Original Research Article

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Prevalence and determinants of prehypertension among youth in Ghana

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ABSTRACT

Background: Recent studies showed an increased prevalence of prehypertension and alarming trend of prehypertension among the youth. This study was aimed at determining the prevalence of prehypertension and its determinants among male youth in Ghana.

Methods: The study retrieved data from the 2014 Ghana Demographic and Health Survey (GDHS). For this study, the data related to men was used and those aged 15-24 years were extracted for the analysis. The sample which comprised of 1,363 respondents was analysed using descriptive statistics, simple and multiple logistic regressions. Multicollinearity test was also carried out using the variance inflation factor and tolerance to determine independents variables that were correlated. Crude and adjusted odds ratios were reported accordingly.

Results: The overall prevalence of prehypertension was 5%. Among those who were pre-hypertensive, 4.1% were secondary school graduates and 2.6% were not sexually active in the last four weeks prior to the study. Similarly, 4.3% of those who were pre-hypertensive had their blood pressure taken in the morning. Occupation and region of residence played significant roles in prehypertension prevalence. Whilst arm circumference, sexual behaviours and smoking habit were significant predictors of prehypertension.

Conclusions: Educational level, occupation, sexual behaviours such as having too many sexual partners, and smoking were significant predictors of prehypertension. This study suggests that education on the importance of regular blood pressure monitoring among the youth should be intensified. Also, education hinging on some of the negative effects of cultural shifts and transformations like sexual partners' acquisition should be intensified.

Keywords: Determinants, Ghana, Prehypertension, Prevalence, Youth

INTRODUCTION

There has been an increase in the incidence of cardiovascular diseases (CVD) especially hypertension and its related deaths globally. Hypertension is gradually becoming a serious public health concern in developing countries particularly because mortality associated cardiovascular diseases in developing countries is higher in younger people than in developed countries. In Africa, CVD is among the top 20 diseases responsible for mortality. Population-based studies in Ghana have shown rise in hypertension prevalence and its impact on stroke morbidity and mortality over the past decades. 5,6

Notwithstanding this, awareness, treatment and control of hypertension in Ghana are poor. Lifestyle factors, high population growth in urban areas have been reported as the attributing factors to the rise in the burden of hypertension.⁷ Other researchers in a population-based review revealed that obesity, lack of exercise and poor diet were associated with the rising prevalence of hypertension.⁸

It is a known fact that prehypertension is a precursor to the development of hypertension. Recent studies among younger population showed an increased prevalence of prehypertension and alarming trend of prehypertension

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among the study population.¹⁰ Individuals with prehypertension are at two to three fold higher risk of developing hypertension as compared to optimal BP individual.⁹ Various studies have revealed that the rate at which individuals are converted from pre-hypertensive stage to clinical hypertension is 37% or more.^{11,12} The development of prehypertension is influenced by several factors such as genetic and environmental predisposition.^{13,14}

It was found that early diagnosis of prehypertension and early intervention by adopting healthy lifestyle could reduce the rate of progression to clinical hypertension.¹⁵ The impact of treating patients with hypertension would result in much higher cost compared to early management of prehypertension. In a study conducted in Ghana among tertiary students, the prevalence of prehypertension was found to be higher than hypertension among the study population.¹⁶

In our quest to find studies on determinants of prehypertension among the youth in Ghana, we noticed that such studies are rare. Therefore, facts on the prevalence of prehypertension and its determinants among youth is timely in order to determine the strategies for controlling and preventing hypertension.

The aim of this study was to determine the prevalence of prehypertension and its determinants including arm circumference, sexual behaviours and smoking habits among the youth in Ghana.

METHODS

Study design

The survey employed cross sectional study design which sought to collect data on study participants from all enumeration areas across the country at a particular point in time.

Study place and period

The 2014 GDHS was conducted in urban and rural areas and each of Ghana's 10 administrative regions. A household listing operation was undertaken in all the selected enumeration areas in January-March 2014 and household to be included in the survey were randomly selected from the list. Data collection took place between September to mid-December, 2014.

Selection criteria

All women age 15-49 who were either permanent residents of the selected households or visitors who stayed in the household the night before the survey were eligible to be interviewed and have their blood pressure measured.

