(36.3)	41	(18.1)	20	(8.8)	4	(1.8)	147	(65.0)
	Male	38	(16.8)	31	(13.7)	6	(2.7)	4	(1.8)	79	(35.0)
Alcohol²	Never	91	(40.3)	52	(23.0)	21	(9.3)	5	(2.2)	169	(74.8)
	Have	29	(12.8)	20	(8.8)	5	(2.2)	3	(1.3)	57	(25.2)
Smoking³	Never	95	(42.0)	47	(20.8)	22	(9.7)	6	(2.7)	170	(75.2)
	Have	25	(11.1)	25	(11.1)	4	(1.8)	2	(0.9)	56	(24.8)
BMI Categories⁴	Under-weight	5	(2.4)	7	(3.4)	1	(0.5)	0	(0)	13	(6.3)
	Normal	48	(23.1)	20	(9.6)	7	(3.4)	3	(1.4)	78	(37.5)
	Over-weight	34	(16.3)	26	(12.5)	7	(3.4)	2	(1.0)	69	(33.2)
	Obese	24	(11.5)	14	(6.7)	8	(3.8)	2	(1.0)	48	(23.1)
Activity⁵	<150min /wk	33	(14.7)	35	(15.6)	9	(4.0)	6	(2.7)	83	(37.1)
	>150min /wk	85	(37.9)	37	(16.5)	17	(7.6)	2	(0.9)	141	(62.9)

Significance (p)- 1)0.168 2)0.693 3)0.109 4)0.531 5)0.004

of female and 36.8% of males were having diabetes mellitus. Most of the patients did not have a family history of hypertension. Several previous studies have shown a significant association of hypertension with these major risk factors (34-40).

According to the NICE guideline, the cut off values of BMI for Asians,(22) majority of our study population were either overweight or obese. The mean BMI was 24.16 kg/m² and the mean waist circumference was 90.22cm for females and 88.14cm for males with no significant difference in gender (p=0.193). However, 81.6% of females and 41.4% of males had waist circumference above the risk level for south Asians i.e. 80cm for female and 90cm for males (p-value<0.05)(37,38).Therefore, abdominal obesity is a major risk factor among elderly females. Previous study in Sri Lanka in 2014 reports the mean BMI as 23.1kg/m² and mean waist circumference as 81.8cm in the general population (20). Therefore, the elderly hypertensive patients tend to have higher BMI and prevalence in central obesity. The majority of the patients had an adequate amount of physical activity as recommended by the American Heart Association for adults i.e. 150min per week (23).

With regard to major diseases contributed by hypertension,31.8% had ischemic heart disease, 11.5% had stroke and 3.8% had chronic kidney disease. Prevalence of these diseases showed a significant association with activity levels. A previous study done in Karnataka, India has shown a prevalence of 9.8% for ischemic heart disease and 5.7% for stroke in elderly hypertensive patients (41). Another study in Brazil has shown a significant association of major complications with the male sex (42).

There were some limitations in this study; the prevalence of major modifiable risk factors was reported as low due to the majority of the subjects being female. Further, selected subjects may not be a representative sample of the general population as this was a single station study.

Even though there have been previous studies in Sri Lanka to assess the prevalence of hypertension and risk factors in the general population, this is the first study that focused on the elderly age group. Also,we could assess the prevalence of various presentations of

hypertension which might be useful in early identification of patients and to assess the control of the disease.

Conclusion

We have found that dizziness and chest pain were common symptoms among the elderly age group, and smoking and alcohol consumption among males. Abdominal obesity among females was another major risk factor. These areas need to be addressed to improve public awareness in order to detect early hypertension and prevent its devastating complications.

Abbreviations

CKD: Chronic Kidney Disease

IHD: Ischaemic Heart Disease

SBP: Systolic blood pressure

DBP: Diastolic blood pressure

BMI: Body mass index

NICE: National institute of health and care excellence

ECG: Electrocardiogram

Declarations

Ethical Approval and Consent to Participate

Ethical approval for this research work was obtained from the Ethical Review Committee, Faculty of Medicine, University of Peradeniya, Sri Lanka. All the data were collected from the participants after obtaining written consent.

Consent for Publication

Not applicable.

Availability of Data and Material

The dataset generated or analyzed during the current study are available from the corresponding author on reasonable request.

Competing Interests

We declare that we have no competing interests.

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Authors' Contributions

UR conceived the research idea and guided it. UR and MB did the literature survey and drafted the paper. UR,MB,TJ and ST did data analysis. MB, NW and

RB did data collection and entry. All authors made substantial contribution to design acquisition and interpretation of data and writing the manuscript and have given final approval of the version to be published. Also all authors agreed to be accountable for all aspects of their work.

