Adherence to Antihypertensive Medication in a Specialist Led-Hypertension Clinic in Sub-Saharan Africa

By Dr. Yaw Adu-Boakye, Dr. Joshua Arthur, Dr Obed Ofori Nyarko, Dr. Clara Nkyi, Dr. Solomon Gyabaah, Dr. Saabea Owusu Konadu, Dr. Gilda Opoku, Dr. Prince Yaw Boahene, Mr. Abdul Razak Mohammed, Mr. Samuel Frimpong Odoom & Dr. Fred Adomako Boateng

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Keywords: hypertension; adherence; specialist-led clinics; blood pressure control; kumasi; Ghana.

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Strictly as per the compliance and regulations of:

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Adherence to Antihypertensive Medications

Dr. Yaw Adu-Boakye [α], Dr. Joshua Arthur [σ], Dr. Obed Ofori Nyarko[ρ], Dr. Clara Nkyi [ω],
Dr. Solomon Gyabaah [¥], Dr. Saabea Owusu Konadu [§], Dr. Gilda Opoku [χ], Dr. Prince Yaw Boahene [ν],
Mr. Abdul Razak Mohammed [θ], Mr. Samuel Frimpong Odoom [ζ] & Dr. Fred Adomako Boateng [£]

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Results: Amongst 361 participants recruited, average age was 59.74 years and majority were female (81.99%). Overall, 75.35% of participants had their blood pressures controlled. Our study found a relatively high adherence rate (57.34%) to treatment recommendations according to MMAS-8. Adherence was positively associated with older age, and negatively associated with factors such as comorbidities and the use of calcium channel blockers.

Conclusion: The high prevalence of BP control found in this study can be linked to the relatively high level of adherence found amongst the participants. Specialized-clinics that adopt a holistic and patient-centered care approach such as counseling on diet, exercise and complications of hypertension, may be an important factor in ensuring adherence.

Author α χ ν: Komfo Anokye Teaching Hospital, Department of Medicine, Kumasi-Ghana. e-mails: dradubee@gmail.com, gipoku@gmail.com, drboaheneprince@gmail.com
Author σ: Public health unit, Komfo Anokye Teaching Hospital. e-mail: jaarthur@kathhsp.org
Corresponding Author ρ: Komfo Anokye Teaching Hospital, Department of Medicine, Kumasi-Ghana. e-mail: Obednyarko360@gmail.com
Author ω: e-mail: Clarankyi09@gmail.com
Author ¥: Komfo Anokye Teaching Hospital, Department of Surgery, Kumasi-Ghana. e-mail: Soul10137@yahoo.com
Author §: Komfo Anokye Teaching Hospital, Department of Child Health, Kumasi-Ghana. e-mail: saabeaowusu@gmail.com
Author θ ζ: Child health directorate, Komfo Anokye Teaching Hospital, Kumasi-Ghana. e-mails: Raj.abdul@yahoo.com, samfroid@gmail.com
Author £: District Health Director, Ahafo Region, Ghana. e-mail: Fred.adomakoboateng@gmail.com

Better adherence leads to better control which ultimately leads to improved outcomes, prolonged survival and reduction in the incidence of end organ damage from hypertension.

Keywords: hypertension; adherence; specialist-led clinics; blood pressure control; kumasi; Ghana.

I. Introduction

Hypertension is the biggest single contributing risk factor to global morbidity and mortality burden[1]. As a disease entity which affects approximately one-third of adults globally, cardiovascular (CV) disease represents the largest epidemic ever experienced by mankind [1]. According to Lim and colleagues, raised blood pressure (BP) currently causes approximately 9.4 million deaths each year worldwide and this figure is expected to rise, given an expanding and aging global population[1]. Hypertension is defined as having a persistently elevated systolic blood pressure of 130mmHg or above and/or a diastolic of 80mmhg and above. It affects about one billion people worldwide[2]. Several drug classes have been shown to provide cost-effective BP lowering for the prevention of the adverse CV sequelae of raised BP.

