RISK FACTORS ASSOCIATED WITH UNCONTROLLED HYPERTENSION AMONG TREATED ADULTS RESIDING IN AN URBAN AREA OF KERALA- A CROSS SECTIONAL STUDY

Jayasree Chandrasekharan Nair Saradamma[1], Athira Thekke Kottarath[2], Ankitha Saleem[3], Asha Thulaseedharan Jaya[4], Aleesha Thaj[5]

[1]Professor, Department of Community Medicine, Travancore Medical College, Kollam, Kerala.
[2]House Surgeon, Department of Community Medicine, Travancore Medical College, Kollam, Kerala.
[3]House Surgeon, Department of Community Medicine, Travancore Medical College, Kollam, Kerala.
[4]House Surgeon, Department of Community Medicine, Travancore Medical College, Kollam, Kerala.
[5]House Surgeon, Department of Community Medicine, Travancore Medical College, Kollam, Kerala.

ABSTRACT

BACKGROUND

Non communicable disease control involves not only intake of medications, but also a substantial change in the life style of the patient. This is absolutely true regarding hypertension. In this study, we attempted to find out the proportion of patients with uncontrolled hypertension in spite of taking treatment, among adults residing in Kollam municipal corporation area. An exploration into the risk factors which are associated with non-control of hypertension even though they have been diagnosed as hypertensives and were under treatment was also done. The findings may throw light over the deficiencies in the modalities undertaken to treat hypertension as it is done presently. The objectives of the study were- 1) to determine the proportion of uncontrolled hypertensives among treated adults residing in an urban area of Kerala. 2) to identify the risk factors associated with uncontrolled hypertension in the above population.

MATERIALS AND METHODS

A cross sectional study was conducted during the months of February & March of 2017. The study area included 5 wards in the Kollam Municipal Corporation area. The study subjects included 300 individuals above 18 years of age, residing in the study area.

RESULTS

The prevalence of hypertension was found to be 40% in the study area. 27% were identified as pre-hypertensives. Of the previously diagnosed hypertensives undergoing treatment, 68.3% were found to have uncontrolled hypertension. Higher age ($p<0.05$), sedentary lifestyle ($p<0.05$), regular intake of alcohol ($p<0.05$), stress ($p<0.001$), dyslipidaemia ($p<0.001$), diabetes mellitus ($p<0.05$), family history of hypertension($p<0.01$) and family history of first degree relative dying before the age of 40 years following Coronary Artery Disease were found to be significantly associated with uncontrolled hypertension.

CONCLUSION

The prevalence of uncontrolled hypertension is high even among patients on treatment (68.3%). Programmes focusing on ensuring compliance of hypertensives on treatment regarding life style modification should receive equal importance as drug compliance.

KEYWORDS

Urban Population, Uncontrolled Hypertension, Proportion, Risk Factors.

HOW TO CITE THIS ARTICLE: Saradamma JCN, Kottarath AT, Saleem A, et al. Risk factors associated with uncontrolled hypertension among treated adults residing in an urban area of Kerala- a cross sectional study. J. Evid. Based Med. Healthc. 2019; 6(10), 751-756. DOI: 10.18410/jebmh/2019/156

BACKGROUND

Non communicable diseases are responsible for 71% of all deaths globally. Deaths between 30-69 years due to Non communicable diseases are considered "premature" deaths. 85% of these "premature deaths" occur in developing countries. Tobacco use, sedentary life style, unhealthy diet, harmful alcohol use, mental stress, environmental factors are all considered to be risk factors for Non communicable diseases.[1]

In India, 60% 0f all deaths are due to non-communicable diseases. Of these, hypertension is an important contributor to morbidity and mortality. It is a risk factor for various serious health conditions like cerebrovascular accidents, coronary heart disease, visual problems etc. The prevalence of high blood pressure has been found to be 32.55% in India.[2] The problem of hypertension and the complications that could result from that condition becomes more serious in a country like India. This is because, good quality care for such patients for a prolonged period of time is a heavy burden on our health services, especially in the rural areas. A large majority of patients are not able to afford such specialized services in the private sector.[3]

Financial or Other, Competing Interest: None.
Submission 04-02-2019, Peer Review 06-02-2019,
Acceptance 25-02-2019, Published 07-03-2019.
Corresponding Author:
Dr. Jayasree C. S,
'Sreeramgam', A-4,
Sreeramgam Lane, Sasthamangalam,
Thiruvananthapuram- 695010, Kerala.
E-mail: jayasree_cs@yahoo.com
DOI: 10.18410/jebmh/2019/156

