Adherence to drug therapy among hypertensive patients attending two district hospitals in Ghana

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Abstract

Background: A major drawback to the management of hypertension among patients is poor adherence to pharmacotherapy. Factors that influence non-adherence to antihypertensive drugs could vary, depending on the prevailing condition of patient and setting. Knowledge of adherence patterns and behavior of hypertensive patients to pharmacotherapy could improve health-directed policies towards hypertension management.

Objective: The objective of this study was to determine factors that influence adherence to oral antihypertensive drugs among patients attending two district hospitals in the Volta Region of Ghana.

Methods: The study was cross-sectional. Respondents were hypertensive patients attending Krachi West District (n=187) and Hohoe Municipal (n=183) hospitals between March 2016 to May 2016. Data was collected using a structured questionnaire and Morisky 8 Item Measurement of adherence scale.

Results: Adherence to oral antihypertensive drugs was 89.2%. However, more than half of these respondents appeared to have uncontrolled blood pressure; and this may be due to self-response bias, blood pressure being measured only on the day of the interview or use of fake drugs (which was not assessed in this study). The strongest predictors of adherence were; knowledge on hypertension, perception of severity of condition and the amount of alcohol consumed in a day by respondents.

Conclusion: Good adherence to oral antihypertensive drugs was observed in this population despite uncontrolled hypertension in a number of the respondents. The three independent predictors of adherence to antihypertensive medications in this study were respondent's knowledge about hypertension, perception of severity of their condition and the amount of alcohol consumed in a day. Regular patient education and counseling by medical practitioners should be encouraged in these settings to improve patient adherence.

Keywords: Adherence; antihypertensive drug; hypertension; Ghana.

Introduction

Hypertension or high blood pressure is a public health problem that affects many worldwide. It is estimated that about 7.5 million deaths are linked to hypertension annually [1, 2]. The global prevalence of hypertension in adults was estimated to be 40% in 2008, with a substantial number of these patients from sub-Saharan Africa[3]. In Ghana, the prevalence of hypertension has been reported to range from about 19 % to 33 % in the rural areas, and 26 % to 48 % in urban communities [4].

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Blood pressure control is the most important strategy in management of this chronic disease. Reports, however, show that blood pressure control is generally poor among hypertensive patients in sub-Saharan Africa [5, 6]. This problem in sub-Saharan Africa is as a result of a complex interplay between patient, healthcare providers, and socioeconomic factors. Furthermore, patients in these settings lack relevant knowledge about hypertension and its management. A number of patients in sub-Saharan Africa also have beliefs about hypertension that may be different from orthodox medicine [6], thus, making management in these settings challenging.

Among measures to control high blood pressure include pharmacotherapy. Blood pressure control with this approach cannot be achieved without cooperation from patient. Reports suggest that poor adherence to

drug therapy is a setback to the management of hypertension. Often non-adherence to drug therapy can lead to medical complications (such as stroke, myocardial infarction, cardiac and renal failure), poor quality of life, amongst others [7]. Reports also suggest that there is poor adherence to drugs used in the management of chronic medical conditions, and this is known to lead to worse health outcomes [8]. The asymptomatic nature of some of the chronic diseases (like hypertension) further exacerbates non-adherence or poor adherence to drug therapy [9].

Adherence to drugs can be estimated either directly or indirectly. The direct approach involves, amongst others, assaying for parent drug or metabolite of the drug in blood and/or urine. Adherence can also be assessed indirectly with questionnaires. While the latter is definitively less accurate, questionnaires with validated scales are relatively credible. There is a paucity of data on adherence (and factors that influence patient adherence) to drug therapy among hypertensive patients in a number of resource-poor countries, Ghana inclusive. Furthermore, there are few adherence studies that have used validated scales, like the Morisky 8 Item Measurement of adherence. The current study focused on Volta Region of Ghana (as it was called before the creation of new regions in Ghana in February 2019). The region initially could be divided into two geographical sectors: northern and southern Volta. For the purpose of sampling, the Northern sector of the Volta Region was split into two; rural (Krachi West) and urban (Hohoe municipality) districts. The objective of the study was to determine factors that influence adherence to oral antihypertensive drugs among patients attending two district hospitals in the northern part of the former Volta Region of Ghana. Results from this study would inform policymakers, health managers and health workers on the state of adherence to antihypertensive medication: with a future need of designing interventions that can improve patient adherence.

Methods
Study design and sites
The study was a cross-sectional one, where hypertensive patients attending the outpatient department (OPD) of two district hospitals in the northern part of the Volta Region of Ghana were interviewed between the months of March 2016 to May 2016. In addition, respondents had their blood pressure measured (more than 2 readings) on the day of the interview. The blood pressure of respondents was classified based on the Seventh Report of the Joint National Committee on Prevention,

Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7) classification of hypertension [10].
Study participants from the two hospitals: Krachi West District Hospital and Hohoe Municipal Hospital were interviewed using a structure questionnaire. Additionally, clinical information was obtained from their respective hospital records.
This study was approved by the Institutional heads of the selected Government hospitals under the Ghana Health Service.

Inclusion and exclusion criteria
Patients were included if they were aged 18 years and above, diagnosed with hypertension for at least 6 months, and on medication during the period of data collection. Patients were still included in the study if they had co-morbid medical conditions: such as diabetes, provided they were still on anti-hypertensive medication. Pregnancy induced hypertensive patients and patients who did not consent to be part of the study were excluded.

Sample size calculation
The sample size for this study was computed based on formula reported elsewhere [11].
Below is the formula used to derive the appropriate sample size:

$$N = \frac{Z^2 P(1-P)}{d^2}$$

N=Estimated minimum sample size
Z=Standard deviation of 1.96 at 95% confidence interval
P= Prevalence of medication adherence (33.3 %)
d=margin of error is 5%

Among adult hypertensive patients in a multi-center cross-sectional study conducted in Ghana and Nigeria, 33.3% of respondents adhered to oral antihypertensive drugs [3]. Thus, this was used as prevalence. The level of significance and margin of error were set as 0.05% and 5%, respectively. This gave a calculated minimum sample size of 341. The sample size was increased to 370 to improve precision and power. Based on calculated sample, 183 and 187 respondents were randomly smpled from Hohoe Municipal Hospital and Krachi West District Hospital, respectively.

