Stroke Awareness and Drug Adherence among Adult Hypertensives in a Tertiary Health Care Centre

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Authors' contributions

This work was carried out in collaboration between all authors. Author NNU performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Authors CEN and OEN managed the analyses of the study. All authors read and approved the final manuscript.

Article Information

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ABSTRACT

Stroke is rated as the second leading cause of death worldwide. Stroke is mostly a preventable neurological disease because many of its risk factors such as hypertension, dyslipidemia, diabetes mellitus and smoking can be prevented either by lifestyle modification or by pharmaco-therapeutic interventions. Effective therapy for stroke prevention involves the use of antihypertensive therapy since antihypertensive medications is key in achieving controlled blood pressure. This is a cross-sectional study of 130 participants from the University of Port Harcourt Teaching Hospital, Nigeria conducted between August and September 2016. The results showed that 90.8% of the study population knew what a stroke was. Out of the 130 participants, the results showed that 70% were nonadherent to their antihypertensive medication, and among those classified as non-adherent, 45.4% were classified as low adherent. This study showed that a significant predictor of stroke awareness was the level of patient education (p=0.01, OR=0.143, 95%CI= [0.030-0.682]). A significant predictor of high adherence to antihypertensive medications in this study was the duration of been hypertensive (p=0.035, OR=0.377, 95%CI = [0.153-0.934]). Finally, a significant predictor of optimal blood pressure control was the level of adherence (p=0.01, OR=0.523, 95%CI= [0.318-0.861]). The outcome of this study underscores the need to enhance the level of formal education of the populace.

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1. BACKGROUND

Stroke is rated as the second leading cause of death worldwide with an annual mortality rate of 5.5 million [1]. The burden of stroke does not lie solely in the high mortality but also on the high morbidity, with as much as 50% of survivors remaining chronically disabled [2]. The burden of stroke is especially high in low and middle income countries which accounts for more than 85% of all stroke-related mortality [3], and due to high fatality rates and overwhelming resource incurred by the health systems, stroke and many non-communicable diseases (NCDs) are now targeted public health priorities in these regions [4], [5].

Globally, about 16 million new cases of stroke and 62 million stroke survivors were estimated in 2005, with deaths from stroke accounting for 9.7% of all global deaths, and this is expected to increase to over 23 million new stroke cases and 7.8 million stroke deaths by 2030 in the absence of significant global public health response [6], [7]. Thus stroke is a disease of immense public health importance.

The incidence and prevalence of stroke have not been established in Nigeria. A Stroke Registry domiciled in Ibadan, South-Western Nigeria gave the annual incidence of stroke in Nigerians as 26 per 100,000 populations [8]. The frequency of stroke in hospital populations in Nigeria has varied from 0.9% to 4.0%, whereas among neurological admissions, stroke accounted for 0.5% to 45% [9].

Africa is particularly worst hit, owing to population growth, unchecked industrialization and increased consumption of western diets, leading to a rise in many modifiable vascular disease risk factors including smoking, harmful use of alcohol, physical inactivity and unhealthy diets, and invariably resulting in increased prevalence of hypertension, diabetes and obesity [10], [11]. Newer but less-documented vascular risk factor including increase of the apoB/apoA1 ratio, sedentarism, insufficient daily fruit and vegetable intake, psychosocial stress, sleep-related breathing disorders, and inflammatory markers are currently being investigated to ascertain their roles in the aetiology of strokes [12]. Even with this increasing burden, the public health response, access to health services and treatment options in many African countries has

been poor [11], [13]. Specifically, the lack of functional stroke units, neurologists, health workers, cranial computed tomography (CT) scans, magnetic resonance imaging (MRI) machines and echo-doppler machines, among many others, has negatively affected stroke outcomes [13]. Moreover, the high cost of medical care in a relatively low-income African society could have resulted in high stroke fatalities, as some studies have indicated that stroke prevalence and deaths in Africa increased due to an overtly poor socioeconomic status [14].

Stroke is mostly a preventable neurological disease because many of its risk factors such as hypertension, dyslipidemia, diabetes mellitus and smoking can be prevented either by lifestyle modification or by pharmaco-therapeutic interventions. Effective therapy for stroke prevention hence comprises of a combination of antihypertensive therapy, anti-platelets and anti-lipids.

The use of antihypertensive medications is a key component of the long-term approach to controlling blood pressure levels. The effectiveness of antihypertensive treatment is recognised in its ability to reduce the occurrence of major adverse cardiovascular events (MACE) such as stroke, acute myocardial infarction and sudden cardiac death. Current estimates however reveal that only one-sixth of all patients come close to perfect adherence to their medication regimen [15]. Nonadherence to antihypertensive medication is the main reason for failure to achieve optimal blood pressure control among patients under treatment [16]. As reported by the World Health Organization, adherence to medication in patients with chronic diseases such as hypertension averages only around 50% in developed countries. The situation is reported worse in developing countries due to poor accessibility to medications and health care services [17]. Also, the asymptomatic nature of the condition intensifies the problem of nonadherence in hypertension [18].

The aim of this study was to evaluate stroke awareness, including the risk factors and to estimate the rate of adherence to medications and to study the factors that might affect adherence and the effects of nonadherence on blood pressure among hypertensive adults.