Despite the availability of these antihypertensive medications, global data suggest that less than half of those classified as hypertensive are aware of their problem[3]. Furthermore, less than a third of those who are treated for hypertension get their BPs controlled to currently recommended targets[3]. In Ghana, the prevalence of hypertension ranges from 19% to 48% between studies[4]. Old age, over-nutrition and alcohol consumption were some of the factors independently associated with hypertension[4]. According to a 2010 study by Bosu and others, less than one-third of hypertensives were aware of their condition and less than one-tenth had their blood pressures controlled even though there has been a trend towards improved awareness, treatment and control between 1975 and 2005[4]. Due to the asymptomatic nature at onset, diagnosis and adherence to treatment recommendation

is often challenging. Treatment of hypertension requires lifestyle modifications and medications or a combination of both.

Adherence is defined as the extent to which a person's behavior corresponds with agreed recommendations from a health care provider[5]. Adherence to therapies is a primary determinant of treatment success and encompasses numerous health-related behaviours that extend beyond taking prescribed medication[5]. It reflects therapeutic behaviours which include seeking timely medical attention, taking prescribed medication appropriately, attending follow-up appointments, being immunized and adopting recommended behavioural modifications. Good outcomes from chronic disease management such as for hypertension, depends largely on the degree of patient adherence to medication and physician advice.

Despite worldwide improvement in diagnosis and treatment options for chronic diseases, a lack of adherence remains an impediment to improving patients' overall quality of life. A study by Criswell and others in 2010 reported that medication self-efficacy and social support were the most important determinants of medication and lifestyle adherence[6]. The same study also found that non-adherent patients experienced a lower level of social support from people outside their families and patients who were adherent to medication- and lifestyle recommendations reported higher medication self-efficacy as compared to non-adherent patients. There are various means of measuring adherence to chronic medication use in clinical practice, including direct and indirect measures. Direct means include the use of direct assays such as laboratory measurement of biological markers or drug metabolites. Indirect means of measurement include pill-counting, patient self-reporting and the use of modern electronic systems that record medication tablet dispensing[7], [8]. In Ghana, a study conducted at the out-patients department (OPD) of the Korle Bu Teaching Hospital amongst 413 patients found an adherence level of 47% [9]. Another Ghanaian study done in the Komfo Anokye Teaching Hospital between December 2001 and April 2002 found adherence level as low as 7%[10]. A study conducted in Malaysia observed good adherence in 53.4% of the 653 patients sampled[11]. It also found female participants to be more likely to adhere to their medication regime, compared to their male counterparts. Congestive heart failure and the presence of other comorbidities also led to higher adherence rates according to the study by Rao Chythra R. et al[11]. Other factors that had the strongest positive effect on adherence included duration of hypertension (the shorter the duration, the better the adherence) and the use of calcium antagonists, and angiotensin-converting enzyme (ACE). Patients taking two or more drugs and those prescribed more expensive drugs were found to be poorly adherent[11]. Good knowledge of the condition as well as of the medications prescribed has been associated with good adherence to medication in several studies[12]. A study conducted in Northern Ireland by Nazli MuzeyyenSencan found that 9.3% of participants were non-adherent with their antihypertensive medication when assessed using a self-reported adherence scale[13]. The same study also found that 37.9% of respondents had scores indicative of depressive symptoms, a significant comorbidity. It found age as the only significant predictor of medication adherence in that population. Another study conducted in Pennsylvania found the highest rates of adherence were associated with ACE inhibitors and calcium antagonists, and adherence was significantly higher than with diuretics and beta blockers [14]. The study also found poor adherence to be associated with a higher health care cost. Poor adherence to antihypertensive medication is a multifactorial challenge that affects both the patient and the health care system. As a multifactorial problem, adherence is usually influenced by different contextual factors to varying extents. Some of these factors are at the individual level whereas others may operate at the social and health system level.

