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Factors Associated with Uncontrolled High Blood Pressure amongst patients with Hypertension at Harare Central Hospital in Zimbabwe

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Abstract

Background: Hypertension is a public health problem with high mortality and morbidity globally. A rapid assessment of hypertensive patients at Harare Central Hospital Outpatients Department (OPD) in June 2013 revealed that 41% of patients had uncontrolled hypertension. We, therefore, explored the factors associated with uncontrolled hypertension among hypertensive patients at Harare Hospital.

Methods: A one-on-one unmatched case-control study was conducted among 118 cases and 118 controls. A case was a person aged 18years and above on hypertensive treatment for ≥6months with mean Blood Pressure (BP) ≥ 140/90mmHg while a control was 18years and above on hypertensive treatment ≥6 months with mean BP<140/90mmHg. Interviews were used to collect information on socio-demographic, treatment, health system, condition, and patient-related factors. Written informed consent was obtained from all study participants. Medication adherence was measured with Morisky medication adherence scale-8.

Results: The median ages for cases were 49 years (IQR: 41-63) and 48 years (IQR: 42-62) for controls. Almost 57% were women with 23% living in rural areas. Most cases (94%) and controls (78%) added salt to meals. Rural women were less likely to have uncontrolled BP compared to urban women (OR=0.7; 95%CI: 0.35, 1.37). Lack of exercise, adding salt to meals and eating fruits/vegetables less than three times/week were associated with uncontrolled BP. Independent factors associated with uncontrolled BP were low adherence to medication, aOR 22.03 (95%CI: 9.10,53.5), receiving health education, aOR 0.24 (95%CI: 0.11 , 0.53), exercises aOR 0.33 (95%CI: 0.15,0.73) and on medical insurance aOR 2.69 (955CI: 1.12,6.44).

Conclusions: Common risk factors for hypertension were associated with uncontrolled BP. Since these are modifiable factors there is a need to implement interventions that will encourage healthy living in this population to improve treatment outcomes.

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Introduction

Hypertension, defined as a blood pressure of at least 140/90mmHg, continues to be a disease of public health importance with high mortality and morbidity. Hypertension is the commonest cardiovascular disorder that affects about a fifth of the adult population in many high, middle and low-income countries. It accounts for 20-50% of all deaths due to cardiovascular diseases [(1)]. Complications of hypertension include coronary heart disease, stroke, congestive heart failure and renal dysfunction. Proper control of hypertension reduces the risk of these adverse outcomes. However, the control of high blood pressure in the community is far from optimal [(2)].

The increasing economic consequences of hypertension illustrate the need for long-term control programmes that focuses on primary prevention, early detection and adequate treatment [(2)]. Findings of a rapid assessment undertaken among hypertensive patients at Harare Central Hospital outpatients` department (OPD) in June 2013 showed that 41% of patients had uncontrolled hypertension. We, therefore, set out to determine the factors associated with uncontrolled hypertension at Harare Central Hospital Outpatient Department, Zimbabwe.

Methods

A one-on-one unmatched case-control study was conducted at the outpatients department at Harare Central Hospital among patients on treatment for hypertension for at least three months prior to the study. A case was defined as a person aged 18 years and older on treatment for hypertension for at least 6months with mean systolic and diastolic BP of at least 140 and 90mmHg respectively. A control was a person aged 18 years and older on treatment for hypertension for at least 6 months with mean systolic and diastolic BP below 140mmHg and 90mmHg respectively.

Using the StatCalc utility of Epi Info software version 3.5.3 and assuming 95% confidence interval, 80% power to detect a difference of 4.44 times between cases and controls to have hypertension given the proportion of controls with obesity was 3.23% (Mishra 2011) [(3)] and correcting for 10% attrition, a minimum sample size of 137 cases and 137 controls was required.