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References :

1. Narváez I, Iriarte JA, Lafuente PJ, et al. Arterial hypertension as a cardiovascular risk factor in an elderly community of low social condition. *Journal of Clinical and Basic Cardiology* 2001; 4 (3):225-227
2. Ralapanawa U, Dharmaratne SD, Jayawickrema KP, et al. Epidemiology of newly diagnosed hypertensives in a tertiary care hospital in a developing country. *Clinical and Experimental Hypertension*. 2017; 39 (3):251-256.
3. Jayawardana NWIA, Jayalath WATA, Madhujith WMT, et al. Aging and obesity are associated with undiagnosed hypertension in a cohort of males in the central province of Sri Lanka: a cross-sectional descriptive study. *BMC Cardiovascular Disorders* 2017; 17:165, DOI 10.1186/s12872-017-0600-8
4. Mancia G, Fagard R, Narkiewicz K, et al. 2013 ESH/ESC guidelines for the management of arterial hypertension: the Task Force for the Management of Arterial Hypertension of the European Society of Hypertension (ESH) and of the European Society of Cardiology (ESC). *Eur Heart J*. 2013 ;34(28): 2159-219. doi: 10.1093/eurheartj/eh151.
5. Sawicka K., Szczyrek M., Jastrzębska I, et al. Hypertension – The Silent Killer. *Journal of Pre-Clinical and Clinical Research*, 2011; 5(2):43-46
6. Van Rossum CTM, Van de Mheen H, Witteman JCM, et al. Prevalence, Treatment, and Control of Hypertension by sociodemographic factors among the Dutch elderly. *hypertension* 2000; 35:814-821. <http://hyper.ahajournals.org/>
7. Global Health and aging-WHO 2011:1-32. http://www.who.int/ageing/publications/global_health.pdf
8. Fagard RH, Epidemiology of hypertension in the elderly. *The American journal of geriatric cardiology* 2002; 11(1):23-28)
9. Schoenenbergera AW, Schoenenberger-Berzinsb R, Gabriela R, et al. Arterial hypertension in elderly patients. *Cardiovascular medicine* 2014; 17(3): 76-81
10. Aronow WS, Fleg JL, Pepine CJ, et al. ACCF/AHA 2011 expert consensus document on hypertension in the elderly: a report of the American College of Cardiology Foundation Task Force on Clinical Expert Consensus documents developed in collaboration with the American Academy of Neurology, American Geriatrics Society, American Society for Preventive Cardiology, American Society of Hypertension, American Society of Nephrology, Association of Black Cardiologists, and European Society of Hypertension. *J Am Coll Cardiol*. 2011; 57 (20):2037-114. doi: 10.1016/j.jacc.2011.01.008.
11. Soyibo AK, Barton EN. Evaluation and management of hypertension in the elderly. *West Indian Med J*. 2012 ;61(9):907-11.
12. Wild S, Roglic G, Green A, et al. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. *Diabetes Care*. 2004; 27(5):1047-53.
13. Cheng KC, Chen YL, Lai SW. Prevalence of dyslipidemia in patients receiving health checkups: a hospital-based study. *Cholesterol*. 2011; 2011:314234. doi: 10.1155/2011/314234.
14. Mozaffarian D, Roger VL, Benjamin EJ, et al.; American Heart Association Statistics Committee and Stroke Statistics Subcommittee. *Circulation*.