In spite of the improvement in diagnosis and treatment options for hypertension, poor adherence remains an impediment to reducing end-organ damage and improving patients' overall quality of life especially in sub-Saharan Africa. This study sought to investigate adherence rates and the local factors that contribute to nonadherence amongst hypertensive patients attending a specialist-led clinic in Kumasi-Ghana in order to improve patient outcome.

II. METHODS

a) Study design and site

This hospital-based cross-sectional study was conducted at the out-patient clinic of County Hospital, a large privately-owned multi-department urban health facility in Kumasi, Ghana. The specialist-led hypertension clinic caters to a diverse population of patients with different personal and socio-demographic characteristics.

b) Study population

The study involved hypertensive patients, aged 18 years and above and who have been enrolled in the Hypertensive Clinic for at least 12 months. The study was conducted between October 2019 and January 2020.County hospital runs two (2) hypertension clinics per week and sees an average of thirty-five (35) patients per clinic day. The hospital runs a counseling, dietary education session and short fitness exercise for patients on every clinic day.

c) Data collection, Processing and Analysis

Data for the study was collected using an electronic questionnaire developed in open data kit (ODK®). The research team collected data directly from patients and medical records. The electronic questionnaire included variables on sociodemographic characteristics, clinical characteristics such as class of drugs taken by the patients and the Morinsky adherence scale (MMAS) to assess adherence of respondents to their medications.

The MMAS-4 is the original four item scale has a reliability score of 0.61 as a measure of internal consistency [15]. The MMAS-4 has been significantly revised since its introduction in 1986 by Morisky DE, Green LW and Levine DM. A higher MMAS-4 score significantly correlated with the presence of a drug metabolite marker[15]. MMAS- 8 is a modification of MMAS-4 into an 8-item scoring scale and has a higher reliability score of 0.83. The MMAS-8 has proven reliable in indirectly measuring the medication-taking behavior of patients with chronic diseases such as hypertension and diabetes mellitus[16]–[18]. The MMAS-8 was used as a measure of adherence in this study.

d) Assessment of Medication Adherence

The MMAS-8 questionnaire adopted scoring algorithm, where negative response for each item was coded as 1, except for the question asking if the patient took their medications yesterday (where a positive response was coded as 1). The total MMAS-8 score was calculated by summing the values from all the 8 question items. Adherence was defined as having a MMAS-8 score more than 6 out of a total of 8 scores. Cronbach's alpha test of internal consistency was calculated at 0.79 for the 8 items in MMAS-8 score.

e) Data analysis

The data was analyzed using Stata/SE 14.0 statistical software (StataCorp. 4905 Lakeway Drive Station, Texas 77845, USA). Descriptive statistics was performed for all variables and expressed as means and standard deviation for continuous variables.

Bivariate analysis (logistic regression) was done to measure the strength of the association between socio-demographic, BP level, antihypertensive drug used and medication adherence score. These were presented as crude (unadjusted) Odds ratio. Multivariate logistics regression model was fitted using forward stepwise approach to adjust for the effect of other confounding factors in order to unravel the true factors associated with medication adherence score. The regression models controlled or adjusted for age, gender, educational level, occupation, cigarette smoking and family history of hypertension.

All statistical analysis was done at a 95% significance level with p values < 0.05 considered as statistically significant. Cronbach's alpha test of internal consistency was calculated at 0.79 for the 8 items in MMAS-8 score.

f) Operational definitions

Three seated Blood Pressure (BP) measurements were obtained at 5-minute intervals from each participant. An average was calculated for each of the three systolic and diastolic measurements taken. Hypertension was defined as an average systolic BP (SBP) $\geq$140 mm Hg and/or an average diastolic BP (DBP) $\geq$ 90 mm Hg. Controlled hypertension was defined as having an average SBP <140 mm Hg and/or an average DBP < 90 mm Hg, whilst on medication.