As far as Kerala is concerned, the health facilities, services available and the awareness in the community are marginally better than many other states in India.[4] Still, the prevalence of hypertension remains at a high 32-55% according to various studies.[5,6,7] The most disturbing fact is that even in patients who come to the health facilities and avail services, the blood pressure is not being controlled over a prolonged period of time .Since, sustained elevation of blood pressure can lead to a large number of complications, hospital admissions and increased mortality, it is a cause for concern. The management of complications with interventions like dialysis etc. will incur a huge expenditure for the individual and the health system. Control of hypertension cannot be brought about by the regular intake of drugs alone. Life style modification is also equally important. So it was thought that a probe into the exact factors responsible for the blood pressure not being controlled even in patients who receive treatment would be worthwhile.

Several workers have identified factors like obesity, sedentary life style, hypercholesterolemia, high salt intake, smoking, alcoholism, intake of certain drugs, mental stress etc. to be associated with hypertension. A search regarding the role of co morbidities like diabetes is also called for. An understanding of how these factors operate at the individual level and community level and which are of more importance in the case of patients already diagnosed and prescribed treatment is crucial in formulating and implementing robust and effective control programmes. Health policies could be formulated by the state based on such information. Risk factor studies in hypertension by various investigators have proved that any control programme will essentially need multisectoral efforts to bring about a positive outcome.[8]

MATERIALS AND METHODS

The study was a cross sectional one done by the interns of community medicine department of Travancore Medical College, Kollam. The study area is located in the field practice area of the department, which includes 12 wards out of the 55 urban wards of Kollam Municipal Corporation. 5 wards were selected randomly from these 12 wards. The population of each of these wards comes to approximately 6500.[9] The study period was from 1-2-2017 to 31-3-2017.

The sample size was calculated based on the prevalence of hypertension in the area obtained in a previous study by the students. This being 25%, using the formula of $4pq/d^2$ the total sample size calculated was calculated as 300 considering an allowable error of 20% of p. The sampling technique used was that of systematic random sampling. From each of the randomly selected 5 wards, 60 individuals were selected. The first house in each ward was selected randomly. Then, every 10^{th} house was included. All the members of the selected houses above the age of 18 years were included in the study. This was continued till the numbers of individuals from each ward reached 60. Thus, from 5 wards, a total of 300 subjects were selected. The inclusion criteria for "uncontrolled B P" was as follows: - Those who were already diagnosed as hypertensives and were on treatment at the time of our study, and on measurement, their B P was found to be systolic blood pressure of >=140 mm of Hg and/ or a diastolic blood pressure of >=90 mm of Hg. Individuals who have problems in communicating, those who refused to give consent and those who had a known secondary cause for hypertension(like adrenocortical tumours, renal diseases etc.,) were excluded from the study. The data collection was done by the interns based on a pretested structured questionnaire. Before data collection, it was translated into Malayalam and then back translated into English.

Blood pressure was measured after a 5 minutes' resting period. Standardized calibrated mercury sphygmomanometers were used. The average of 2 readings, taken at least 10 minutes apart was recorded as the blood pressure of the individual. The B P was measured with the cuff on the left forearm and the individual in the sitting position. The fifth Korotkoff sound was used to determine the diastolic B P. Two other B P measurements were taken in each participant within 30 minutes and the mean value of the recorded B P was considered as the B P of the participant. The weight was measured with a beam balance, height with anthropometric rod and waist & hip circumference with non-stretchable tape.

Physical activity was taken sedentary for house wives and males with clerical jobs and business. The remaining were included as moderate and above. Moderate salt intake was taken for subjects who reported that they used pickles/dried fish more than 3 times a week. High salt intake was considered when, in addition to this, the subject is in the habit of adding more salt to rice, curd etc., at the table. Stress was self-reported. Dyslipidaemia was found out from the treatment records of the individual by perusing the laboratory investigation reports.

Data analysis was done using spss software version 16. The test of significance used was Chi Square. A p value of <0.05 was considered as significant.

Clearance from Institutional Ethical Committee was obtained before the start of the study.

