Prevalence of hypertension in a sample of community members in a low-income peri-urban setting in Gaborone, Botswana

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Informed consent: Written consent was obtained from each participant before the screening was conducted and a number was allocated to each participant to maintain anonymity and protect privacy.

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Abstract

Background: Cardiovascular disease remains the leading cause of death worldwide. Hypertension is a primary risk factor for the development of cardiovascular disease and affects more than a quarter of the global adult population. Africa is a continent where the prevalence of non-communicable diseases including cardiovascular disease and hypertension, is increasing rapidly. Botswana is a developing country in Sub-Saharan Africa. In such contexts the early identification of hypertension, through community screening initiatives, is an important tool for the management of cardiovascular disease in the population.

Objective: To investigate and describe the prevalence of hypertension in a sample of community members residing in a low-income peri-urban setting in Gaborone, Botswana.

Method: 364 adult participants had their blood pressures measured during a community health screening exercise. The values were analysed and categorised using the American Heart Association classification scale as either being *normal*, *elevated*, *hypertensive stage 1* or *hypertensive stage 2*.

Results: 234/364 (64%) of participants were found to have blood pressures within normal limits. 53/364 (15%) had elevated blood pressures, 57/364 (16%) were in hypertensive stage 1 and 20/364 (5%) were in hypertensive stage 2.

Conclusions: Hypertension in Africa is a growing concern. Botswana appears to be no exception with a 36% prevalence of *abnormal* blood pressures being recorded. However, the majority of these were classified as *elevated* or *stage 1*. Early identification and treatment of hypertension in these early stages can significantly decrease the risk of developing *stage 2* hypertension and the related systemic complications.

Introduction

Cardiovascular Disease (CVD) remains the leading cause of death worldwide; 80% of these deaths occur in low- and low-middle income countries.[1] Hypertension is the primary risk factor for the development of CVD and affects more than a quarter of the global adult population.[2,3] In the year 2000 there were 972 million people living with hypertension globally,[1] and it is estimated that by 2025 this number will have increased to over 1.6 billion.[3] Consequently, hypertension is increasingly becoming recognised as a medical and public health concern in developing countries.[4]

In Sub-Saharan Africa (SSA), the prevalence of CVD and hypertension is increasing with around 10-20 million people of an estimated 650 million population reportedly suffering from hypertension.[4-6] The incidence of hypertension in the region appears to be the highest amongst people living in urban communities and, similar to global findings, it is seen to increase with age.[3,4,6] Additional risk factors for the development of hypertension are

well documented and include tobacco and alcohol use, unhealthy diet with high salt and fat intake, physical inactivity and obesity.[4] The high and growing prevalence of hypertension in SSA has also been linked to population growth associated with rising urbanization and adoption of Western lifestyles.[7] Recent surveys have shown that the prevalence of hypertension for both rural and urban populations increased between 30 and 60% in SSA in people aged 65 years and above.[8] However, unlike developed regions of the world, reliable up-to-date detailed data for SSA remains limited.[9]

Early identification of hypertension is recognised as an important step in reducing the risk of people developing CVDs.[5] Despite this and the availability of effective low-cost treatments, a lack of screening persists, resulting in many cases of hypertension within SSA remaining undiagnosed. This may explain why the identification and control of hypertension in developing countries and regions like SSA are reported to be far lower than in high-income countries and developed regions such as the United States of America and the United Kingdom.[2] Consequently, improved screening for hypertension should be an important activity if we are to achieve one of the region's Sustainable Developmental Goals of reducing premature morbidity due to non-communicable diseases (NCDs) by a third by 2030.[10]

Botswana is a developing country in SSA and like other countries in the region it faces the burden of managing an aging population with a growing burden of NCDs. The population of Botswana is only around 2,412,093 people with 59.1% of its residents reportedly living off less than $ 5.50 (USD) per day.[12] In the capital city of Botswana, Gaborone, unemployment and poverty are prominent in regions of the city, and contribute to unhealthy lifestyles choices and options that include, poor diet and eating habits. All of the above may contribute to the development of NCDs, including hypertension.[4] Despite this up-to-date information showing the current prevalence of hypertension in many countries in the region including Botswana remains unknown.[11] This paper describes the prevalence of hypertension we found in a sample of community members residing in Naledi, a low-income, peri-urban community in Gaborone.