When patients presented for regular reviews and follow-ups, their blood pressure measured using a portable desk mercury sphygmomanometer (C E desk sphygmomanometer model 0483) by a Nurse screening patients for the study. They were allowed to rest for at least five minutes prior to the measurements. Each patient had two blood pressure readings taken at least 3 minutes apart from both arms. During measurement, patients were seated comfortably in a chair with back supported and feet (without shoes) resting flat on the floor. The upper arms were left bare without constrictive clothing and supported on a table at the level of the heart. A third reading was taken from the arm with the higher reading and the average of the two readings from the same arm was recorded.

Outpatients` booklets were reviewed and kept away (from interviewer) by the same nurse to check for blood pressure readings over the preceding 6months. After measurements, patients were classified as either cases or controls. Only patients with consistently controlled blood pressure were classified under controls while those with high readings were classified as cases. Patients were then requested to participate in the study. Only those who agreed were then put in separate line lists and assigned numbers corresponding to the numbers on the list. From these line lists patients were randomly selected using the lottery method until the minimum sample size was reached. Patients who refused to participate were replaced.

Each patient had their weight measured using a pre-calibrated bathroom scale while wearing light clothing and barefoot. Weight was rounded off to the nearest 1kg. Every morning the scale was checked for accuracy using a standard 2kg dumbbell. Each time the recorded weight was 2kg.

Height was measured with the patient standing upright against a wall using a previously affixed height measuring device. Participants stood barefoot, with their backs, buttocks, and heels in contact with the wall. Body Mass Index (BMI) of each patient was then calculated using the formula: [weight (kg)]/[height (m)]^2. Obesity was defined as a BMI at least 30kg/m^2 based on the World Health Organization (WHO) guidelines [(4)].

Interviews were used to collect information on socio-demographic, therapy, health system, condition, and patient-related factors during the period among cases and controls. Outpatients` booklets and cards were checked by the Nurse screening patients to see treatment being received and any other co-morbid conditions as well as complications experienced as a result of hypertension. This information was subsequently documented on the questionnaires after the interviews. Each interview took an average 35 minutes to conduct for patients.

Medication adherence was assessed using the Morisky medication adherence scale-8 questionnaire [(5)]. Data was analysed using Epi info version 3.5.1. Frequencies and percentages were calculated for categorical variables and a measure of central tendency such as median was used for continuous data. Odds Ratios (ORs) were calculated to measure the strength of associations. Stratified analysis was done to check for effect modification and control for confounding. All calculations were done at 95% confidence intervals.

Frequencies, proportions, odds ratios, stratified Chi-square tests and logistic regression analysis was done using Epi info 3.5.1 (CDC, Atlanta, 2011). All calculations were made at 95% confidence interval (95%CI). Univariate analysis was initially done fitting information into previously prepared shell tables and graphs. This was followed by bivariate analysis to examine two variables comparing risk factors and case status. Stratified analysis was done for factors found to be statistically significant in the bivariate analysis to control for confounding and identify effect modification.

Table 1: Socio-demographic characteristics associated with uncontrolled blood pressure among blood pressure patients at Harare Central Hospital, Zimbabwe, 2013

Variable	Case n (%)	Control n(%)	p-value
Sex			
Female	61 (52)	75 (63)	0.07
Male	57 (48)	43 (36)	
Age-years			
25-45	40 (34)	52 (44)	
46-65	57 (48)	43 (36)	
≥66	21 (18)	23 (20)	
Median age in years	49 (Q_1=41;Q_3=63)	48 (Q_1=42;Q_3=62)	0.3
Marital status			
Married	85 (72)	86 (73)	0.002
Single	9 (8)	3 (3)	
Divorced	1 (0.8)	13 (11)	
Widowed	23 (19)	16 (14)	
Education level			
None	10 (8)	5 (4)	0.06
Primary	31 (26)	51 (43)	
Secondary	59 (50)	46 (39)	
Tertiary	17 (14)	29 (25)	
Residence			
Rural	21 (18)	28 (24)	0.26
Urban	97 (82)	90 (76)	
Employment status			
Employed			
Unemployed	58 (49)	59 (50)	0.9
	60 (51)	59 (50)	
Monthly Income			
1-100	43 (36)	50 (42)	0.6
101-300	27 (23)	24 (20)	
301-500	43 (36)	24 (20)	
>500	5 (4)	7 (6)	

Stepwise logistic regression analysis was then conducted to estimate measures of association of significant variables found in the bivariate analysis at the p=0.25 level.