In half of the households, all men age 15-59 who were either permanent residents of the selected households or visitors who stayed in the household the night before the survey were eligible to be interviewed. In addition, in the subsample of households selected for the male survey. Blood pressure measurements were performed among eligible men who consented to being tested.

Sampling procedure

The 2014 GDHS adopted a two-stage sampling strategy to allow estimates of key indicators at the national level, urban and rural areas and each of the country's 10 administrative regions. The first stage of the sample design involved selection of clusters consisting of enumeration areas (EAs) delineated for the 2010 Ghana Population and Housing Census (PHC). As a result, a total of 427 clusters were selected in the entire country (216 clusters in urban areas and 211 clusters in rural areas). The second stage involved household listing in all the selected EAs. About 30 households were selected from each cluster through a systematic random sampling, and a total of 12,831 households were selected throughout the country.

Data collection

Data collection was carried out by 25 field teams, each consisting of one supervisor, one field editor, two female interviewers, one male interviewer, and two health technicians. Senior staff members from Ghana Statistical Service (GSS) and the Ghana Health Service (GHS) coordinated and monitored the fieldwork. Paper questionnaires were used for the interviews. After the interview, field editors entered the questionnaire data on laptops with passwords protecting the data files. Electronic data files were transferred to the central office every few days via the secured Internet File Streaming System (IFSS). Participants in fieldwork monitoring also included two survey technical specialists from the DHS Program. Data collection took place over about 3.5 months, from early September to mid-December 2014.

Blood pressure readings were taken from consenting individuals. During the individual interview, three blood pressure measurements were taken from consenting women age 15-49 in all of the selected households and men age 15-59 in the subsample of households selected for the male survey (half of the households). Blood pressure was measured using the LIFE SOURCE® UA-767 Plus blood pressure monitor, a digital oscillometric device with automatic upper-arm inflation and automatic pressure release. Measurements were taken at intervals of 10 minutes or more. The average of the second and third measurements was used to classify the respondent with respect to hypertension, according to internationally recommended categories. ¹⁸ The results, as well as information about the symptoms of high blood pressure and ways in which it can be prevented, were provided to the respondent via the blood pressure reporting form.

Data processing

In the 2014 GDHS, paper questionnaires were used for the interviews (as noted), and the CAFE system was used by the field editor to enter the data in the field. All electronic data files were transferred from the field (via IFSS) to the GSS central office in Accra, where they were stored on a password-protected computer. The data processing operation included 100 percent verification of information and secondary editing, which involved resolution of computer-identified inconsistencies. The data processing activities at the central office were led by senior staff from GSS and one more staff member who participated in the main fieldwork training. Data processing was accomplished using CSPro software. Data entry and editing were initiated in September 2014 and completed in February 2015.

Statistical analysis

"Stata" statistical package version 12 was employed in the analysis. A sample weight variable was generated using the sampling weight in the dataset. The dataset was then declared as a survey dataset using the generated weight, primary sampling unit and strata. This was then applied in all the analysis. Key variables that were are religion and occupation. Arm circumference, time of blood pressure measurement and age at first sex were categorized whiles blood pressure was transformed into binary variable (normal or prehypertensive). Prehypertension was defined as an average systolic BP reading ranging from 120-139 mmHg and average diastolic BP reading ranging from 80-89 mmHg. Those respondents with average systolic and diastolic BP less than 120 mmHg and 80 mmHg respectively were classified as normal blood pressure. The covariates that were examined included: age, level of education, region of residence, time of taking BP measurement, arm circumference, age at first sex, recent sexual activity, occupation, number of sex partners and smoking.

Mean and standard deviations were used to describe continuous variables and percentages were used to describe categorical variables. Simple and multiple logistic regression models with robust variance estimator at a 95% confidence interval (CI) was used to obtain odds ratios. Each of the selected risk factors were assessed independently with the outcome variable (blood pressure) in a simple logistic regression model to obtain the significant variables. The multiple logistic regression model considered all the significant risk factors. Statistical significance was denoted with an asterisk (*). p<0.001, p<0.01 were represented by *** and ** respectively, while * denoted p<0.05. The risk factors included in the final multivariable logistic regression model were significant at p<0.05 as well those recommended by literature. We also tested for multicollinearity using variance inflation factor (VIF) and tolerance to determine variables that were correlated. The results of the multicollinearity test is available in Table 1. As a general rule of thumb, a variable with VIF values greater than 10 or tolerance value of 0.1 or less indicates multicollinearity and imply further investigation. From the output, all the VIF values were less than 10 and all the tolerance values were greater than 0.1.