III. Ethical Considerations

Participation Informed Consent Forms (ICF) were designed based on the principles of Good Clinical Practice (GCP). The content of the ICF were clearly explained to the understanding of the potential participants. Literate participants were allowed to write and sign the ICF while non-literate participants thumb printed their consent, assisted by a third party, preferrably an accompanying relative (as witness) who countersigned the ICF. Ethical approval was obtained from the Committee on Human Research Publication and Ethics (CHRPE) from the Kwame Nkrumah University of Science and Technology after administrative approval from County Hospital.

This study posed minimal or no anticipated risks to participants since it was a non-invasive study, with no identifying information collected. There was no cost to the participant nor was there compensation to participate in this study

IV. Results

a) Sociodemographic of the hypertensive patients

The study involved 361 patients who consented to participate in the study. All participants were included in the analysis of the study. Out of this, 296 (81.99%) were females and 65 (18.01%) were males, giving a female-male ratio of 4.6:1.More than half of the patients (n=219; 60.66%) were over 55 years old with a mean age of 59.74. The majority (n=296; 81.99%) of respondents had some level of education but only 11% had achieved tertiary education. Further details of participant socio-demographics can be found in Table 1.

Table 1: Socio-demographic of study participants

Variables	Frequency (n=361)	Percentage (%)
Gender		
- Male	65	18.01
- Female	296	81.99
Age (years)		
- Middle age (36-55)	142	39.34
- Older age (>55)	219	60.66
Mean (SD)	59.74 (±10.91)	
Educational level		
- No formal education	65	18.01
- Basic education	119	32.96
- Secondary education	135	37.40
- Tertiary education	42	11.63
Occupational status		
- Unemployed	140	38.78
- Unskilled	171	47.37
- Skilled	27	7.48
- Professional	23	6.37
Religion		
- Christian	326	90.30
- Muslim	33	9.14
- Traditionalist	2	0.56
Enrolled on NHIS		
- No	2	0.55
- Yes	359	99.45
Smoke cigarette		
- No	343	95.01
- Yes	18	4.99

b) Clinical Characteristics of Participants

Out of the 361 hypertensive patients, more than half 234 (64.32%) reported a family history of hypertension. Almost half (n=167; 46.26%) of participants reported a comorbidity, out of which 82.63% were Diabetic. A little over three quarters (n=272; 75.35%) had controlled blood pressure (optimal blood pressure) with a mean systolic and diastolic pressure of 125.25/75.54mmHg.

More than half (n=207; 57.34%) were adherent (MMAS-8 score 6 to 8) to antihypertensive medication prescribed (Table 2).

Table 2: Clinical Characteristics of Hypertensive Patients

Variables	Frequency (n=361)	Percentage (%)
Diagnosis		
- HPT	223	61.77
- Both HPT and Diabetes	138	38.23
Family history of HPT		
- No	95	26.32
- Yes	234	64.32
- Do not know	32	8.66
Comorbidity		
- No	194	53.74
- Yes	167	46.26
Blood pressure		
- Controlled	272	75.35
- Uncontrolled	89	24.65
Mean (SD)	125.25 (±15.15)	
Comorbidity(n=167)		
- Diabetes	138	82.63
- Others	29	17.37
Medication adherence		
- Non-adherent	154	42.66
- Adherent	207	57.34

c) *Class of Antihypertensive Drugs used among the Hypertensive Patients*

The most common class of drugs prescribed for participants were calcium channel blockers (n=244; 67.59%) and angiotensin receptor blockers (n=238; 65.93%). Other classes of medications prescribed included statins (30.47%), beta-blockers (26.04%), ACE inhibitors (10.53%) and diuretics (8.31%). (Table 3).