RESULTS

Those who were already diagnosed as high blood pressure were included as hypertensives as per our case definition. In addition to that, those who were found to have a systolic blood pressure of >=140 mmHg and/ ora diastolic blood pressure of >=90 mmHg were considered as hypertensives.[10] Thus, out of our 300 subjects, a total of 120 were hypertensives. Of this, 19 were newly detected cases. 101 people had already been detected with hypertension earlier and are under treatment. Blood pressure of 69 people (68.3%) among them was found to be high as per our case definition. So the proportion of uncontrolled hypertension among our study subjects is 68.3%.

They were taken as "individuals with uncontrolled hypertension in spite of being under treatment" The major factors associated with this was explored.

Risk Factors	Frequency	Percentage
Age		
18-34	0	0
35-49	6	8.7%
50-64	48	69.6%
65 and Above	15	21.7%
Education		
<10 Yrs. of Schooling	39	56.6%
>10 Yrs. of Schooling	30	43.5%
Monthly Income		
BPL	16	23.2%
APL	53	76.8%
Treatment Regularity		
Regular	50	72.5%
Irregular	19	27.5%
Frequency of Check up		
Not Even Once in Six Months	3	4.3%
At Least Once in Six Months	66	95.7%
Place of Treatment		
Govt.	17	24.6%
Private	52	75.4%
Physical Activity		
Moderate and Above	18	26.1%
Sedentary	51	73.9%
Salt Intake		
Low	-	-
Moderate	66	95.7%
High	3	4.3%
Stress	40	60%
Smoking	5	7.2%
Alcohol	11	15.9%
Diabetes Mellitus	40	60%
Dyslipidaemia	23	33.3%
CAD	14	20.3%
Family History of Hypertension	54	78.3%
BMI>23	35	50.7%
Waist to Hip Ratio (Males) >.9	12	46.1%
Waist to Hip Ratio (Females) >.8	20	465%

Table 1. Descriptive Data of The Subjects with Uncontrolled Hypertension

The current study showed 69 people among 101 known case of hypertension (68.3%) were having uncontrolled blood pressure. Of this, 43 (62.3%) were females and 26 (37.7%) were males. Majority were in the age group 50-64 (69.6%) and most of them have <10 yrs. of schooling (56.6%) and are leading a sedentary lifestyle (73.9%). Majority of the uncontrolled patients were stressed (60%). 5 among the uncontrolled hypertensives were smokers (7.2%) and 11 (15.9%) were alcoholics. Among 69 people with uncontrolled hypertension 60% were having diabetes and 33.3% were having dyslipidaemia as per their medical records. 20.3% of them had first degree relatives who died of CAD before 40 yrs. of age and 78.3% of them had a positive family history of hypertension. When BMI, waist to hip ratio were taken into consideration 50.7% were having high BMI. 12(46.1%) males had a waist to hip ratio of >=0.9 and 20(46.5%) females had high waist to hip ratio >=0.8.

Risk Factors	Uncontrolled (69)	Controlled (32)	Total (101)	Chi Square Value	p-Value
Age					
18-34	0	0			
35-49	6(8.7)	9(28.1)	15	7.4	0.024
50-64	48(69.6)	15(46.9)	63		
65 and Above	15(21.7)	8(25)	23		
Education					
>10 Yrs. of Schooling	30(43.5)	16(50)		0.375	0.345
<10 Yrs. of Schooling	39(56.5)	16(50)			

Treatment Regularity					
Regular	50(72.5)	21(65.6)	71		
Irregular	19(27.5)	11(34.4)	30	0.490	0.318
Frequency of Check up					
>6 Months	3(43.5)	0	3	1.43	0.314
At Least Once In 6 Months	66(57.5)	32(100)	98		
Physical Activity					
Moderate and Above	18(26.1)	2(6.2)	20		
Sedentary	51(73.9)	30(93.8)	81	5.417	0.015
Salt Intake					
Low	0	0			
Moderate	66(95.7)	30(93.8)	96	0.16	0.509
High	3(4.3)	2(6.2)	5		
Smoking					
No	64(92.8)	28(87.5)	92	0.743	0.304
Yes	5(7.2)	4(12.5)	9		
Alcohol					
No	58(84.1)	31(96.9)	89	3.43	0.056
Yes	11(15.9)	1(3.1)	12		
Stress					
No	29(40)	25(78.1)	54	11.448	0.001
Yes	40(60)	7(21.9)	47		
Diabetes Mellitus					
No	29(40)	20(62.5)	49	3.668	0.044
Yes	40(60)	12(37.5)	52		
Dyslipidaemia					
No	46(66.7)	22(68.8)	68	11.100	0.001
Yes	23(33.3)	10(31.2)	33		
Family History					
No	15(21.7)	16(50)	31	8.2	0.004
Yes	54(78.3)	16(50)	70		
CAD					
No	55(79.7)	32(100)	87	7.538	0.003
Yes	14(20.3)	0	14		
BMI					
<23	34(49.3)	16(50)	50	0.005	0.558
>=23	35(50.7)	16(50)	51		
W/H ratio					
Males</=.9	14(53.8)	6(33.3)	20		
>.9	12(46.2)	12(66.7)	24	0.376	0.363
Females<=.8	23(53.5))	10(45.5)	33		
>.8	20(46.5)	12(54.5)	32		