We started with a single variable adding the other variables one by one at the 0.05 level (95% CI) eliminating all non-significant variables until all possible variables had been added.

Ethical review and approval for the study were offered by the Joint Research and Ethics Committee of Parirenyatwa Hospital (JREC). Permission to conduct the study was granted by the Medical Research Council of Zimbabwe (MRCZ). All respondents signed a consent form after the purpose of the study was explained. Data was collected during the months of June and July 2013.

Results

In this study, we managed to interview 118 case-control pairs at Harare Central Hospital giving a response rate of 86.1%.

Demographic characteristics

Women constituted the majority of the patients in this study, being 52% and 63% of cases and controls respectively. The median ages for cases were 50 years (IQR: 41-63) and 48 years (IQR: 42-61) for controls, (p-value 0.35). Most cases (82%) and control (76%) lived in urban areas. Almost 57% were women with 23% living in rural areas. The demographic characteristics of cases and controls were significantly different (p-value >0.05) with respect to median age, the highest level of education, monthly income and employment status (**Table 1**).

Factors associated with Uncontrolled

Table 2: Socio-economic and medical factors associated with uncontrolled blood pressure among blood pressure patients at Harare Central Hospital, Zimbabwe, 2013

Characteristic	Cases n (%)	Controls n (%)	OR	95% CI
On medical aid	49/118 (4.5)	29 (24.6)	2.19	1.25, 3.82
Smoking	11/118 (9.3)	3/118 (2.5)	3.94	1.1, 14.8
Alcohol use	27/118 (22.9)	11/118 (9.3)	2.89	1.36, 6.14
Exercises	37/118 (31.4)	79/118 (66.9)	0.23	0.13, 0.39
BMI	44/118 (37.3)	27 (22.9)	2	1.13, 3.54
Low Adherence to medicines	83 (70.3)	10 (8.5)	25.6	12.0, 54.7

with uncontrolled hypertension. This relationship between exercising and uncontrolled hypertension was modified by body mass index. The benefit of exercising against uncontrolled hypertension was less among obese patients as compared to non-obese patients (**Table 3**). Upon stratification by age, exercising patients who were at least 40years old were significantly less likely to have uncontrolled hypertension (OR 0.19, 95%CI: 0.10-0.36) as compared to those younger than 40years (OR 0.38: 95%CI: 0.12-1.20). However, the chi-square for differing odds ratios by stratum indicated that the odds ratios did not differ by stratum (Chi-Square 0.969, p-value 0.33). A similar outcome was noted when the data was stratified as younger than 60years and at least 60years old. Being on medical insurance was associated with higher risk of uncontrolled hypertension. This relationship was, however, modified by employment status where the risk was over-estimated among those who were employed while being under-estimated among drank alcohol more likely to have low adherence (OR 35, 95%CI: 3.7-331) as compared to those who did not (OR 23.3, 95%CI: 10.3-52.5).

Exercising was less likely to be associated those who were not employed (**Table 4**). The odds ratios did not differ by stratum as shown by chi-square (1.13) and high p-value (0.29) for differing odds ratios (in the summary of the output) by stratum.