Data collection
Data was collected using a structured questionnaire by two trained pharmacists and two pharmacist assistants.

The questionnaire was based on a modified health belief model [12]. Respondents were randomly selected from diagnosed hypertensive patients who attended the outpatient department (OPD) of the Hohoe Municipal Hospital and Krachi West District Hospital. Simple random sampling was used to recruit hypertensive patients at the two hospitals. Each hypertensive patient was given a number and then a table of random numbers to decide which patient to include. Patients were randomly sampled until sample size was achieved. Clinical and medical history, knowledge on hypertension and medications, adherence to antihypertensive medication, adherence to lifestyle modification(s), perception of severity of hypertension, barriers to adhering to therapy and socio-demographic data were collected. Informed consent to participate was obtained from all respondents. Respondents who consented to be part of the study were interviewed at the point of receiving their medications. Patients who refused to give consent were excluded from study. Some aspects of the questionnaire are described below.

Patient knowledge on hypertension and medications

This section looked at respondent's knowledge of antihypertensive medications. Respondent's knowledge of antihypertensive medications was assessed by their ability to mention names or identify drugs, knowledge of common side effects and dosing frequency. A maximum score of three (3) was allotted to each medication (ie. a score of 1 was assigned to name of drug or correct identification of drug, the common side effect of that drug and the dosing frequency of the drug). A percentage score of 65% and above was considered good knowledge of antihypertensive medication and a score below 65% was considered poor knowledge.

The second part of this section of the questionnaire assessed respondent's level of knowledge of hypertension. A Hypertension Knowledge Questionnaire (HKQ), adopted from Bioma et al [3], was used. Responses to the HKQ items were mainly of two options (Yes =1, and No =0). The maximum score for this questionnaire was 15, and the minimum was zero (0). A score of 10 and above was considered good knowledge, and a score below 10 was poor knowledge.

Adherence to antihypertensive medication and lifestyle modification

The Morisky 8 Item Measurement of Adherence is one of the most accepted self-reported medication adherence scales. It has an outstanding validity and reliability in patients with arterial hypertension and other chronic condition. We therefore adopted this scale to assess level of adherence to antihypertensive medication(s). All questions had two options.

Questions like; "Did you take all your medications yesterday". With this question, a "NO" scored zero (0) and a "YES" scored one (1). The last question had a 5-point Likert scale option; (A) Never/Rarely (B) Once in a while (C) Sometimes (D) Usually (E) All the time. These were scored 4, 3, 2, 1 and 0, respectively, and the final score was then divided by 4.

As per the Morisky 8 Item Adherence scale, scores are to be summed to create an overall adherence score with a possible range of 0 to 8. Adherence score of 6 or more indicated high or good adherence, and adherence score below 6 was considered low or non-adherence.

Additionally, a 10-item scale was developed to assess lifestyle modification. The items were related to lifestyle factors which increased or decreased risk of hypertension. A typical question was: "How often do you eat vegetables?" The responses were noted on a 4-point Likert scale. The response options were: daily (4), frequently (3), rarely (2), never (1). The adherence score for each item was obtained by calculating the mean score. A cut-off point was set at 3 and respondents were categorized into adherent and non-adherent groups. Respondents with a score of 3 and above were considered as adherent and those with a score below 3 were considered as non-adherent.

Perception of severity of hypertension, and barriers to adhering to therapy

A 4-item scale was developed to measure perception of severity of hypertension. Respondents were asked to rate whether their hypertension was severe. The response options were: strongly agree (4), agree (3), disagree (2), strongly disagree (1). The perception score for each item was obtained by calculating the mean. A cut off point was set at 3.

Respondents with a score of 3 and above were regarded as having a high perception of severity and those with scores of below 3 as having a low perception of severity

Regression Analysis of Treatment Adherence with Predictors (independent) Variables

Multiple regression was employed to determine which of theoretical variables of the Health Belief Model, clinical characteristics and socio-demographic characteristics predicted adherence to antihypertensive medication. A stepwise multiple regression analysis was further performed on the predictor variables, this was done to estimate the relative contribution of each variable to treatment adherence. Multiple regression analysis

was performed because adherence was hypothesized as a complex multidimensional phenomenon that cannot be easily predicted with a single variable.

A model was created and each independent variable added sequentially to test its relative contribution. Variables that did not contribute to the model were dropped, and those that contributed were retested to ascertain their predictability.

Data Analysis

Data generated from the questionnaires were entered and analyzed using Statistical Package for Social Sciences (SPSS Inc. Chicago, Illinois) version 16 software. The outcome variable in this study was the measure of drug adherence as assessed by self-reported Morisky Adherence Measurement scale. Scores were then transformed into a dichotomous variable with a score greater than 6 considered as "good adherence" [13]. In some instances, measures of central tendency (mean, median, and mode) were calculated and used to describe the data. Cross-tabulation was then performed to investigate the correlation between adherence (as the dependent vari-

able) and socio-demographic characteristics, as well as clinical characteristics using Cramer's V, and the Pearson's correlation coefficient. An association was considered to be statistically significant if p value < 0.05. Stepwise multiple regression was conducted to establish relative contributions of individual predictors to adherence behavior. This was used to determine the extent to which a group of variables were related. All graphs were generated using R[14] with ggplot2 [15] and dplyr [15,16] packages.