Table 2. Risk Factors Associated with Uncontrolled Hypertension

In our study we found statistically significant association between uncontrolled hypertension and risk factors such as higher age ($p<0.05$), sedentary lifestyle ($p<0.05$), regular intake of alcohol ($p<0.05$), stress ($p<0.001$), dyslipidaemia (0.001), family history of hypertension ($p<0.01$) and family history of first degree relative dying before the age of 40 years following Coronary Artery Disease. At the same time the association of uncontrolled hypertension with risk factors like level of education, regularity of treatment, frequency of check-up, salt intake, smoking, Body Mass Index, waist to hip ratio were not statistically significant.

DISCUSSION

From the study conducted in surrounding area of Travancore Medical College and Hospital, it is seen that proportion of uncontrolled hypertension in known hypertensives is 68.3%. In a study done by Idris Guesseous, Murielle Bochud et al in Geneva, Switzerland it was found that the proportion of uncontrolled hypertension was found to be 40.6%.[11] This proportion turned out to be 65% in a study by Sathish S et al in a rural area in India.[12] This is quite high.

This study showed the proportion of uncontrolled hypertensives is highest in the age group of 50-64 years (69%). But in the Switzerland study[11] it was found to be the 65-74 years age group. This may be explained by the fact that the onset of hypertension in India has been found to be

one decade earlier than that in the developed countries as found by Singh et al in India.[13]

A sedentary life style has been identified as a risk factor for many life style diseases. Also, it has been established that has a physically active person is more likely to sustain the control of risk factors achieved than a sedentary one. In our study, we found a significant association between a sedentary life style and uncontrolled hypertension. Of the 69 individuals with uncontrolled hypertension, 51 were found to lack regular physical exercise. ($\chi2=5.4$. $p<0.01$) Studies all over the world have demonstrated the role of physical exercise in preventing complications of hypertension by ensuring its control in a sustained manner. Many communications from the WHO regarding sustained control of hypertension also emphasizes the role of regular physical activity. In uncontrolled hypertension, lack of regular physical exercise has been pointed out as a major determinant.[14] The role of regular physical activity in sustaining the control of blood pressure has been established by authors like Korsager et al.[15]

We found a statistically significant relationship between uncontrolled hypertension and regular intake of alcohol. In the group of respondents with uncontrolled hypertension, 15.9% were regularly consuming alcohol, whereas in the group with sustained control of hypertension, this was only 3%. ($\chi2=3.43$; $p<0.05$). This fact has been shown by various investigators. Miller et al have established the significant association between excessive intake of alcohol and hypertension control.[16] The harmful effect of regular intake of alcohol on blood pressure and the need to reduce alcohol intake for managing uncontrolled hypertension has been stressed in various studies.[17]

As established by various researchers all over the scientific community, our study also found a significant association between self-perceived psychological stress and uncontrolled blood pressure. Only 21.9% of subjects in the group with sustained control of blood pressure reported self-perceived psychological stress whereas 605 of the group with uncontrolled hypertension experience mental stress.($\chi2=11.44$; $p<0.001$).Steptoe A, Kivimaki et al had studied and explained the mechanism behind the sustained rise in blood pressure in the presence of mental stress.[18] Various studies have been done and results have been put forth supporting the relationship between mental stress and lack of blood pressure control. One such study is by Jadhav, Jatti et al which was done in western Maharashtra, India. They have concluded that mental stress definitely acts as a risk factor for hypertension and that pharmacological control of hypertension is difficult if the mental stress issues of the patient is not addressed and resolved.[19] Another such study is the one done by Ganesh Kumar et al among bank employees of Urban Puducherry. Their conclusions were also the same as the above.[20]