Table 3: Class of Antihypertensive Drugs used among the Hypertensive Patients

Variables	Frequency (n=361)	Percentage (%)
Calcium channel blockers		
- No	117	32.41
- Yes	244	67.59
Diuretics		
- No	331	91.69
- Yes	30	8.31
Beta-blockers		
- No	267	73.96
- Yes	94	26.04
Angiotensin converting enzyme inhibitors		
- No	323	89.47
- Yes	38	10.53
Angiotensin receptor blockers		
- No	123	34.07
- Yes	238	65.93
Centrally acting		
- No	322	89.20
- Yes	39	10.80
Statins		
- No	251	69.53
- Yes	110	30.47

d) *Factors Influencing Medication Adherence among Hypertensive Patients*

Bivariate analysis of medication adherence and patient demographic factors, clinical characteristics and drug classes taken was performed. Significant association was demonstrated between age of patient, existence of other comorbidities and certain classes of antihypertensive medications. Older patients (> 55 years) were more likely (aOR=2.74, CI=1.60- 4.68; p<0.000) to adhere to their antihypertensive medications compared to their younger counterparts (<55 years). Having a comorbid condition was associated with reduced likelihood to adhere to antihypertensive drugs (aOR=0.30, CI=0.13-0.71, p=0.006). Similarly, being on calcium channel blockers was associated with a 46% less likelihood to adhere, compared to other classes of antihypertensive drugs (aOR=0.54, CI=0.33-0.91, p=0.020). (Table 4).

Table 4: Factors affecting medication adherence

Variable	OR (95%CI)	p-value	aOR (95%CI)	p-value
Gender				
- Male	1.00		1.00	
- Female	0.95 (0.55-1.63)	0.840	1.46 (0.70-3.06)	0.310
Age				
- Middle age	1.0		1.00	
- Older age	2.18 (1.41-3.36)	<0.000*	2.74 (1.60-4.68)	<0.000*
Smoke cigarette				
- No	Ref		1.00	
- Yes	0.58 (0.22-1.50)	0.261	0.36 (0.11-1.16)	0.088
Family history of HPT				
- No	1.00		1.00	
- Yes	1.09 (0.69-1.77)	0.722	1.13 (0.65-1.97)	0.666
- Do not know	0.67 (0.30-1.50)	0.329	0.00 (0.13-1.26)	0.118

Family history of diabetes				
- No	1.00		1.00	
- Yes	1.05 (0.51-2.14)	0.897	1.21 (0.71-2.07)	0.488
- Do not know	1.15 (0.54-2.42)	0.723	1.73 (0.61-4.90)	0.301
Comorbidity				
- No	1.0		1.00	
- Yes	0.42 (0.19-0.93	0.031*	0.30 (0.13-0.71)	0.006*
Waist-to-height				
- Normal	1.00		1.00	
- Abnormal	0.96 (0.30-3.08)	0.944	0.89 (0.24-3.30)	0.861
Blood pressure level				
- Uncontrolled	1.00		1.00	
- Controlled	0.94 (0.58-1.52)	0.799	0.80 (0.45-1.42)	0.447
Calcium channel blockers				
- No	1.0		1.00	
- Yes	0.73 (0.47-1.15)	0.180	0.54 (0.33-0.91)	0.020*
Diuretics				
- No	1.0		1.00	
- Yes	1.13 (0.53-2.41)	0.759	1.17 (0.49-2.80)	0.718
Beta-blockers				
- No	Ref		Ref	
- Yes	1.36 (0.84-2.20)	0.217	1.25 (0.71-2.20)	0.432
Angiotensin converting enzyme inhibitor				
- No	1.00		Ref	
- Yes	1.16 (0.58-2.30)	0.675	1.73 (0.73-4.08)	0.212
Angiotensin receptor blockers				
- No	Ref		Ref	
- Yes	1.03 (0.66-1.59)	0.905	1.23 (0.70-2.17)	0.478
Centrally acting				
- No	Ref		Ref	
- Yes	0.96 (0.49-1.87)	0.901	1.05 (0.48-2.31)	0.906