Results

Socio-demographic characteristics of respondents
In all, 370 respondents were interviewed. Females were more than two thirds, (76.2 %), of the study population. About half (50.5%) of the respondents were middle aged, and more than a third (39.2%) of the respondents were more than 65 years. Majority of the respondents (94.3%) used the National Health Insurance Scheme (NHIS) to access healthcare in the two hospitals. Results of socio-demographic characteristics of respondents are presented in Figure 1.
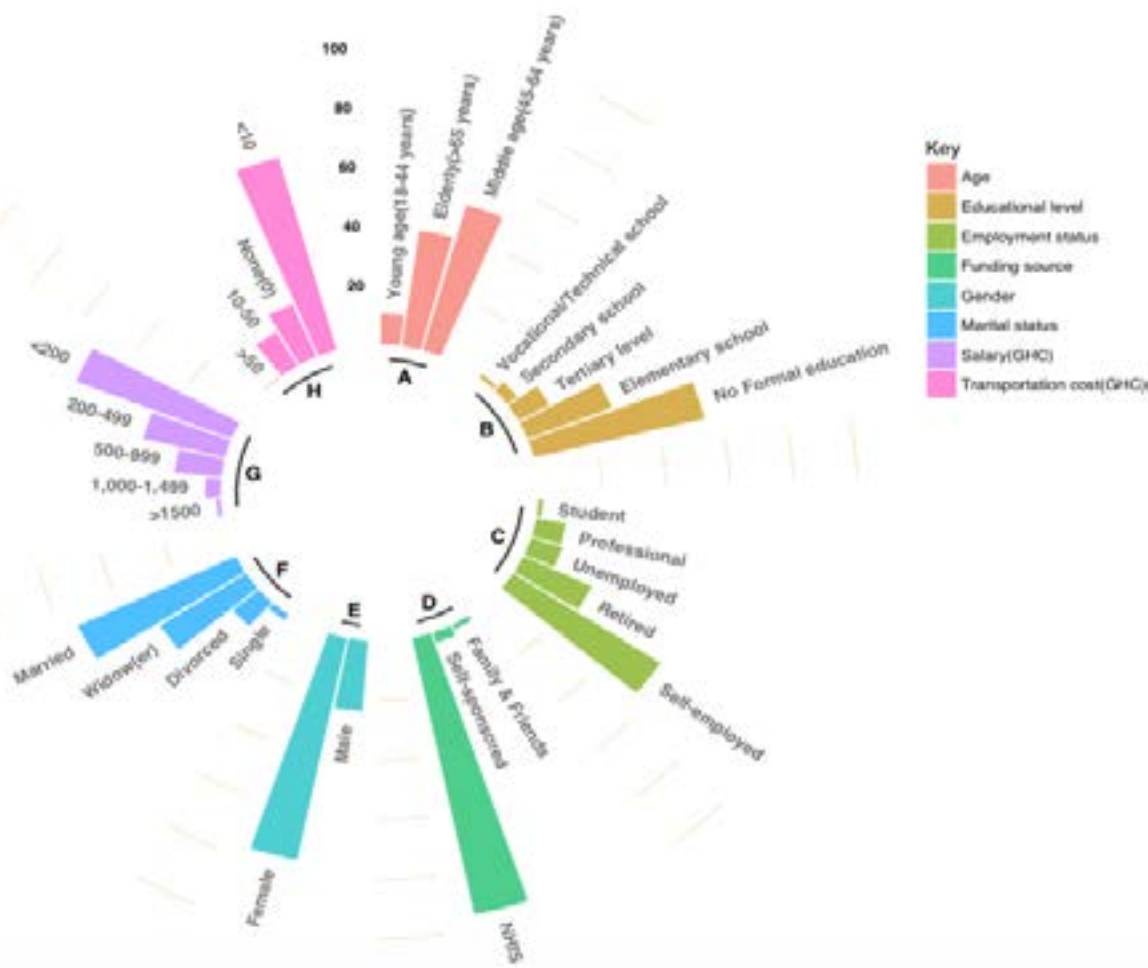

Figure 1*: A circular barplot of the socio-demographic characteristics of respondents in the study (n=370).*
The height of each bar represents the cumulative percentage response of each characteristic:
(A) Age (B) Educational level (C) Employment status (D) Funding for hospital visits and treatment
(E) Gender (F) Marital status (G) Salary (Ghana Cedis) (H) Transportation (Ghana Cedis)

Clinical characteristics of respondents

More than 50 % of the respondents had blood pressure (mean readings) greater than 140/90 mmHg upon assessment. Diabetes mellitus was the most common co-morbid condition among respondents. More than seventy percent (73.5 %) of the respondents were taking two antihypertensive medications. Also, 15.9 % and 10 % of the respondents were taking one and three antihypertensive medications, respectively. Other clinical characteristics of respondents are summarized in Figure 2.
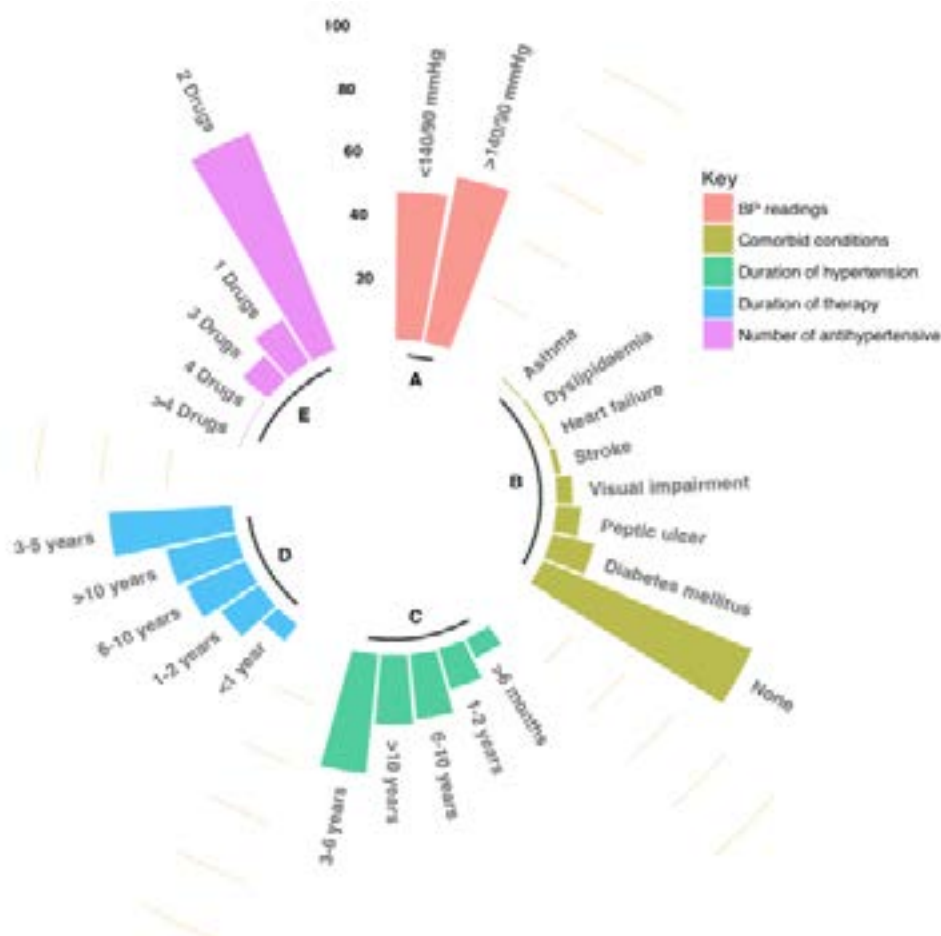