Table 1: Test for Multicollinearity.

Variable	VIF	1/VIF
Age at first sex	5.51	0.181499
Recent sexual activity	3.45	0.289573
Number of sex partners	1.98	0.504075
Age	1.67	0.599278
Arm circumference	1.22	0.819406
Highest educational level	1.22	0.822958
occupation	1.18	0.845986
Region	1.18	0.850126
NHIS coverage	1.17	0.853752
Smoking status	1.05	0.956053
Time of BP measurement	1.02	0.977008

VIF = Variance Inflation Factor; 1/VIF = Tolerance.

Ethical approval

Ethical clearance was provided by the Ghana Health Service Ethical Review Committee, Research and Development Division, Ghana Health Service; and the Institutional Review Board of ICF International. All data were anonymised by the Demographic and Health Survey (DHS) team before making them available online. Ghana Statistical Service did not take data from participants' medical records, rather, anthropometric and blood pressure measurements were taken as part of the data collection. Respondents provided written informed consent before participating in the study.

RESULTS

The average age was 18.9 years and majority of the youth (76.3%) had completed secondary education. More than half (51.3%) belong to the Akan ethnic group.

A higher proportion (38.5%) belong to the non-working group and most of them (70%) have arm circumference above 25 cm. More than one-third of the respondents had their blood pressure taken in the morning and majority of them (53.5%) responded they have never had sex prior to study being conducted. Close to one-third of the respondents (65.3%) do not have sex partner and 1.5% of the total respondent smokes (Table 2).

Table 3 shows distribution of prehypertension among respondents based on demographic characteristics. Proportion of prehypertension in the respective group was higher among secondary school graduate (4.1%), Pentecostals/charismatics (2.6%), Akan (2.7%), manual workers (1.8%).

Table 2: Background characteristics of respondents (n=1,363).

Variables	Frequency (N)	Percentage (%)
Age (mean=18.9; SD=2.8)		
15-19	818	60.0
20-24	545	40.0
Highest educational level		
No education	42	3.1
Primary	225	16.5
Secondary	1040	76.3
Higher	56	4.1
Religion		
Orthodox	334	24.5
Pentecostal/charismatic	425	31.2
Other Christian	274	20.1
Islam	241	17.7
Traditionalist	27	2.0
No religion	61	4.5
Region		1.5
Western	155	11.4
Central	125	9.2
Greater Accra	267	19.6
Volta	104	7.6
Eastern	147	10.8
Ashanti	244	17.9
Brong Ahafo	112	8.2
Northern	110	8.1
Upper East	63	4.6
		2.6
Upper West	35	2.0
Ethnicity	COO	71. 2
Akan	699	51.3
Ga/Dangme	116	8.5
Ewe	169	12.4
Guan	26	1.9
Mole-Dagbani	184	13.5
Grusi	29	2.1
Gurma	83	6.1
Mande	23	1.7
Other	34	2.5
Occupation		
Not working	525	38.5
Professional/technical/ managerial	224	16.4
Agriculture	339	24.9
Manual worker	275	20.2
Blood pressure		
Normal	1295	95.0
Pre-hypertensive	68	5.0
Arm circumference (cm)		
25 and below	409	30.0
26 and above	954	70.0
Time of BP measurement		
Morning	589	43.2
Afternoon	279	20.5
Evening	495	36.3
Recent sexual activity		
Never had sex	729	53.5
Active in the last 4 weeks	192	14.1
Not active in the last 4 weeks	442	32.4
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Continued.

Variables	Frequency (N)	Percentage (%)
Age at first sex (years)		
No had sex	729	53.5
8-14	117	8.6
15-19	408	29.9
20 and above	109	8.0
Number of sex partner		
None	890	65.3
One	373	27.4
Two	71	5.2
Three and above	29	2.1
Smoking status		
No	1343	98.5
Yes	20	1.5

Table 3: Distribution of prehypertension according to demographic characteristics (n=1,363).

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		` /	` /	
	Other	32 (2.3)	2 (0.2)	

Continued.