Materials and methods

Study design and setting

We followed a prospective quantitative design making use of a purpose designed context-specific survey. The survey was completed using data obtained during a community health outreach project. The outreach project was funded by the University of Johannesburg and involved students from the Faculty of Health Sciences, under supervision of trained professionals, screening members of the Old Naledi community in Gaborone, Botswana for selected predisposing factors for development of NCDs such as diabetes and cardiovascular disease. Old Naledi is a peri-urban community on the outskirts of Gaborone, Botswana. This community is characterised by poverty, high unemployment rates, alcohol abuse issues, and scarce resources such as food, running water, and electricity.[13] The exact population of Old Naledi could not be found in the Botswana demographic survey report,[13] but it was estimated at around 90,000 inhabitants in 2011.[14]

Participants and sampling

Participants consisted of members of the community of Old Naledi, aged 18 years and older, who gave written consent for their demographic and health data to be included in the study. The Old Naledi community was purposively chosen by academics from the University of Botswana, Department of Nursing. These colleagues were involved in advising on aspects of the logistical organisation of the study and had a good insider perspective relating to the socio-economic conditions of the community in Old Naledi. The final sample included 364 (n=364) participants.

Data collection

Screening is generally defined as the attempted detection of unknown disease among an apparently healthy population by means of tests or examinations to identify potential risks for the disease.[5] A screening station was set up at the community centre in Old Naledi and community leaders invited members of the community for free health screening over a period of three days. Those who did not meet the inclusion criteria were still screened but their data was not included in the results of the study.

Data was gathered over a period of 3 days from members of the community who presented themselves for free screening at the identified outreach site in old Naledi district. The demographic data captured included gender, age, highest level of education, marital status, employment status, number of people per household and monthly income.

A component of the screening included focused history taking and measurement of cardiovascular parameters such as heart rate and blood pressure. Whilst several additional parameters and tests were conducted during the screening, this paper focuses on describing the analysis and findings relating to those datasets that were relevant to the prevalence of hypertension within the sample. In this regard participants had their blood pressures measured using a micro life® electronic non-invasive blood pressure (NIBP) monitor.[15] Both the systolic blood pressure (SBP) and diastolic blood pressure (DBP) were recorded, using the right arm after 5 minutes of rest.[16] The NIBP monitors used were all calibrated and checked prior to and during the screening. Participants with abnormal findings were reassessed again after a period of rest (>30 minutes) at the end of the screening session to ensure that the readings initially recorded were accurate and consistent.

Data analysis

The information from the survey was entered into a Microsoft Excel® spread sheet. The data were captured by creating columns on the Excel spread sheet indicating the socio-economic data first. Secondly, columns were created to capture the SBP and the DBP separately and that allowed us to make inferences regarding the blood pressure levels. Other data such as the participant's weight, height, BMI, blood glucose and cholesterol levels were also captured; however, this data is not the focus of this article. The data was analysed using the statistical software programme (IBM SPSS 23.0).

For analysis and reporting on the prevalence of hypertension we adopted the blood pressure classifications and ranges of the American Heart Association, as indicated in Table 1.[16]

Ethical considerations

The study was approved by the University of Johannesburg research ethics and the higher degrees committees (Ethical Clearance Number REC-241112-035). Permission was also granted from the Botswana Ministry of Health to conduct the study. The community leader of the Old Naledi district was also approached for permission to engage with members of the community. Written consent was obtained from each participant before the screening was conducted and a number was allocated to each participant to maintain anonymity of the participant and to protect privacy.

Results

Result are presented in terms of participants demographics and socio-economic profiles (Table 2), thereafter, in Table 3, we highlight the prevalence of hypertension within the sample.

As indicated in Table 1, the 31-50 age group was the most represented (n=181), followed by the 18-30 age group (n=137). Female predominance was denoted by a 60.4% representation (220). Very few adults over the age of 50 presented themselves for the screening. Only 207 (56.9%) reported to have completed high school and just over half of the participants reported to be employed or self-employed, while 142 (39%) reported to be unemployed. Most of the participants, 259, (71.2%) were unmarried.

Prevalence of hypertension

The classification is arranged according to different blood pressure categories namely normal, elevated, high blood pressure (hypertensive stage 1), high blood pressure (hypertensive stage 2).