Hypertension, when accompanied by co-morbidities is difficult to control. Co-morbidities like diabetes Mellitus, dyslipidaemia etc. have been extensively studied by researchers to find out association if any with control of hypertension. In our study, we found out that 60% of the subjects with uncontrolled hypertension we known diabetics where as it is only 37.5% for the group with control ($\chi2=3.668$; $p<0.05$). As far as dyslipidaemia is concerned, 33.3% of those with uncontrolled hypertension shows dyslipidaemia. The percentage of subjects with their blood pressure under control, reporting dyslipidaemia is 31%($\chi2=11.1$; $p<0.001$). In a study conducted by Choudhary, Sharma et al in Jaipur, India, it was concluded that the presence of co-morbidities is a significant attribute for poor control of blood pressure.[21] A study conducted among patients in Kerala too showed the significant association of co morbidities with control of hypertension.[22] Similarly, Kumar A, Kalmath B C et all have reached a conclusion of direct relationship between co-morbidities and variable control of blood pressure.[23] This fact was found true in yet another study conducted by Suresh P, Sandhya A M et al.[24]

Family history of high blood pressure is a factor that is associated with long standing hypertension that is not controlled or poorly controlled. We, in this study found it to be an association which is statistically significant. 78.3% of the respondents in the group with uncontrolled hypertension reported a family history of hypertension At the same time, only 50% of the group with controlled blood pressure had such a history($\chi2=8.2$; p, 0.005). So also, work done by Babiker, Elkhalifa et al have reached conclusions which agree with ours.[25] Likewise, study done among elderly hypertensive patients in Southern China showed statistically significant association between in family history of hypertension.[26]

Early deaths in the family due to coronary heart disease have been found to be statistically significant correlate of uncontrolled hypertension in some studies. Our study also had the same finding. In the group of participants with uncontrolled hypertension, 20.3% said that they had a death due to coronary heart disease for a first-degree blood relative less than 40 years of age ($\chi2=7.5$; $p<0.005$). In the research done by Dhar L this has been found to be true.[27] Work done by Kunungo et al has shown that there is a statistically significant association between early deaths due to coronary heart disease and uncontrolled hypertension.[28] Even though a strong association has been found by various authors regarding uncontrolled hypertension and risk factors like level of education, regularity of treatment, frequency of check-up, salt intake, Body Mass Index and waist to hip ratio, we failed to discover a statistically significant relationship by our study.

CONCLUSION

The prevalence of uncontrolled hypertension is high even among patients on treatment. Higher age, sedentary lifestyle, regular intake of alcohol, stress, dyslipidaemia, family history of hypertension and family history of first degree relative dying before the age of 40 years following Coronary Artery Disease are significantly associated with uncontrolled hypertension. The health-care providers will have to ensure compliance of the patients under treatment regarding not only their regular drug intake and periodic

check-ups but also the adherence to healthy life style modifications. Only such an approach can bring about control of hypertension which can be sustained.

Recommendations

1. Awareness Programmes stressing on control of risk factors by life style modification should be given importance.
2. Hypertensives who are under treatment should be closely monitored by the health care providers to ensure the control of associated risk factors to achieve sustained control of their high blood pressure.

REFERENCES

[1] WHO. Key facts: non communicable diseases. WHO 2018. https://www.who.int>New>Fact

[2] https//|www.ncbi.nlm.nih.gov/pmc|articles|PMC 5648412. Last accessed on 07-02-2019.

[3] Anchala R, Kannuri NK, Pant H, et al. Hypertension in India: a systematic review and meta-analysis of prevalence, awareness and control of hypertension. J Hypertens 2014;32(6):1170-1177.

[4] Sebastian NM, Jesha MM, Haveri SP, et al. Hypertension in Kerala: a study of prevalence, control and knowledge among adults. Int J Med Sci Public Health 2016;5(10):2041-2046.

[5] Suma RK, Mayamol TR, Divakaran B, et al. Hypertension: prevalence, awareness, treatment and control in a rural area of North Kerala, India. Int J Community Med Public Health 2017;4(10):3561-3567.

[6] Zachariah MG, Thankappan KR, Alex SC, et al. Prevalence, correlates, awareness, treatment and control of hypertension in a middle aged urban population in Kerala. Indian Heart Journal 2003;55(3):245-251.