(*)=Statistically Significant

V. DISCUSSION

a) Blood pressure control

Blood pressure control amongst respondents was optimum. Most of our study participants had their blood pressures controlled with a mean systolic and diastolic of 125.25mmHg and 75.54mmHg amongst hypertensives who had been on treatment for at least a year. This is in contrast to a systematic review by Bosu and colleagues which found that less than ten percent (10%) of hypertensives had their blood pressures controlled according to most Ghanaian studies[4]. This could be due to the effective management by cardiology specialists and the relatively high adherence of most patients to treatment recommendations. Our study site also runs a counselling, dietary session and short fitness exercise for patients on every clinic day. Also, our study was conducted in an urban setting and this might contribute to the better control of hypertension similar to a study by Chow and others which found increased awareness, treatment, and control of hypertension in urban communities compared to rural communities[3]. In addition, this could it be due to the nature of people who may opt for care in private clinics, they may have better socioeconomic profile, be better motivated or may be more likely to have better support systems.

b) Adherence rates

The overall adherence rate found in this study falls within 52% to 92% reported from western studies[19]. It is similar to that reported by an Ethiopian study [20] even though it is considerably less than the adherence rate of 82.2% reported by a Malaysian study[21]. Previous studies conducted on adherence in Ghana found lower rates of 47% in Korle Bu[9] and 7% in Komfo Anokye Teaching Hospital[10]. The rates of good adherence to antihypertensive medications may vary due to a host of factors such as the study design and population, method of adherence measurements, biases, scoring systems used etc. Population wise, adherence rates may vary due to perception of orthodox medications, poverty, cost of medications, insurance policies, self-care attitudes and social support systems in place. Our study site is a specialist led clinic and this might explain the reason for a high adherence rate comparable to that of developed countries. Our clinic setting employs a patient-centered care approach which focuses on true partnership between patients and healthcare staff. It involves counselling and education

on hypertension and its end-organ damage, diet and exercise. In addition, patient communal coping in our clinic setting might also be a contributing factor to the relatively high adherence rate observed in this study.

c) Factors affecting medication adherence

Worldwide, there are several studies that have associated several factors to medication adherence. Medication adherence has been associated with a host of factors such as demography, psychological factors as well as disease and medication-taking behaviors[22]. Based on the results of our study, adherence to antihypertensive medication is influenced by factors such as older age, significant comorbidities and the use of calcium channel blockers.

As found in other studies[22], younger adults had lower adherence rates compared to older adults. Older people are more accepting of their diagnosis and hence may be more inclined to follow through with their medications. Also, younger people have more distractions in terms of work and meeting responsibilities compared to those over 55 who may be retired, have less work commitments or may be settled into a more routine life.

The presence of other comorbidities such as atrial fibrillation, diabetes mellitus and glaucoma were found to be significantly associated with poorer adherence amongst hypertensives. Comorbidities can lead to a higher pill burden which can negatively influence adherence to medications. This finding is however in contrast to studies by Rao Chythra R. and others who found congestive heart failure and the presence of other comorbidities led to higher adherence rates [11]. Perhaps, one can reason that the presence of severe life-threatening comorbidities tend to increase reliance on medications for survival and hence may make patients somewhat more adherent. The conflicting evidence with regards to comorbidities and medication adherence suggests a more nuanced relationship that requires further contextual examination.

The use of calcium channel blockers was associated with lower rates of adherence amongst hypertensive patients. This could be as a result of the side effects of pedal edema and headaches. This was also in contrast with a Pennsylvanian study which found the highest rates of adherence were associated with ACE inhibitors and calcium antagonists, significantly higher than with diuretics and beta blockers[14].

VI. Conclusion

From our study, blood pressure control among respondents at the specialist led clinic was optimum. Our study also found a relatively high adherence rate to medications which was positively associated with older age, and negatively associated with factors such as comorbidities and the use of calcium channel blockers. The relatively high level of adherence found in this study can be attributed to our specialist-led setting which uses a patient-centered care approach involving adequate counseling and education of patients and communal coping mechanisms used by patients. The high prevalence of BP control found in this study can be linked to the relatively high level of adherence found amongst the participants. Better adherence leads to better control which ultimately leads to improved outcomes, prolonged survival and reduction in the incidence of end organ damage from hypertension. The extent to which such adherence is influenced by attendance by specialist physicians in the local context should be the subject of further enquiry.