Figure 2: A circular barplot of selected clinical characteristics of hypertensive respondents (n=370). The height of each bar represents the cumulative percentage response of each characteristic: (A) Blood pressure readings (B) Comorbid conditions (C) Duration of hypertension (D) Duration of antihypertensive therapy (E) Current number of antihypertensive medication taken by respondent

Associated risk factors for hypertension, education on hypertension, and information on skipped drug doses

Of the respondents, 98.9 % did not smoke cigarette, and 89.7% did not consume alcohol. About two thirds (62.7 %) of the respondents were educated on hypertension and its management by pharmacists, and a fifth (19 %) of respondent had no education from any healthcare professional. Furthermore, less than a third (27.7 %) of the respondents skipped one or more of their drug doses within the last three days prior to the interview, whilst the majority (70.3 %) adhered to their doses within the last three days. Forgetfulness (53.4 %) and herbal medication use (30.1 %) were the most frequently self-reported reasons for skipping drug doses in the past three days. Data on associated risk factors for hypertension, education on hypertension, and information on skipped drug doses are summarized in Figure 3.
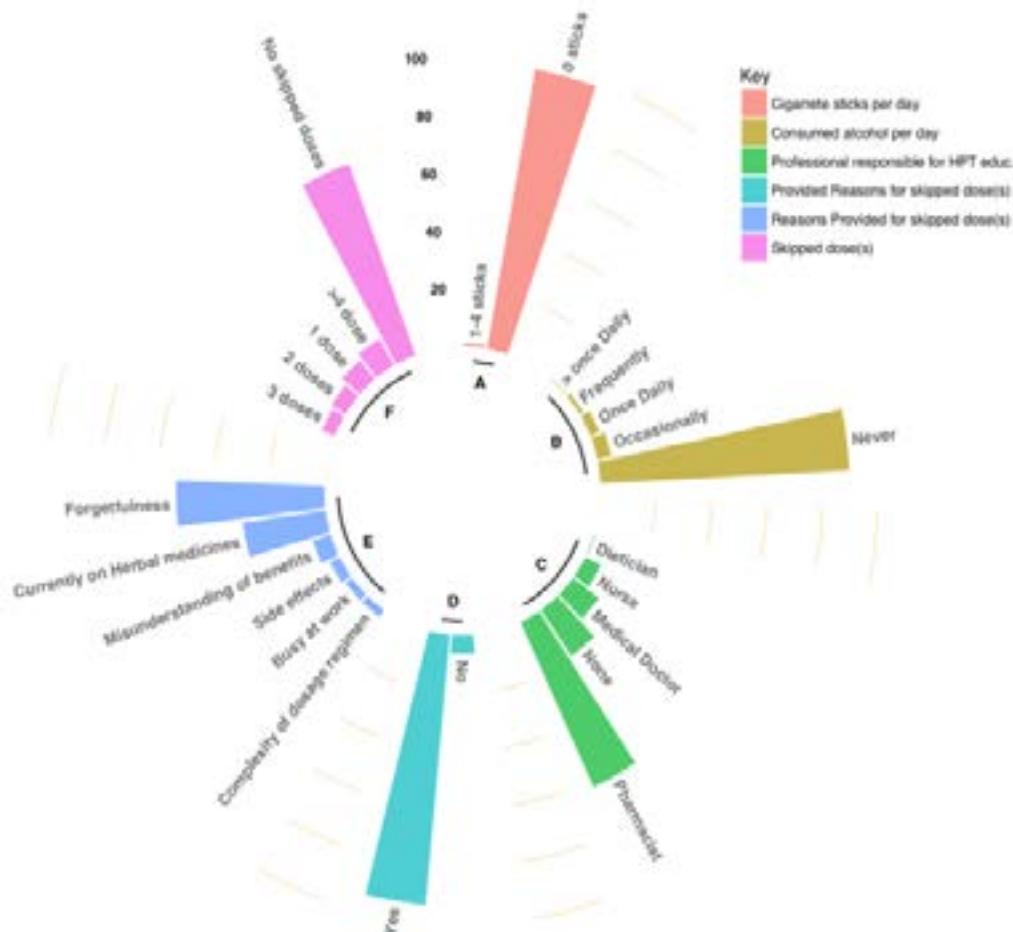
Figure 3: A circular barplot of associated risk factors for hypertensive, education on hypertension, and information of skipped drug doses among respondents (n=370). The height of each bar represents the cumulative percentage response of each characteristic: (A) Number of cigarette sticks smoked per day (B) Frequency of alcohol consumption per day (C) Professional responsible for hyper tension education (D) Provided reasons for skipped dose(s) (E) Reasons provided for skipped dose(s) (F) Number of skipped doses