Independent Factors Associated with Uncontrolled Hypertension

Table 3: Association between exercise and uncontrolled BP stratified by body mass index, Harare Central Hospital, Zimbabwe, 2013

Variable	Case	Control	OR	95%CI
BMI **≥30**				
Exercises Yes	16	14	0.53	0.20, 1.40
No	28	13		
Exercises Yes	21	65	0.16	0.08, 0.31
No	53	26		
Crude				
Exercises Yes	37	79	0.23	0.13, 0.39
No	81	39		
P<0.0001				

Table 4: Association between being on medical aid and uncontrolled BP stratified by employment status, Harare Central Hospital, Zimbabwe, 2013

Variable	Case	Control	OR	95%CI
Employed				
On medical insurance Yes	35	25	2.01	0.96, 4.21
No	23	33		
Not employed				
On medical insurance Yes	14	4	4.28	1.32, 13.9
No	45	55		
On medical aid				
Yes	49	29	2.19	1.25, 3.82
No	68	88		
P=0.006				

Hypertension

Almost half the cases (49%) and controls (50%) in the study were employed. Patients with uncontrolled BP were more likely to be on medical insurance than those with controlled hypertension (OR 2.19; 95%CI: 1.25, 3.82) (**Table 2**).

Smoking (OR 3.94, 95%CI: 1.1-14.8), drinking alcohol (OR 2.89, 95%CI: 1.36-6.14), having a BMI >30 (OR 2.00, 95%CI: 1.13-3.54) were associated with uncontrolled hypertension (**Table 2**).

Patients who engaged in exercises were less likely to have uncontrolled hypertension (OR 0.23; 95%CI: 0.13, 0.39). Similarly, patients who received health education on hypertension were less likely to have uncontrolled hypertension (OR 0.20; 95%CI: 0.11, 0.34).

There was low adherence to medication (70%) among cases compared to 9% among controls. High adherence was at 3% and 27% of cases and controls respectively. The likelihood of uncontrolled hypertension among patients with low adherence was significantly higher compared to those with medium and high adherence to medicines (OR 25.6; 95%CI: 12.0, 54.7).

Low adherence to medication was the most important singular factor influencing the development of uncontrolled hypertension.

Stratified Analysis

Patients who received health education were less likely to have uncontrolled hypertension. Among

Table 5: Independent factors associated with uncontrolled BP at Harare Central Hospital, Zimbabwe, 2013

Variable	Crude OR	aOR	95%CI
Ever received Health education	0.2	0.24	0.11, 0.53
Low adherence to medication	25.6	22.03	9.10, 53.5
Exercises	0.23	0.33	0.15, 0.73
On medical insurance	2.19	2.69	1.12, 6.44

these, patients with insurance were less likely to have uncontrolled hypertension (OR 0.06, 95%CI: 0.02-0.20) as compared to patients without insurance (OR 0.31, 95%CI: 0.16-0.60). Confidence intervals for these strata were overlapping suggesting no difference.

A comparison was made on the effects of alcohol on low adherence to medication. Patients who

Multivariate analysis was done using the variables: low adherence to medicine, exercise, smoking, drinking alcohol, ever received health education and on medical aid.

Independent factors associated with uncontrolled hypertension were: ever received health education, low adherence to medication, exercises and on medical insurance while controlling for medical insurance, taking alcohol, body mass index and employment respectively (**Table 5**).

Discussion

This study investigated factors that were associated with uncontrolled hypertension among cases and controls in a central hospital in Harare, Zimbabwe. This study found that low adherence to medicine and being on medical insurance was independently associated with uncontrolled blood pressure. Conversely, receiving health education on hypertension and exercising were independently associated with controlled hypertension.

For a patient on treatment to achieve better control of their blood pressure, adherence to medication has to be very high. Missing doses allow the damaging effects of the condition to prevail. As a result complications such as stroke become common among patients with low adherence to medication. In our study, adherence was affected by taking alcohol intake. Taking alcohol may result in a patient forgetting to take their doses as alcohol impairs judgement and memory. Other studies found poor lifestyle, age, employment and obesity to be associated with low adherence to medication [6, 7, 8].