- 2014 Jan 21;129(3):e28-e292.doi: 10.1161/01.cir.0000441139.02102.80.
15. Rådholm K. Cardiovascular risk factors in elderly with special emphasis on atrial fibrillation, hypertension and diabetes 2015:78p. <https://doi.org/10.3384/diss.diva-121286>
 16. Singh R. Isolated systolic hypertension Medicine Update 2012; 22:111-116.
 17. Flack JM, Peters R, Shafi T, et al. Prevention of hypertension and its complications: theoretical basis and guidelines for treatment. *J Am Soc Nephrol.* 2003 Jul;14(7 Suppl 2):S92-8.
 18. Varon J, Strickman NE. Diagnosis and treatment of hypertensive crises in the elderly patients. *Journal of Geriatric Cardiology* 2007;(4):50-5.
 19. Liyanage P. Elderly population in Sri Lanka. *Health Net* 2011.
 20. Katulanda P, Ranasinghe P, Jayawardena R, et al. The prevalence, predictors and associations of hypertension in Sri Lanka: a cross-sectional population based national survey. *Clinical and Experimental Hypertension* 2014; 36(7):484-491, DOI:10.3109/10641963.2013.863321
 21. Aronow WS, Fleg JL, Pepine CJ, et al. ACCF/AHA 2011 expert consensus document on hypertension in the elderly: a report of the American College of Cardiology Foundation Task Force on Clinical Expert Consensus Documents. *Circulation.* 2011;123(21):2434-506. doi: 10.1161/CIR.0b013e31821daaf6. Epub 2011 Apr 25.
 22. Obesity: Identification, Assessment and Management of Overweight and Obesity in Children, Young People and Adults: Partial Update of CG43. National Clinical Guideline Centre (UK). London: National Institute for Health and Care Excellence (UK); 2014. Doi: <https://www.ncbi.nlm.nih.gov/pubmed/25535639>
 23. American Heart Association Recommendations for Physical Activity in Adults. http://www.heart.org/HEARTORG/HealthyLiving/PhysicalActivity/FitnessBasics/American-Heart-Association-Recommendations-for-Physical-Activity-in-Adults_UCM_307976_Article.jsp#.Vx2TX9R97eg
 24. Department of Census and Statistics Sri Lanka. Census of population and housing. Percentage distribution of population according to district by population, 2012. http://www.statistics.gov.lk/pophousat/cph2011/pages/activities/reports/cph_2012_5per_rpt.pdf.
 25. Annual Health Bulletin, Medical Statistical unit, Ministry of health, Sri Lanka 2012, <http://www.health.gov.lk/en/publication/AHB-2012/Annual%20Health%20Bulletin%20-%202012.pdf>
 26. lack B, Wabwire-Mangen F, Smeeth L, Montgomery JM, Kiwanuka N, Breiman RF. Risk factors of hypertension among adults aged 35-64 years living in an urban slum Nairobi, Kenya. *BMC Public Health* 2015;15:1251. DOI 10.1186/s12889-015-2610-8
 27. Doulogou B, Kouanda S, Rossier C, Soura A, Zunzunegui MV. Differences in hypertension between informal and formal areas of Ouagadougou, a sub-Saharan African city. *BMC Public Health* 2014, 14:893 <http://www.biomedcentral.com/1471-2458/14/893>
 28. The Japanese Society of Hypertension Guidelines for the Management of Hypertension (JSH 2009). *Hypertension Res* 2009; 32: 3-107.
 29. Granados-Gamez G, Roales-Nieto JG, Gil-Luciano A, et al. A longitudinal study of symptoms beliefs in hypertension. *International Journal of Clinical and Health Psychology* 2015; <http://dx.doi.org/10.1016/j.ijchp.2015.07.001>
 30. Baumann L, Leventhal H. I can tell when my blood pressure is up, can't I? *Health Psychology* 1985;7: 309-328.
 31. Kruszewski P, Bieniaszewski JN, Krupa-Wojciechowska L. Headache in patients with mild to moderate hypertension is generally not associated with simultaneous blood pressure elevation. *Journal of Hypertension* 200;18:437-444.
 32. Al Hewiti A. Adherence to long-term therapies and beliefs about medications. *International Journal of Family Medicine* 2014. <http://dx.doi.org/10.1155/2014/479596>.
 33. Granados G, Roales-Nieto JG, Moreno E, et al. Creencias sintomas y adherencia al tratamiento farmacológico en pacientes con hipertensión.

- International Journal of Clinical and Health Psychology 2007;7: 697-607.
34. Madhumitha M, Naraintran S, Manohar C, et al. Hypertension- Prevalence and risk factors among urban population in North Karnataka. International Journal of Current Research and Review (IJCR) 2014;6 (7): 39-45.
35. Islam SM, Mainuddin A, Islam MS, et al. Prevalence of risk factors for hypertension: A cross-sectional study in an urban area of Bangladesh. Glob Cardiol Sci Pract. 2015 ;(4):43. doi: 10.5339/gcsp.2015.43. eCollection 2015.
36. Yadav S, Boddula R, Genitta G, et al. Prevalence & risk factors of pre-hypertension & hypertension in an affluent north Indian population. Indian J Med Res. 2008 ;128(6):712-20.
37. Naing C, Aung K. Prevalence and risk factors of hypertension in Myanmar: a systematic review and meta-analysis. Medicine (Baltimore). 2014 ;93(21):e100. doi: 10.1097/MD.000000000000100.
38. Tohme RA, Jurjus AR, Estephan A. The prevalence of hypertension and its association with other cardiovascular disease risk factors in a representative sample of the Lebanese population. Journal of Human Hypertension 2005; 19:861-868. doi:10.1038/sj.jhh.1001909; published online 7 July 2005
39. Misra A, Vikram NK, Gupta R, et al. Waist circumference cutoff points and action levels for Asian Indians for identification of abdominal obesity. International Journal of Obesity 2006; 30:106-111. doi:10.1038/sj.ijo.0803111; published online 27 September 2005
40. Waist Circumference and Waist-Hip Ratio: Report of a WHO Expert Consultation. Geneva 2008: 8-11 http://apps.who.int/iris/bitstream/10665/44583/1/9789241501491_eng.pdf
41. Hameed S, Chethana K, Brahmbhatt KR, et al. Prevalence of Hypertension and Its correlates in Elderly Population of Coastal Karnataka. National Journal of Community Medicine 2014; 5(1): 25-28.
42. Noblat AC, Lopes MB, Lopes GB, et al. Complications of hypertension in men and women seen in a referral outpatient care unit. Arq Bras Cardiol. 2004 ;83(4):314-9. <http://dx.doi.org/10.1590/S0066-782X2004001600006>