Occupation			
Not working	506 (37.1)	18 (1.3)	
Professional/ technical/managerial	210 (15.4)	13 (1.0)	
Agriculture	324 (23.8)	15 (1.1)	
Manual worker	252 (18.5)	25 (1.8)	

N = total number respondents, n= number of respondents who were normal and hypertensive % = percentages corresponding to n.

Table 4: Distribution of prehypertension according to lifestyle, arm circumference, time of BP measurement and NHIS coverage (n=1,363).

	Blood pressure classification		
Variables	Normal	Prehypertension	
	N (%)	N (%)	
Recent sexual activity			
Never had sex	704 (51.7)	26 (1.9)	
Active in the last 4 weeks	184 (13.5)	8 (0.6)	
Not active in the last 4 weeks	406 (29.7)	35 (2.6)	
Age at first sex (years)			
No had sex	703 (51.6)	26 (1.9)	
8-14	112 (8.2)	6 (0.4)	
15-19	381 (27.9)	26 (1.9)	
20 and above	98 (7.3)	11 (0.8)	
Number of sex partner			
None	852 (62.5)	38 (2.8)	
One	351 (25.7)	23 (1.7)	
Two	65 (4.8)	6 (0.4)	
Three and above	26 (1.9)	2 (0.2)	
Smoking status			
No	1274 (93.4)	69 (5.1)	
Yes	19 (1.4)	1 (0.1)	
Arm circumference (cm)			
25 and below	392 (28.8)	11 (0.8)	
26 and above	902 (66.1)	58 (4.3)	
Time of BP measurement			
Morning	550 (40.4)	38 (2.8)	
Afternoon	269 (19.7)	11 (0.8)	
Evening	474 (34.8)	21 (1.5)	
NHIS coverage [£]			
No	654 (48.0)	36 (2.6)	
Yes	640 (47.0)	34 (2.4)	

 $N = total \ number \ respondents, n = number \ of \ respondents \ who \ were \ normal \ and \ hypertensive \ \% = percentages \ corresponding \ to \ n; \\ \pounds = Recommended \ by \ literature; \ NHIS = National \ Health \ Insurance \ Scheme.$

Table 5: Factors associated with prehypertension among male youth in Ghana (n=1,363).

Variables	Crude OR (CI)	AOR (CI)
Age (years)		
15-19	1.00	1.00
20-24	1.89 (1.77, 2.03)***	1.07 (0.98, 1.17)
Highest educational level		
No formal education	1.00	1.00
Primary	0.34 (0.28, 0.41)***	0.39 (0.32, 0.46)***
Secondary	0.85 (0.74, 0.97)*	0.99 (0.86, 1.14)
Higher	1.62 (1.36, 1.93)***	1.95 (1.61, 2.36)***
Region		
Western	1.00	1.00
Central	0.81 (0.71, 0.92)***	0.90 (0.78, 1.05)

Continued.

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Greater Accra	0.78 (0.69, 0.89)***	0.73 (0.64, 0.82)***
Volta	2.29 (2.06, 0.256)***	2.94 (2.60, 3.32)***
Eastern	0.65 (0.56, 0.73)***	0.77 (0.67, 0.89)***
Ashanti	0.52 (0.45, 0.59)***	0.44 (0.38, 0.52)***
Brong Ahafo	0.93 (0.83, 1.05)	1.04 (0.91, 1.18)
Northern	0.96 (0.86, 1.08)	1.14 (1.01, 1.29)*
Upper East	0.44 (0.39, 0.51)***	0.69 (0.59, 0.80)***
Upper West	0.30 (0.25, 0.37)***	0.43 (0.35, 0.53)***
Occupation		
Not working	1.00	1.00
Professional/ technical/ managerial	1.71 (1.56, 1.89)***	0.06 (0.050, 0.08)***
Agriculture	1.26 (1.15, 1.38)***	0.05 (0.04, 0.07)***
Manual worker	2.49 (2.27, 2.73)***	0.09 (0.07, 0.12)***
Arm circumference (cm)		
25 and below	1.00	1.00
26 and above	2.23 (2.04, 2.42)***	1.61 (1.47, 1.77)***
Time of BP measurement		
Morning	1.00	1.00
Afternoon	0.55 (0.50, 0.61)***	0.55 (0.50, 0.61)***
Evening	0.64 (0.59, 0.69)***	0.66 (0.61, 0.72)***
Recent sexual activity	,	
Never had sex	1.00	1.00
Active in the last 4 weeks	1.24 (1.12, 1.37)***	0.75 (0.63, 0.89)**
Not active in the last 4 weeks	2.29 (2.13, 2.48)***	1.94 (1.67, 2.25)***
Age at first sex (years)	<u> </u>	
Had no sex	1.00	1.00
8-14	1.44 (1.19, 1.73)***	0.88 (0.74, 1.04)
15-19	1.83 (1.70, 1.98)***	0.77 (0.69, 0.85)***
20 and above	3.07 (2.80, 3.36)***	1.10 (0.96, 1.56)
Number of sex partner		
None	1.00	1.00
One	1.50 (1.39, 1.61)***	0.88 (0.78, 0.99)*
Two	2.13 (1.89, 2.41)***	1.49 (1.27, 1.75)***
Three and above	1.58 (1.32, 1.89)***	1.25 (1.01, 1.56)*
Smoking status	, , , , ,	
No	1.00	1.00
Yes	0.63 (0.48, 0.80)***	0.74 (0.58, 0.95)*
NHIS coverage [£]	(0.10, 0.00)	
No	1.00	1.00
Yes	0.95 (0.89, 1.01)	1.03 (0.96, 1.10)
		*-n<0.05: **-n<0.01: ***-n<0.001: f-Pacammendad