Antihypertensive drug regimen of respondents

Data analysis revealed most of the respondents were on combination antihypertensive medications. The most frequently prescribed antihypertensive medica- tions were amlodipine (42.2 %), lisinopril plus hydro- chlorthiazide (19.1 %) and bendrofluthiazide (18.3 %). The least prescribed antihypertensive medications were furosemide (1.9 %), losartan (1.8 %) and methyldopa (0.1 %) as shown in Figure 4.
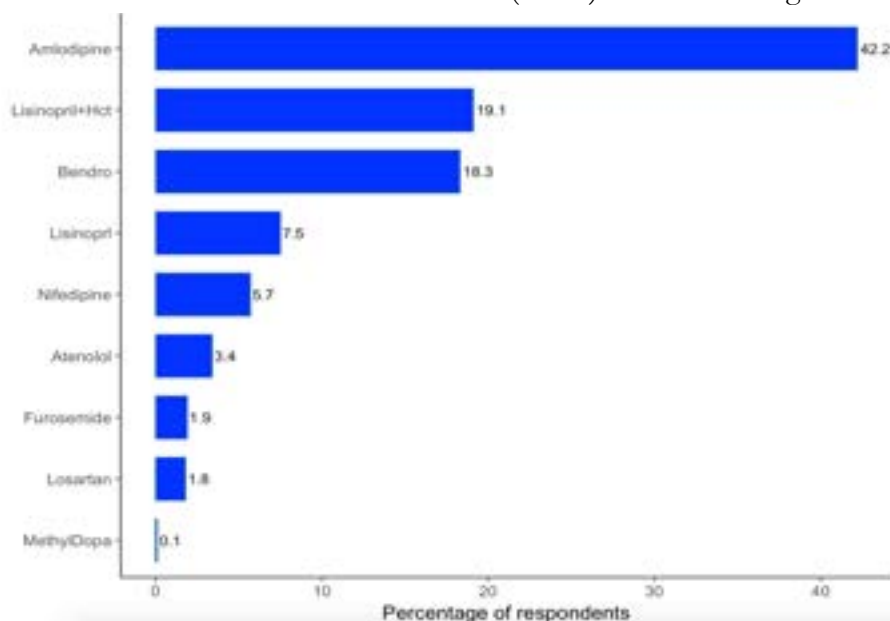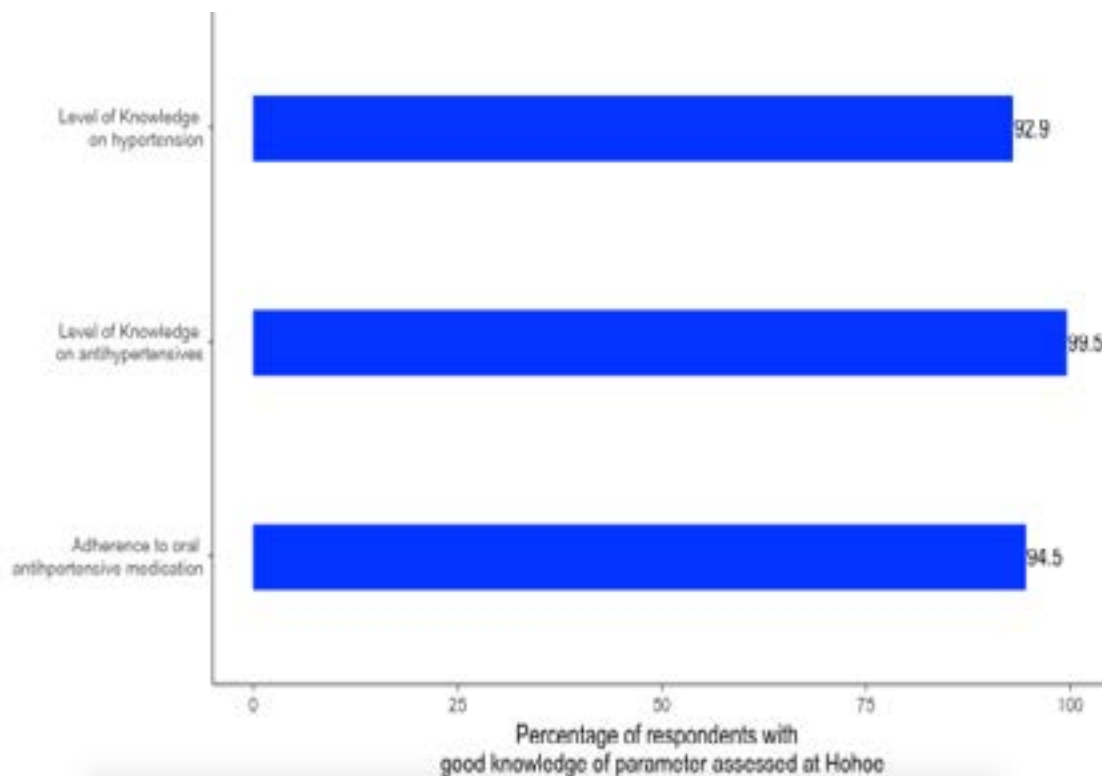

Figure 4: A barplot of the percentage of respondents on a particular medication (n=370). The height of each bar represents the cumulative percentage of persons on the specified medication.

Knowledge of hypertension and oral antihypertensive drugs, and adherence to medication

Majority of respondents had good knowledge on hypertension (82.4 %) and their antihypertensive medication (94.6 %). A summary of this information is shown in Figure 5 A and B.