Referring to the categories of hypertension as indicated in Table 2, in this study, participants were considered to have an "abnormal" blood pressure when they presented a SBP greater than 130 mmHg and/or a DBP greater than 85 mmHg.[4] Hypertension stage 1 was noted as a SBP 140-159 mmHg and a DBP of 90-99 mmHg. Hypertension stage 2 was noted as a SBP of ≥160mmHg and a DBP of ≥100 mmHg. Several related studies conducted in Africa also defined hypertension as such.[24,25] Where the screening elicited significant health concerns, participants were counselled and provided with referral letters to appropriate local health care facilities for further investigations and treatment.

Table 3 indicates the blood pressure measurements of the 364 participants (n=364) according to the various categories.

In Table 3, *Normal blood pressure (SBP < 130 mmHg and DBP < 80 mmHg):* 234 (64%) of the participants presented a normal blood pressure. *Elevated blood pressure (SBP 130-139 mmHg and/or DBP 80-89 mmHg):* 53 (15%) of the participants had an elevated blood pressure. *Hypertension stage 1: SBP 140-159 mmHg and/or DBP 90-99 mmHg):* 57 (16%) of the participants presented a blood pressure in the hypertension stage 1 range. *Hypertension stage 2: ≥160 mmHg and/or ≥100 mmHg):* 20 (5%) of the participants presented a blood pressure in the hypertension stage 2 range.

Table 1. American Heart Association classification of hypertension based on blood pressure measurements. Adapted from: Unger T, *et al.* (2020).[16]

Blood pressure classification	SBP	DPB
Normal BP	<130 and	<85
Elevated	130-139 and/or	85-89
High blood pressure (hypertension stage 1)	140-159 and/or	90-99
High blood pressure (hypertension stage 2)	≥160 and/or	≥100

SBP, systolic blood pressure; DPB, diastolic blood pressure; BP, blood pressure.

Table 2. Demographic and socio-economic profile.

Variable	Frequencies (n)		%	
Age (years)	Male	Female	Male	Female
18-30	49	88	13.5	24.2
31-50	82	99	22.5	27.2
>50	13	33	3.6	9
Total	144	220	39.6	60.4
Level of education				
No formal schooling	37	10.1		
Incomplete primary school	6	1.7		
Primary school completed	66	18.1		
High school	207	56.9		
Tertiary education	48	13.2		
Total	364	100		
Occupation				
Employed/self employed	189	51.9		
Student	14	3.8		
Home maker	4	1.1		
Unemployed (able to work)	142	39		
Unemployed (unable to work	9	2.5		
Retired	6	1.6		
Total	364	100		
Marital status				
Married	51	14		
Unmarried	259	71.2		
Cohabitation	39	10.7		
Divorced or widowed	15	4.1		
Total	364	100		

Discussion

Socio-demographics

One hundred and eighty-one (49.7%) participants were between the ages of 31-50 years. A prior study conducted in Botswana mentioned that people between the ages of 55-64 years are 7 times more likely to have hypertension compared to those aged 25-34 years.[4] Very few of our participants (46; 12.6%) were over the age of 50 years. Studies have shown that there is a higher prevalence of hypertension among urban populations and that hypertension increases with age.[4] Consequently, the prevalence of stage 1 and 2 hypertension noted in our sample may have been higher if greater numbers of *older* community members had presented for the screening.

Aside from increasing age, additional factors such as gender, level of education, social stress, hardening and shrinking of the arteries, obesity, and leading an unhealthy lifestyle can all contribute to hypertension.[18,19,20] In our sample there were significantly more female participants (220; 60.4%). This is not unexpected as women are noted to be more likely than men to attending community screening opportunities and seek treatment for general health problems.[19]

Two hundred and seven (56.9%) participants indicated that they have completed high school and 48 (13.2%) indicated that they have a tertiary education. A study conducted in Vietnam revealed that people with low educational status were more often hypertensive than those with educational statuses.[19] A study conducted in South Africa found that among women a higher level of education and income were associated with a lower SBP and DBP.[21]

Concerning potential socio-economic stressors, in our study, 142 (39%) participants indicated they were unemployed. Prior studies have found linkages between lower-income groups (because of socio-economic stress, lack of access to facilities, and poor diet) to increased risk of developing hypertension.[8] Two hundred and fifty-nine (71.2%) participants were unmarried. A study conducted in rural Nigeria showed that a high proportion of married people were hypertensive.[22]