OR=Odds Ratio; AOR=Adjusted Odds Ratio; CI=95% Confidence Interval; *=p<0.05; **=p<0.01; ***=p<0.001; £=Recommended by literature; NHIS=National Health Insurance Scheme

Table 4 shows distribution of prehypertension among respondents based on lifestyle, arm circumference and time of measurement and NHIS coverage. Proportion of prehypertension in the respective group was higher among respondents who were not sexually active in the last 4 weeks prior to the study (2.6%). Prehypertension was equally high among those who had no sex prior to the study and those who had sex between 15-19 years (1.9%). It was higher among those who do not have sex partner, non-smokers (5.1%), those with arm circumference above 25 cm as well as those who had their blood pressure taken in the morning (4.3%) and (2.8%) respectively. Higher proportion of prehypertension was recorded among those who were not covered under the NHIS.

Table 5 reveals the factors associated with prehypertension. Highest educational level was significantly associated with prehypertension with those with primary education 61% less likely to develop prehypertension compared to those with no formal education (AOR=0.39; 95%CI=0.32-0.46).

However, those with post-secondary education were at a higher risk of developing prehypertension compared those with no formal education (AOR=1.95; 95%CI=1.61-2.36). Prehypertension was less prevalent among those who reside in Greater Accra, Eastern, Ashanti, upper east and upper west regions compared to those living in western region. However, those living in northern and Volta regions were more likely to develop

hypertension compared to those living in western region. Occupation was significantly associated with prehypertension. Prehypertension was less prevalent among professionals, agricultural workers and manual workers compared to those who do not work. Respondents with arm circumference above 25 cm were 61% more likely to develop prehypertension compared to those with arm circumference less than 26 cm (AOR=1.61; 95% CI=1.47-1.77).

Time of measurement is a significant predictor of prehypertension with those whose blood pressure taken in the afternoon and evening less likely to develop prehypertension compared to those whose blood pressure was taken in the morning. Those who were sexually active in the last four weeks prior to the study were 25% less likely to develop prehypertension compared to those who never had sex (AOR=075; CI=0.63-0.89). However, those who were not sexually active in the last four weeks prior to the study were 94% more likely to develop prehypertension compared to those who never had sex (AOR=1.94; 95%CI=1.67-2.25). These were statistically significant. Age at which respondents had first sex is a significant predictor or prehypertension with those who had sex between 15-19 years were less likely to develop prehypertension compared to those who had no sex (AOR=0.77; 95%CI=0.69-0.85). Those who had sex above 19 years were at a higher risk of developing prehypertension compared to those who had no sex (AOR=1.10; 95%CI= 0.96-1.56). Those who had one sexual partner were 12% less likely to develop prehypertension compared to those with no sexual partner. However, those with two and three or more sexual partner were at a higher risk of developing prehypertension compared to those with no sexual partner (AOR=1.49; 95%CI=1.27-1.75) and (AOR=1.25; 95%CI=1.01-1.56) respectively. These were statistically significant. Smokers were significantly less likely to develop prehypertension compared to non-smokers (AOR=0.74; 95%CI=0.58-0.95). Youth who were covered under the NHIS were 3% more likely to be prehypertensive compared to those not covered under the NHIS (AOR=1.03; 95%CI=0.96, 1.10).