A
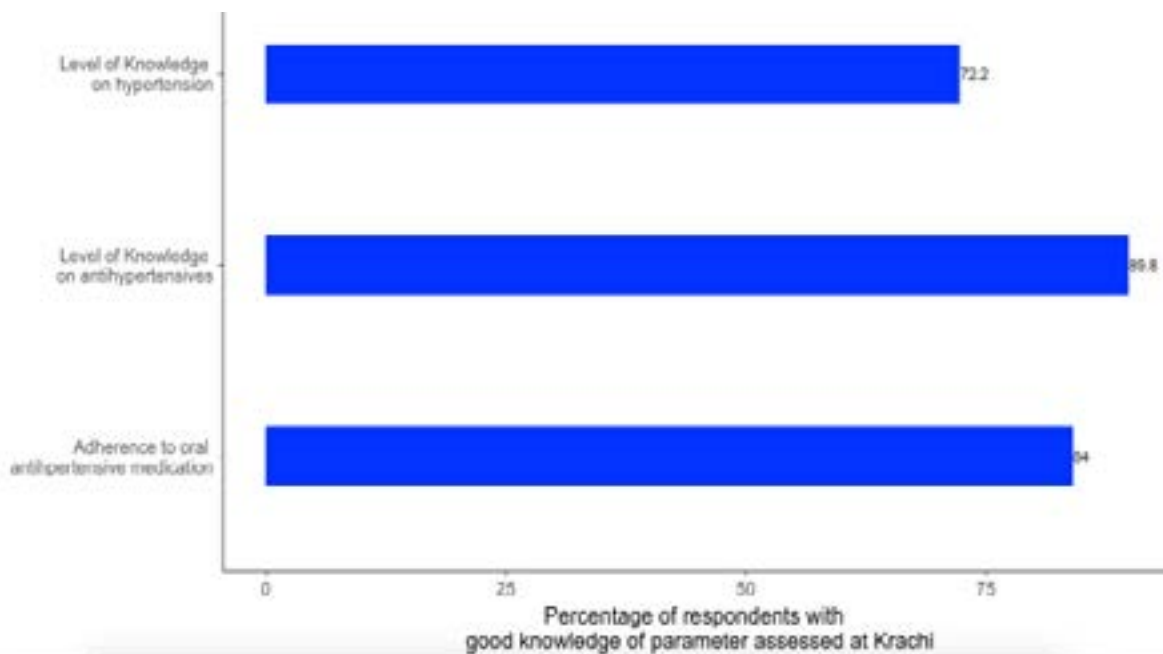
B

Figure 5: A barplot of the percentage of respondents with knowledge on hypertension and antihypertensive medication, and adherence to oral antihypertensive drugs at (A) Hohoe & (B) Krachi

Distribution of Theoretical Variables of Health Belief Model

A large number of the respondents (97.6 %) confirmed the benefits of adhering to their antihypertensive medications. Additionally, more than two thirds (88.4 %) of the respondents perceived little or no barriers to adhering to their antihypertensive medications. Less than a third (27.0 %) of the respondents also perceived their current blood pressure condition as severe, and majority (73.0 %) saw their condition as not severe. A summary of responses from participants is shown in Figure 6. Pearson's correlation conducted to assess the relationship between adherence and the five theoretical variables of the health belief model revealed that perception of benefits, cues to action, perception of risk and perception of barriers showed no significant association with treatment adherence ($p > 0.05$). Perception of severity of disease was found to be correlated ($r = -0.219$ and $p < 0.001$) with treatment adherence.
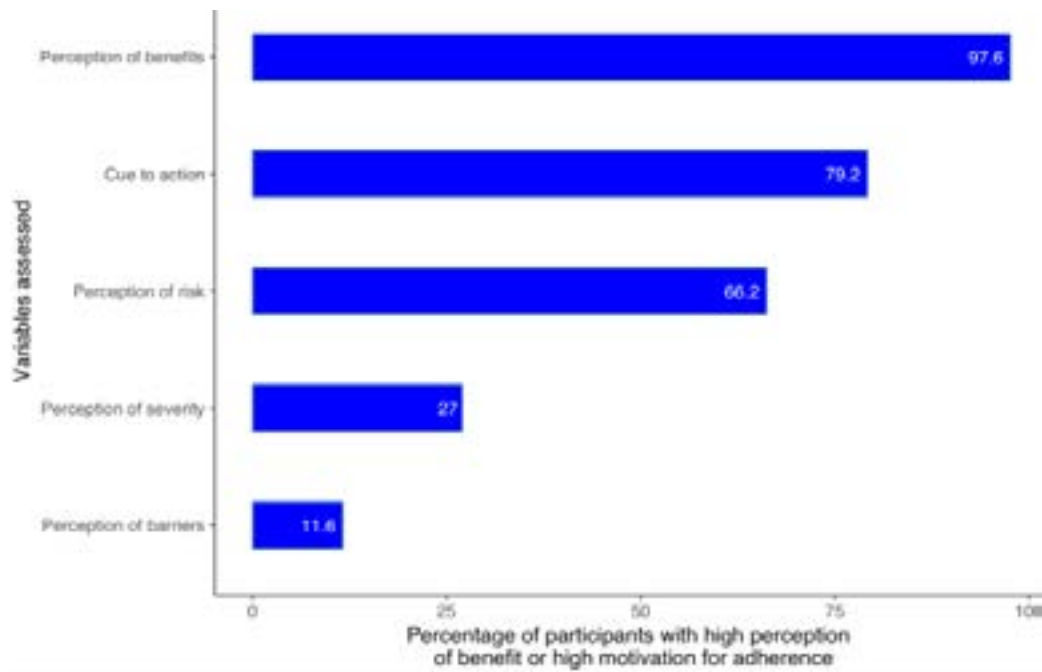

Figure 6: A barplot of the percentage of respondents with varying perceptions of Health Belief Model (n=370).

Association between Adherence and Respondent Variables

All the variables tested were found to be associated with adherence to antihypertensive medication. Source of funding and average cost of transportation to health facility were found to be associated with adherence ($p < 0.01$). However, there was a weak corresponding correlation i.e. Cramer's V of 0.206 and 0.172, respectively. Respondents who had some form of education on hypertension by health-care providers were more adherent to their antihypertensive medication as compared to their counterparts who had no education ($p < 0.001$; Cramer's V = 0.233). Those who had education on hypertension from pharmacists (93.5 %) recorded a higher adherence than respondents who had education from both medical doctors (86.0 %) and nurses (82.6 %).

Respondents who were both occasional and frequent alcohol consumers were more likely to be non-adherers to antihypertensive medications ($p < 0.001$; Cramer's V = 0.230). Respondents who did not consume alcohol recorded adherence level of 91.3 %. A summary of adherence and respondent variables are presented in Table 1.