What is already known about this topic

- Worldwide and particularly in sub-Saharan Africa there is an increasing prevalence of hypertension and its complications;
- In spite of increasing availability of modern treatment options for hypertension, adherence to treatment modalities remain an impediment to the control of hypertension;
- Poor adherence to antihypertensive medications is multifactorial and affects not only the patient but the entire health care system.

What this study adds

- A relatively high level of adherence was found amongst hypertensive patients being managed at a specialist-led clinic
- Specialized-clinics that adopt a holistic and patient-centered care approach such as counseling on diet, exercise and complications of hypertension, may be an important factor in ensuring adherence
- Relatively high levels of adherence to antihypertensives correlate with achieving optimum blood pressure targets, which could in turn lead to improved patient outcomes.

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Conflict of interest
All authors declare no conflict of interest

Author's contribution
All authors contributed in idea generational, data collection, analysis, writing and proofreading of this case report and are in agreement with its content before submission.

REFERENCES RÉFÉRENCES REFERENCIAS

1. S. S. Lim et al., "A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010," Lancet, vol. 380, no. 9859, pp. 2224–2260, Dec. 2012, doi: 10.1016/S0140-6736(12)61766-8.

2. N. R. Poulter, D. Prabhakaran, and M. Caulfield, "Hypertension," Lancet, vol. 386, no. 9995, pp. 801–812, Aug. 2015, doi: 10.1016/S0140-6736(14) 61468-9.

3. C. K. Chow et al., "Prevalence, Awareness, Treatment, and Control of Hypertension in Rural and Urban Communities in High-, Middle-, and Low-Income Countries," JAMA, vol. 310, no. 9, p. 959, Sep. 2013, doi: 10.1001/jama.2013.184182.

4. W. K. Bosu, "Epidemic of hypertension in Ghana: a systematic review.," BMC Public Health, vol. 10, p. 418, Jul. 2010, doi: 10.1186/1471-2458-10-418.

5. M. A. Rapoff, "Definitions of Adherence, Types of Adherence Problems, and Adherence Rates," 2010, pp. 1–31.

6. T. J. Criswell, C. A. Weber, Y. Xu, and B. L. Carter, "Effect of self-efficacy and social support on adherence to antihypertensive drugs.," Pharmacotherapy, vol. 30, no. 5, pp. 432–41, May 2010, doi: 10.1592/phco.30.5.432.

7. A. M. Aziz and M. I. Ibrahim, "Medication noncompliance--a thriving problem.," Med. J. Malaysia, vol. 54, no. 2, pp. 192–9, Jun. 1999, Accessed: Jan. 01, 2019. [Online]. Available: http://www.ncbi.nlm.nih.gov/pubmed/10972029.

8. S. H. S. Lo, J. P. C. Chau, J. Woo, D. R. Thompson, and K. C. Choi, "Adherence to Antihypertensive Medication in Older Adults With Hypertension.," J. Cardiovasc. Nurs., vol. 31, no. 4, pp. 296–303, 2016, doi: 10.1097/JCN.0000000000000251.

9. J. G. Laryea, "Factors Influencing Adherence To Oral Antihypertensive Medication Amongst Patients Attending The Korle-Bu Teaching Hospital," 2013, Accessed: Dec. 30, 2018. [Online]. Available: http://ugspace.ug.edu.gh/handle/123456789/5803.

10. K. Ohene Buabeng, L. Matowe, and J. Plange-Rhule, "Unaffordable drug prices: the major cause of non-compliance with hypertension medication in Ghana.," J. Pharm. Pharm. Sci., vol. 7, no. 3, pp. 350–2, Nov. 2004, Accessed: Jan. 12, 2019. [Online]. Available: http://www.ncbi.nlm.nih.gov/pubmed/15576016.