Prevalence of hypertension

Hypertension in Africa is a growing concern and Botswana appears to be no exception with a 36% prevalence of *abnormal* blood pressure being recorded. In trying to contextualise our findings we noted that several studies have been conducted that confirm hypertension is a widespread problem in many communities in developing regions on the continent with prevalence reportedly ranging from 13% to as high as 42%.[3,4,6,7,9,11] We found that 53 (15%) participants had elevated blood pressures, 57 (16%) were in hypertensive stage 1 and 20 (5%) were in hypertensive stage 2, with an accumulative total of 36%, similar to another study also conducted in Botswana that found a prevalence of hypertension at 32%.[17] This is supported by statistics that the World Health Organization (WHO) African Region has the highest prevalence of hypertension (27%), while the WHO Region of the Americas has the lowest prevalence of hypertension (18%).[18]

It should be noted that most of the abnormal blood pressures recorded in our study fell into the *elevated* or *stage 1* categories. This is potentially good news for early identification, as treatment of hypertension in these early stages can significantly decrease the risk of developing *stage 2* hypertension and the related systemic complications.[18]

Blood pressure measurements in the *elevated* and *stage 1* ranges might be attributed to tobacco and alcohol use, unhealthy diet with high salt and fat intake, physical inactivity, and obesity.[4] Previous studies found that the prevalence of NCDs such as hypertension are higher in those residing in urban areas. This study was conducted in a peri-urban community in Gaborone, Botswana. Rural-urban and peri-urban variation may be explained partly by differences in physical and dietary habits. Urban populations are said to have a higher intake of sodium, which is a contributing factor to hypertension.[27] The early identification and treatment of blood pressure measurement that are *elevated* or *stage 1* can significantly decrease the risk of developing hypertension stage 2. This becomes an important finding as it is estimated that there is a 30% conversion rate of hypertension stage 1 to hypertension stage 2 every 4 years.[23]

Patients with stage 2 hypertension have a higher risk of end organ damage compared to patients with well-controlled hypertension.[28] Stage 2 hypertension is associated with stroke, aortic dissection, acute aortic dissection, myocardial infarction, renal failure, and congestive heart failure,[29] amongst many other complications related to end organ damage.

Conclusions

Hypertension is a primary risk factor for CVD in both developed and developing countries. CVD is the leading cause of mortality worldwide and it is estimated to account for 14,3 million premature deaths in developing countries such as Botswana.[30] Studies have shown that the current prevalence of hypertension in many developing countries, particularly in urban communities, is already as high as those seen in developed countries.[4] Although the exact prevalence of hypertension in the total population of Botswana remains unknown, hypertension persists as the most commonly self-reported NCD.[27] In our study a 36% prevalence of *abnormal* blood pressures were recorded in this sample of community members in Botswana. Most cases of hypertension in our study were noted as being in the *elevated* or *stage 1* categories. Health counselling, diet and lifestyle changes coupled with regular monitoring

Table 3. Blood pressure measurements according to categories. Adapted from: Unger T, *et al.* (2020).[16]

Blood pressure category	SBP	DPB	Frequency (n)	%
Normal BP	<130 and	<85	234	64
Elevated	130-139 and/or	85-89	53	15
High blood pressure (hyperten-sion stage 1)	140-159 and/or	90-99	57	16
High blood pressure (Hyperten-sion stage 2)	≥160 and/or	≥100	20	5
Total			364	100

SBP, systolic blood pressure; DPB, diastolic blood pressure; BP, blood pressure.

and proactive treatment can prevent cases from progressing to stage 2 hypertension, where the costs to the individual and the health care system are much higher.

Further research is recommended using larger samples to determine if the prevalence of hypertension in our sample is reflective of the wider population. The results of this study may assist policy makers and programme managers to identify areas in Botswana that need preventative measures, early identification, and treatment of hypertension to prevent CVDs. Feasible and cost-effective interventions such as offering free screening, can assist in reducing the burden and impact of hypertension now and in the future.

Limitations

An unavoidable limitation of a study design such as ours which makes use of people presenting for free screening is the fact that we could not completely control our sample size nor ensure we had an equal number of participants by gender and age. With the NIBP monitor three measurements are automatically taken in succession and the result is analysed and the average displayed, during the single visit. This could result in a misdiagnosis of *true* hypertension, which is conferred after 2 to 3 visits at 1-to-4-week intervals. However, a diagnosis might be made on a single visit if the BP is ≥180/110 mm Hg and there is evidence of CVD.[31,32] Our participants mainly consisted of women. Including more men in the study could have given a broader picture of the prevalence of hypertension in this community. Similarly, most of our participants were between 18 and 50 years of age and the prevalence of stage 1 and 2 hypertension may have been higher if greater numbers of *older* community members had presented for the screening.

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