[7] Harikrishnan S, Sarma S, Sanjay G, et al. Prevalence of metabolic syndrome and its risk factors in Kerala, South India: analysis of a community based cross-sectional study. PLoS One 2018;13(3):e0192312.

[8] ER 2017. State planning board, Thiruvananthapuram. Government of Kerala. Economic Review 2017.

[9] www.censusindia.gov.in/2011 census/dchb/3213 PART A -Kollam pdf Last accessed on 1-07 -02-2017

[10] Bell K, Twiggs J, Olin BR. Hypertension: the silent killer: updated JNC-8 guideline recommendations. Associate Clinical Professor of Pharmacy Practice, Drug Information and Learning Resource Center 2015.

[11] Guessous I, Bochud M, Theler JM, et al. 1999-2009 trends in prevalence, awareness, treatment and control of hypertension in Geneva, Switzerland. PLoS One 2012;7(6):e39877.

[12] Sathish T, Kannan S, Sarma PS, et al. Incidence of hypertension and its risk factors in rural Kerala, India: a community-based cohort study. Public Health 2012;126(1):25-32.

[13] Singh MK, Singamsetty B, Kandati J. An epidemiological study of prevalence of hypertension and its risk factors in a rural community of Nellore, Andhra Pradesh, India. International Journal of Community Medicine Public Health 2016;3(12):3408-3414.

[14] www.emro.who/int/media/world-health-day/physical activity-fact sheet-2013.html.Last accessed on 9-1-2019.

[15] Korsager Larsen M, Matchkov VV. Hypertension and physical exercise: the role of oxidative stress. Medicina (Kaunas) 2016;52(1):19-27.

[16] Miller PM, Anton RF, Egan BM, et al. Excessive alcohol consumption and hypertension: clinical implications of current research. J Clin Hypertens (Greenwich) 2005;7(6):346-351.

[17] https/://www.hopkinsmedie.org health library/ conditions/cardiovascular-diseases/resistant t-hypertension-22-resistant hypertension. Last accessed on 9-1-2019.

[18] Steptoe A, Kivimaki M, Lowe G, et al. Blood pressure and fibrinogen responses to mental stress as predictors of incident hypertension over an 8-year period. Ann Behav Med 2016;50(6):898-906.

[19] Jadhav SB, Jatti GM, Jadhav AS, et al. Stressing "mental stress" in hypertension rural background study. J Clin Diagn Res 2014;8(6):JC04-JC07.

[20] Ganesh Kumar S, Deivanai Sundaram N. Prevalence and risk factors of hypertension among bank employees in urban Puducherry, India. Int J Occup Environ Med 2014;5(2):94-100.

[21] Chaudhary R, Sharma SM, Kumari V, et al. Awareness, treatment adherence and risk predictors of uncontrolled hypertension at a tertiary care teaching hospital in Western India. Indian Heart J 2016;68 Suppl 2:S251-S252.

[22] Kumar SP, Sandhya AM. A study on the glycemic, lipid and blood pressure control of type 2 diabetes patients of Kerala. Diabetes Metab Syndr 2017;11(4):231-235.

[23] Kumar A, Kalmath BC, Abraham G, et al. Role and relevance of blood pressure variability in hypertension related co-morbidities. J Assoc Physicians India 2017;65(12):83-92.

[24] Kumar SP, Sandhya AM. A study on the glycemic, lipid and blood pressure control among the type 2 diabetes patients of North Kerala, India. Indian Heart J 2018;70(4):482-485.

[25] Babiker FA, Elkhalifa LA, Moukhyer ME. Awareness of hypertension and the factors associated with uncontrolled hypertension in Sudanese adults. Cardiovasc J Afr 2018;24(6):208-212.

[26] Yang L, Xu X, Yan J, et al. Analysis on associated factors of uncontrolled hypertension among elderly hypertensive patients in Southern China: a community-based, cross-sectional survey. BMC Public Health 2014;14:903.

[27] Dhar L. Preventing coronary heart disease risk of slum dwelling residents in India. J Family Med Prim Care 2014;3(1):58-62.

[28] Kanungo S, Mahapatra T, Bhowmik K, et al. Patterns and predictors of undiagnosed and uncontrolled hypertension: observations from a poor resource setting. J Hum Hypertens 2017;31(1):56-65.