Table 1: Cross Tabulation of Treatment Adherence against Respondents Variables

Respondents variables (N=370)	Adherence level=89.2%		Cramer's V	P-value
	Adherence (N=330)	Non-adherence (N=40)		
Funding for healthcare Self-sponsored Insurance (NHIS) Family and Friends	9(69.2%) 318(90.6%) 3(50.0%)	4(38.8%) 33(9.4%) 3(50.0%)	0.206	0.0001**
Average cost of transportation Less than GHC10 GHC10-50 More than GHC50 None (GHC 0)	230(92.4%) 38(77.6%) 1(100%) 61(85.9%)	19(7.6%) 11(22.4%) 0 (0.00%) 10(14.1%)	0.172	0.004*
Last visit to the clinic or for review Less than 1 month 1 month 2 months 3 months More than 4 months	49(84.5%) 119(89.5%) 140(95.2%) 6(60.0%) 16(72.7%)	9(15.5%) 14(10.5%) 7(4.8%) 4(40.0%) 6(27.3%)	0.241	0.0001**
Other co-morbid conditions Diabetes mellitus Heart failure Visual impairment High Cholesterol (Dyslipidaemia) Stroke Asthma Peptic ulcer None	48(98.0%) 1(25.0%) 13(72.2%) 3(100%) 6(85.7%) 2(100%) 25(89.3%) 232(89.6%)	1(2.0%) 3(75.0%) 5(27.8%) 0(0.00%) 1(14.3%) 0 (0.00%) 3(10.7%) 27(10.4%)	0.271	0.0001**
Number of doses respondents skipped in the last 3 days None 1 2 3 More than 4	243(93.5%) 25(80.6%) 18(81.8%) 12(66.7%) 32(82.1%)	17(6.5%) 6(19.4%) 4(18.2%) 6(32.3%) 7(17.9%)	0.233	0.0001**
Amount of alcohol consume per day Never Once daily More than once a day Occasionally Frequently	303(91.3%) 11(84.6%) 1(100%) 12(63.2%) 3(60.0%)	29(8.7%) 2(15.4%) 0 7(36.8%) 2(40.0%)	0.230	0.001*
Which healthcare professional educated respondents on hypertension and its management Medical Doctor Pharmacist Nurse Dietician None	37(86.0%) 217(93.5%) 19(82.6%) 0 (0.00%) 57(80.3%)	6(14.0%) 15(6.5%) 4(11.4%) 1(100%) 14(19.7%)	0.233	0.0001**
Level of knowledge of respondent on hypertension Good knowledge Poor knowledge	282(93.1%) 48(73.8%)	23(6.9%) 17(26.2%)	0.228	0.0001**

Regression Analysis of Adherence with Predictors (independent) Variables

The best predictive model was the combination of three predictor variables with an $R^2 = 0.120$, thus contributing about 12.0 % of the variance in treatment adherence. The three independent variables that contributed significantly in predicting adherence to antihypertensive medications were; respondent's knowledge of hypertension, respondent's perception of severity of hypertension and amount of alcohol consumed by respondents in a day, as presented in Table 2. The strongest predictor was knowledge of hypertension (B = 0.135), followed by respondents perception of severity of their hypertension (B = -0.124), and lastly the amount of alcohol consumed in a day by respondents (B = 0.074).

Table 2: Regression Analysis of Predictor Variables for Adherence to Antihypertensive Medication

Predictor Variables	Unstandardized Coefficients		95% Confidence Interval for B		*p*-Value
	B	Std. Error	Lower	Upper	
Constant (intercept)	1.071	0.088	0.899	1.243	<0.0001
Knowledge of Hypertension	0.135	0.041	0.054	0.216	0.001
Perception of Severity	-0.124	0.035	-0.193	-0.055	<0.0001
Alcohol consumed by respondents	0.074	0.019	0.037	0.111	<0.0001

Discussion

Several factors, which may be patient or health system related continue to affect adherence to drugs. Non-adherence to treatment regimen is one of the most common reasons for uncontrolled hypertension. In many developing countries adherence to antihypertensive medication is still a major challenge [7, 17].

The level of adherence to antihypertensive medication in this study was 89.2 %. This was lower than a study conducted in Scotland where adherence was 91.0 %[18]. A similar study conducted in Nigeria reported adherence of 84.8 % in patients attending a cardiology clinic [19]. Additionally, adherence to antihypertensive medication observed in this study was relatively high compared to other reported in Ghana: Komfo Anokye Teaching Hospital (7 %), Korle-Bu Teaching Hospital (47.7 %), and a multi-center study in Ghana and Nigeria (33.3 %) [3, 20, 21]. Although adherence to antihypertensive medication was high in the current study, differences in methods used to assess medication adherence may have accounted for this. Assessment of adherence may differ by population, study design, and method of measurement. Additionally, the difference in adherence observed in Hohoe Municipal Hospital (94.5 %) and Krachi West District Hospital (84 %) can partly be attributed to the fact that, Hohoe is urban with a well establish Hypertensive Clinic, whereas Krachi Hospital is rural without a Hypertensive Clinic.

Generally, non-adherence can be classified as either intentional or unintentional. Intentional non-adherence as a behavior can be viewed in the context of theories of reasoned action and planned behavior. Unintentional non-adherence such as forgetfulness, on the other hand, has been considered to be due to regimen complexity. However, it has also been found to be influenced by beliefs. There is a plethora of literature that supports the association between beliefs and adherence, and it has been proposed that beliefs are the strongest predictors of adherence [22, 23].

Medication side-effects are often reported as a significant contributor to drug non-adherence [24, 25]. However, this study revealed otherwise. Respondents in the current study cited forgetfulness (53.4 %) and herbal medication use (30.1 %) as reasons for skipped doses. This finding is similar to other studies in Ghana and Seychelles, where forgetfulness was found as major reason for non-adherence [21, 26].

This study also revealed that oral amlodipine, lisinopril plus hydrochlorthiazide and bendrofluthiazide were the most commonly used antihypertensive medications. The use of these drugs corroborates a similar study done at the Korle-Bu Teaching Hospital, Ghana [21]. Furthermore, the use of these classes of drugs was consistent with recommendations of the Standard Treatment Guidelines (2010) for hypertension management in Ghana. The guidelines recommend calcium channel blockers, thiazide diuretics and angiotensin converting enzyme inhibitors as first line oral antihypertensive medications [27]. The updated 2013 JNC-8 guidelines also confirmed the findings of this study, which also recommend the use of thiazide diuretics and calcium channel blockers for African hypertensive patients[28]. Although appropriate antihypertensive medications were used by respondents, more than half (53.2 %) of the respondents had poorly controlled blood pressured.