11. C. R. Rao, V. G. Kamath, A. Shetty, and A. Kamath, "Treatment Compliance among Patients with Hypertension and Type 2 Diabetes Mellitus in a Coastal Population of Southern India.," Int. J. Prev. Med., vol. 5, no. 8, pp. 992–8, Aug. 2014, Accessed: Jan. 01, 2019. [Online]. Available: http://www.ncbi.nlm.nih.gov/pubmed/25489447.

12. R. A. Atinga, L. Yarney, and N. M. Gavu, "Factors influencing long-term medication non-adherence among diabetes and hypertensive patients in Ghana: A qualitative investigation," PLoS One, vol. 13, no. 3, p. e0193995, Mar. 2018, doi: 10.1371/journal.pone.0193995.

13. N. M. Sencan, A. Wertheimer, and C. B. Levine, "What determines the duration of patient medication compliance in patients with chronic disease: are we looking in the wrong place?," South. Med Rev., vol. 4, no. 2, pp. 97–101, Dec. 2011, doi: 10.5655/smr.v4i2.1008.

14. J. A. Rizzo and W. R. Simons, "Variations in compliance among hypertensive patients by drug class: implications for health care costs.," Clin. Ther., vol. 19, no. 6, pp. 1446–57; discussion 1424-5, Accessed: Jan. 01, 2019. [Online]. Available: http://www.ncbi.nlm.nih.gov/pubmed/9444452.

15. Marion Carroll, "GEM:Measure Information," 2014. https://www.gem-beta.org/public/MeasureDetail.aspx?mid=1133&cat=2 (accessed Jan. 01, 2019).

16. S. Okello, B. Nasasira, A. N. W. Muiru, and A. Muyingo, "Validity and reliability of a self-reported measure of antihypertensive medication adherence in Uganda," PLoS One, vol. 11, no. 7, Jul. 2016, doi: 10.1371/journal.pone.0158499.

17. W. W. Chung, S. S. Chua, P. S. M. Lai, and D. E. Morisky, "The Malaysian Medication Adherence Scale (MALMAS): Concurrent validity using a clinical measure among people with type 2 diabetes in Malaysia," PLoS One, vol. 10, no. 4, Apr. 2015, doi: 10.1371/journal.pone.0124275.

18. R. Pedersini and J. Vietri, "Comparison of the 4-item and 8-item morisky medication adherence scale in patients with type 2 diabetes," Value Heal., vol. 17, no. 3, p. A183, May 2014, doi: 10.1016/j.jval.2014.03.1066.

19. G. Nabi, B. Pk, D. Mohanta, M. O. U. Ft, and R. Sm, "NON COMPLIANCE PATTERN OF ANTI HYPERTENSIVE TREATMENT," 2015.

20. A. Tibebu, D. Mengistu, and L. N. Bulto, "Adherence to prescribed antihypertensive medications and associated factors for hypertensive patients attending chronic follow-up units of selected public hospitals in Addis Ababa, Ethiopia.," Int. J. Health Sci. (Qassim)., vol. 11, no. 4, pp. 47–52, 2017, Accessed: Dec. 30, 2018. [Online]. Available: http://www.ncbi.nlm.nih.gov/pubmed/29085268

21. A. Ramli, N. S. Ahmad, and T. Paraidathathu, "Medication adherence among hypertensive patients of primary health clinics in Malaysia.," Patient Prefer. Adherence, vol. 6, pp. 613–22, 2012, doi: 10.2147/PPA.S34704.

22. V. Tsiantou, P. Pantzou, E. Pavi, G. Koulierakis, and J. Kyriopoulos, "Factors affecting adherence to

antihypertensive medication in Greece: results from a qualitative study," Patient Prefer. Adherence, vol. 4, p. 335, Aug. 2010, doi: 10.2147/PPA.S12326.