DISCUSSION

To the best of my knowledge, this the first study to determine the prevalence and determinants of prehypertension among male youths in Ghana which was found to be 5%. The study identified several risk factors for prehypertension among male youth in Ghana. These include age at first sex, recent sexual activity, highest educational level, smoking status and time blood pressure measurement. The findings indicate that prehypertension is prevalent among Ghanaian male youth. This prevalence in this cohort under study is comparatively lower than those reported in other studies. ^{18,19} This difference could be attributed to epidemiologic transition of the youth population in these countries.

Determinants of prehypertension

The determinants of prehypertension were based on adjusted odd ratios in Table 5.

This study like other studies confirms age as an important predictor of prehypertension and hypertension. ^{16,20} As population ages, the higher the risk of developing prehypertension. Those age 20 years and above have 7% higher risk of developing prehypertension compared to those less than 20 years though it was not significant after adjusting for other covariates.

The study further found that the odds of prehypertension increased with level of education among respondents. This implies that respondents with secondary primary or higher education were more likely prehypertension history compared to those without formal education. It is quite unclear as to why respondents who were highly educated were more prone to prehypertension than their counterparts who were less or not educated. It would seem that higher education tended to afford young adult men meaningful sources of income coupled with attendant challenges of scheduled programmes with respect to job demands and competition as well as lesser times of exercising and lesser attention to healthy eating habits. This could subsequently lead to a resultant rise in hypertension among the group. A number of studies across the globe have confirmed that literacy or level of education is significantly associated with prehypertension and hypertension. 21,22 A study conducted by Lihua and his colleagues in 2017 demonstrated a positive correlation of educational status with hypertension among Chinese.²³ Another study described a similar phenomenon among young adult Ugandan men, with higher socioeconomic status correlating positively with hypertension.²⁴

This study also revealed that the region where the study participants reside, predisposed them to developing prehypertension or otherwise. Prehypertension was less prevalent among those who resides in Greater Accra, Eastern, Ashanti, upper east and upper west regions compared to those living in western region. However, those living in northern and Volta regions were more likely to develop prehypertension compared to those living in western region. The work pressure in some of the regions particularly Greater Accra. Ashanti and Eastern is high compared to the other regions. As a results, people living in these regions have less time to exercise. It was expected that prehypertension will be more prevalent in these three regions compared to the other but this is not the case. It is not clear why these regions had low prevalent rates than other regions. Further studies need to be carried out to establish if indeed the region in which a respondent reside is associated with prehypertension.

It was also revealed that youth who were currently working had lower odds for prehypertension history compared to their counterparts who were currently unemployed. The risk of prehypertension was 5% to 9% lower for working youth than for the unemployed ones. In a similar study, it was found that unemployment and inability to work predicted hypertension.²⁵ Even though the effect of work status on prehypertension has rarely been considered by studies globally, it is reasonable to speculate that the higher risk of prehypertension history among unemployed men may be due to the possible socio-economic pressures associated with being an unemployed man.

Arm circumference was also found to be associated with prehypertension. Those with arm circumference above 25 cm have a higher odd of becoming pre-hypertensive compared to those with arm circumference of 25 cm or less. Arm circumference has been found to be directly proportional to body weight and body size.26 Which means that as body weight and size of and individual increases, the arm circumference also increases. This suggest that increase in body weight and size is associated with blood pressure. In a study that was aimed at determining the mediation effect of adult body weight and BP on cardiovascular disease, it was revealed that long term increase in body weight is linked to increase in blood pressure.²⁷ It is therefore reasonable to state that higher risk of prehypertension among those with increased arm circumference could be related to increase in body weight and size.

The odds of prehypertension were low among those whose blood pressure measurement was taken in the afternoon and evening compared to those whose blood pressure was taken in the morning. Blood pressure is a hemodynamic parameter that fluctuates throughout the day. Morning BP surge is increased by various factors, including aging, hypertension, glucose abnormality, alcohol intake, smoking, psychological stress, and physical stress.²⁸ The higher odds of prehypertension among respondents whose blood pressure was taken in the morning could be as a result of slight morning blood pressure surges as a result of the onset of hypertension as corroborated by literature.