Complications such as stroke are common in Zimbabwe. Though not shown in the results, the number of patients who had ever experienced a stroke and heart failure was higher among those with well-controlled blood pressure. In this study, there was a positive association between knowledge about complications and adherence [9]. This might reflect a paradigm shift, a wake-up call as both conditions are decidedly uncomfortable for the individual patient and could be an impetus for stricter adherence to medication plans. This highlights the importance of health education on risk factors, prevention of complications and adherence to medication as part of mitigation.

A cohort study done by Hacihasanoğlu et al (2011) among hypertensive patients in Turkey showed that health education improved control of hypertension among those who had been educated about their condition [10]. The fact that those who had health education were less likely to have uncontrolled BP offers a challenge to improve and ensure that every patient is well educated on the course of blood pressure. Health education should not, however, be taken in isolation of other potential factors such as medical insurance. A patient may understand that they should buy medication but are unable to because they do not have money or insurance.

Exercise induces a reduction in levels of catecholamine (e.g. adrenaline), adiposity, increase insulin sensitivity and increases vasodilatation and results in a drop in the BP [11]. The benefits of exercise have been mentioned in literature with some studies specifying different types of exercise strategies [12, 13]. In our study, exercising was associated with low prevalence of uncontrolled hypertension. A major challenge in our environment is that patients tend to tell a health worker what they expect the health worker wants to hear and not what they actually did. As a result, there may have been over-estimation of exercise among these patients thus underestimation of the effect of exercise on uncontrolled hypertension. This is important guiding health education and counselling for patients with hypertension.

Patients on medical insurance were more likely to have uncontrolled blood pressure compared to those without medical aid. These findings are consistent with other studies where health insurance was not necessarily associated with stricter blood pressure control [14]. The assumption is that patients who suffer from chronic illnesses are more likely to seek or register for medical insurance. As they are likely to seek medical care more often, they will need medical insurance more than those without chronic illnesses. For them, medical insurance will cushion them from financial burden. Among those on medical insurance those employed had a lower risk of having uncontrolled hypertension as compared to those who were not employed. There is, therefore, need for insurance companies to shift from their tradition of denying health insurance to chronically ill patients and cover a wider range of chronic illnesses

Studies based on NHANES data and clinical databases have helped to change the perception that patients with uncontrolled hypertension are typically uninsured or have restricted access to healthcare [14]. In contrast to the notion that those who are poor and without health insurance are more likely to have uncontrolled hypertension, a high proportion of patients with uncontrolled hypertension had health insurance and had a regular source of health care. This difference may be due to the socioeconomic status of the country where Zimbabwe is on the lower side [15].

Limitations

Although the internal validity of this study is high the external validity is quite low. The results may represent the patient population in central hospitals but not those attended to in district hospitals where the bulk of patient in this country are attended to.

This was an unmatched case-control study thus differences observed could be due to differences not controlled for in the selection of cases and controls. In our selection, we did not match for age group or by gender.

We could not conduct the Breslow-Day test for homogeneity which means we did not test for homogeneity of the common odds ratio across strata.

Recall bias may have affected the validity of our results due to the fact that patients may not have been in a position to remember medical history sought for. Due to observer bias information on exposure obtained may not have been accurate.

Conclusions

In conclusion, the burden of uncontrolled hypertension has attracted the world's attention and rightfully so as hypertension is well known as a silent killer. Many of the factors that impact on the control of blood pressure as identified in this study are fortunately modifiable. These include low adherence to medicines, not exercising, and obesity. Therefore, in order to improve blood pressure control among hypertensive patients, it is crucial to consider these factors, especially when planning interventions.

Recommendations

We, therefore, recommend that health services in institutions include counselling on modifiable risk factors focusing on lifestyle modification. A multi-professional approach is relevant with a particular focus on nutritionists, counsellors, health promotion officer and exercise experts. In addition, an adequate supply of medicines is vital to avoid patients missing doses thus the supply chain management system needs strengthening. This study did not explore reasons behind low adherence to medication in details. Thus, there is a need for another study on this area which will help guide clinicians mitigate low adherence to medication.

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