The health belief model proposes that patients consider a health-related behavior by their perceived susceptibility to an illness and the seriousness of the illness[29]. Analysis conducted to assess the relationship between adherence and the five theoretical variables of the health belief model revealed four out of the five variables; perception of risk, perception of benefits, perception

of barriers and cues to action showed no significant association with treatment adherence (p > 0.05). These findings were contrary to findings in a study conducted in Seychelles which reported significant associations between treatment adherence and perception of risk, perception of benefits, internal factors and cues to action[26].

On the other hand, perception of severity was the only variable that showed statistical significant association (r = -0.219 and p < 0.001) with treatment adherence. This implied that, adherence will decrease with an increase in patient's perception of severity of disease. Hence, hypertensive patients in this study with low perception of severity (93.3 %) were more likely to adhere to antihypertensive medications than patients who perceived their condition to be severe (78.0 %). However, this finding is contrary to one done in Seychelles; where persons who perceive hypertension to be a serious condition were more adherent to medication and lifestyle modifications[26].

This study revealed two socio-demographic characteristics having a statistical significant association with treatment adherence: source of healthcare funding (p < 0.01) and the average cost of transportation to the hospital (p < 0.01). The study found that respondents who used the National Health Insurance Scheme (NHIS) were more adherent to treatment than those who paid for their own healthcare. Generally, cost of medication can be a limiting factor to drug adherence. These finding did not agree with observations in a multi-center study conducted in Ghana and Nigeria which revealed that patients who used the NHIS were less adherent to antihypertensive medications than those who paid for drugs[3].

This study revealed patients living close to the facility or who pay less for transportation are more likely to go for regular reviews or for medication refills. These individuals were also more adherent to treatment (p < 0.01). Respondents who spent an average of 10 Ghana Cedis (less than USD 3) or less as cost of transportation to health facility were more adherent than those who spent more than 10 Ghana Cedis as transportation cost to healthcare facility.

Result from the current study showed no association between age and adherence to antihypertensive medication. This corroborates findings from a similar study in Kenya[30], but contrasts another conducted in China in which elderly patients were found to be more adherent than young patients[13].

The current study also revealed association between regular clinic follow-ups, education and/or counseling by healthcare professionals, modification in dosage regimen and adherence to antihypertensive therapy. This is consistent with findings from a study done in northern United Arab Emirates[31], where irregular clinic follow-up and lack of health education by healthcare professionals were factors that influenced adherence to antihypertensive medication. On the contrary, a study in Ethiopia observed that adherence was not linked with clinic follow-ups 9. Data from the current study also showed a positive association between education and/ or counseling offered by healthcare professionals and respondents' adherence to their antihypertensive medication. Respondents who had education from pharmacists were more adherent, therefore, engaging pharmacists in patient care could translate into better clinical outcomes. Interventions by the pharmacist in pharmaceutical care is an effective approach to improving adherence to long-term therapy[32].

It is worth mentioning that most of the respondents in the current study appeared to have had their blood pressure poorly controlled (53.2 %). Respondents with uncontrolled blood pressure measured in this study were greater than in similar studies carried out among hypertensive patients from Ethiopia and Democratic Republic Congo (DRC). Patients from the aforementioned studies who had poorly controlled blood pressure were 46.6 % and 15.4 %, respectively[8,33]. We believe that good adherence not translating to blood pressure control in the current study may be as a result of reliance on only patients' responses (response bias) to our questionnaires. Response bias is a widely discussed phenomenon in research where self-reported data is used. There are many reasons respondents might offer biased estimates of self-assessed behaviour. Prominent among these is when respondents wants to 'look good' in a survey, even if the survey is anonymous[34]. Furthermore, in the current study we neither observed patients medication taking behavior, nor assessed concentration of drugs or metabolites in blood or urine to confirm responses on adherence to anti-hypertensive drugs. The difference observed may be pathological differences associated with hypertension among patients at the different study sites. Repetitive blood pressure reading over a period of time is a better reflection of an individual's blood pressure, than at a single time point. Additionally, the high adherence that did not translate to blood pressure control among the study population may be due

to patients using fake drugs (which was not assessed in this study). These enumerated factors are limitations of the current study.

Data from this study showed that occasional and frequent alcohol consumers were less likely to be adherent to antihypertensive medications. Other studies conducted in Seychelles and Finland also revealed that heavy alcohol drinkers were less adherent to their antihypertensive medications than moderate drinkers [35,36]. The reason for this could be the fear of alcohol-drug interaction, and also forgetfulness associated with alcohol consumption. However a similar study in Kenya reports no association between alcohol intake and drug adherence [30].

This study revealed that level of knowledge about hypertension was a strong predictor of treatment adherence. Right knowledge about hypertension aids one to achieve adequate control of blood pressure [8,37]. Since knowledge of hypertension is an important factor that influences perceptions and ultimately adherence behavior, an empowered patient is likely to adhere to his/her antihypertensive medications. Hypertensive patients can only be empowered through well-organized counseling by their respective healthcare providers. However, no association between prior knowledge of hypertension and treatment adherence was found in a similar study elsewhere, however, depression was a significant predictor of non-adherence [38].

Conclusion
Findings from this study showed 89.2% adherence to antihypertensive medications among study participants. The most common self-reported reasons for non-adherence were forgetfulness and the use of herbal medications. Respondents sampled from the hospital with a well-established hypertensive clinic were more knowledgeable and reported higher adherence to antihypertensive medications. Calcium channel blockers and thiazide diuretics were the most commonly used class of antihypertensive medications by study participants.

The three independent predictors of adherence to antihypertensive medications in this study were respondent's knowledge about hypertension, perception of severity of their condition and the amount of alcohol consumed in a day.

Conflict of interest
None to declare.

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