Prehypertension was prevalent among those who were not sexually active in the last four weeks prior to the study. Sex is a form of exercise which increases blood circulation, and also inversely proportional to blood pressure. Previous studies have eluded to a possible mechanism that leads to the reduction in BP following exercise via a decrease in the sympathetic outflow.²⁹ The same study showed a decrease in the sympathovagal balance only following aerobic training. These findings are consistent with other data showing that resistance training increases resting levels of noradrenaline, while aerobic training decreases resting levels noradrenaline.^{30,31} Taken together, these findings suggest that BP changes following some level of exercise.

Age at which youth first had sex was found to be significantly associated with prehypertension. Those who

had sex between 15-19 years had lower odds of having prehypertension compared to who have not had sex. However, higher odd was found to be among those who had sex above 19 years compared to those who had no sex though it was not significant. The possible explanation could be that having sex below 19 years could raise the blood pressure momentarily as a result of anxiety. Sex being a cardiovascular exercise could lead to a better pre-hypertensive outcome among the 15 to 19 years of age group. In the case of those above 19 years, it is possible that they may have a considerable knowledge on aphrodisiacs and may be using it to "boost" their sexual activities. These aphrodisiacs have been found to increase blood flow to the penis for the purpose of sexual activity and hence increase blood pressure.³²

This study also found out that the number of partner an individual has is significantly associated with prehypertension. As the number of sexual partner increases, the higher the risk of developing prehypertension. For example, those with one sexual partner have 12% less risk of developing prehypertension compared to those without sexual partner. However, those with three or more sexual partners have 49% more risk of developing prehypertension compared to those without sexual partner. It is possible that the practice by some youth to have several sexual partners exposes them to a number of responsibilities that may overwhelm them. Youth with many sexual partners may also be tempted to multitask, do many jobs or work extra hard to cater for the needs of these ladies. These may strain or overwhelm them and may explain why youth with many sexual partners in this study had a higher risk for prehypertension history.

Additionally, those who smoked cigarettes or tobacco had lower odds of having a prehypertension history compared to their counterparts who did not smoke anything. It is quite unusual to find men who smoke have a lower risk of prehypertension than their colleagues who did not smoke. It is unclear why this is so, but there could be some intervening factors accounting for this situation, such as the low number of observed smokers among the sample or the likelihood that smokers modified some other aspects of their lifestyle. It is a known fact that smoking habits lead to an increase in the risk of atherosclerosis development which in turns affects the BP and may contribute to increased risk of hypertension and myocardial infarction. This difference therefore need to be further investigated.

The risk of developing prehypertension was 3% higher among those registered with the NHIS compared to those who were not registered with the scheme though not significant. This is contrary to similar studies conducted in Ghana. The plausible explanation could be that those registered with the NHIS may have some form of health condition that will require frequent visit to the hospital and therefore registering with NHIS will reduce the cost associated services rendered at the hospital.

Limitations

The study was biased towards men as the dataset used was solely information collected from men. The results therefore cannot be generalized to include women. Also, data collected in a cross sectional studies such as this cannot be used to estimate prevalence of prehypertension over time because the data were collected only at a single visit. Further, respondents may give socially desirable answers which may lead to underestimation or overestimation of the effects of the variables on the status of prehypertension.

The study is also prone to recall bias as study participants were required to recollect events that happened some months (in some cases years) preceding the study. This may lead to inaccurate reporting of events that happened during the period especially if the respondents have problems with their memory.

CONCLUSION

Although prehypertension is a rising problem in Ghana, the factors associated with prehypertension among the youth is limited. This study used a national level data to the prevalence and determinants prehypertension and provides an empirical data on prehypertension prevalence and its determinants among Ghanaians aged 15-24. The factors that were found to be significant predictors of prehypertension among the youth include educational level, occupation, sexual behaviours such as having too many sexual partners, and smoking. This study suggests that education on the importance of regular blood pressure monitoring particularly among the youth should be intensified. This health screening should come at a reduced or no cost. Also, education hinging on some of the negative effects on cultural shifts and transformations like sexual partners' acquisition should be intensified. Additionally, these determining factors are similar to other cultures especially in West Africa; therefore, other existing interventions from those cultures could be adapted in addressing prehypertension prevalence and it determinants in Ghana.

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