2. MATERIALS AND METHODS

A cross-sectional descriptive study was carried out by applying a structured questionnaire to hypertensive patients treated by the medical out-patient clinics of the University of Port Harcourt Teaching Hospital, Nigeria. Patients were eligible if they were 18 years or older, and had been placed on medication for at least twelve months. Patients with a previous history of stroke were excluded. Study subjects were randomly recruited from hypertensive patients attending the medical out-patients, and the cardiology out-patients clinics of the University of Port-Harcourt Teaching Hospital.

Hypertension was defined as systolic BP of ≥140 mmHg and/or diastolic BP of ≥90 mmHg [19] or patients already under treatment with antihypertensive medications. The questionnaire was administered by the authors. Each consecutive patient who met the study criteria was recruited. Blood pressure was measured with an Accoson mercury sphygmomanometer, after at least 10 minutes' rest. The average of the last two readings was recorded. Blood pressure control was defined as systolic BP <140mmHg and diastolic BP <90mmHg [20].

The dependent variables were medication adherence and BP control. Adherence to antihypertensive medications was measured using the 8-item Morisky Medication Adherence Scale (MMAS-8). Individual item scores were summed and those with a score of 8 were considered adherent to medication. Medication nonadherence referred to a score of <8 (i.e., medium or low adherence).

Adherence level was also graded into medium adherence with a score of 6-8, while a score of <6 were considered low adherence [21].

Demographic and socioeconomic parameters including age, gender, marital status, employment status, education were recorded. Clinical information regarding how long the subjects have been hypertensive, number of BP drugs each patient was taking and the total number of drugs each patient was taking.

The questionnaire presented also had questions about:

1. Subjects awareness of what a stroke was;
2. If subjects were aware that hypertension was a risk factor for strokes; and

3. If any first degree relation had ever suffered a stroke.

2.1 Statistical Analysis

Data collected was entered into Statistical Package for Social Sciences (SPSS) software version 17.0 and used for analysis. Descriptive statistics such as means, standard deviation, proportions, and percentages were used to summarize quantitative and qualitative variables respectively. Bivariate analyses using the Pearson's Chi-square test were employed to assess the association between the outcome measure (level of adherence) and each of the socio-demographic, health-related, and adherence-related variables. Adherence level was dichotomized into adherent and non-adherent. Pearson's correlation was used to compute associations between variables. The student t-test was used to compare means.

Binary logistic regression analysis using the backward stepwise likelihood-ratio method was used to assess the predictors of adherence and BP control while controlling for other possible confounders. P values <0.05 were considered significant.

Ethical approval for the study was obtained from the Ethical Committee of the University of Port Harcourt Teaching Hospital.

3. RESULTS

3.1 Participant's Characteristics

The socio-demographic characteristics of the participants in this study are shown in Table 1. The majority of the participants were female (58.5%), in the 45-57 years' age group (34.65), married (74.6%), employed (67.7%) with tertiary level of education (43.1%).

3.2 Therapeutic Adherence and Blood Pressure Control

The mean age of patients who were adherent to medications was 50.62± 11.8 years while those who were non-adherent had a mean age of 50.00± 13.4 years (p= 0.877).

Majority of the patients have been hypertensive for less than nine years (73.1%). Only 37.9% of patients had blood pressure under control. Non-adherence to medications was present in 70% of

participants. Among the respondents, 30% had a high level of adherence to antihypertensive medications. Among those considered non-adherent, 45.4% had low adherence, and 24.6% had medium adherence. The association of BP control with the degree of adherence was statistically significant (x^2=9.030, p=0.01) as seen in Table 2. According to logistic regression analysis, patients who had high adherence scores were more likely (OR= 0.52, [95%] CI=0.32 to 0.86) to have better blood pressure control than those with medium or low adherence scores (p=0.01). The patients' age, gender, employment status and number of anti-hypertensive medication however failed to predict optimal BP control (p-values: 0.138, 0.865, 0.864 and 0.310 respectively).

Additionally, these associations can be used to investigate a suspected sub-optimal adherence to therapy in patients with uncontrolled BP: 65.6% of patients with uncontrolled BP did not adhere to anti-hypertensive treatment, while 34.4% of patients with BP under control were adherent.

3.3 Medication Use and Stroke Awareness

Majority (90.8%) of the participants were aware of what a stroke was and 77.7% of the hypertensive patients knew that hypertension was a risk factor for stroke.

Table 1. Participants' socio-demographic characteristics

Variables	All number (%)	Controlled BP number (%)	Uncontrolled BP number (%)	Chi-square	p-value
Gender					
Male	54(41.5)	19(38.0)	31(62.0)	0.000	0.985
Female	76(58.5)	28(37.8)	46(62.2)		
Age (years)					
25-35	18(13.8)	7(38.9)	11(61.1)		
36-46	28(21.5)	12(44.4)	15(55.6)	3.842	0.428
47-57	45(34.6)	12(27.9)	31(72.1)		
58-68	23(17.7)	8(38.1)	13(61.9)		
69-79	16(12.3)	8(53.3)	7(46.7)		
Marital status					
Single	13(10)	4(30.8)	9(69.2)	1.167	0.761
Married	97(74.6)	36(39.1)	56(60.9)		
Divorced	5(3.8)	1(20.0)	4(80.0)		
Widowed	15(11.5)	6(42.9)	8(57.1)		
Educational status					
No formal education	12(9.2)	2(16.7)	10(83.3)	13.438	0.004*
Primary	28(21.5)	9(33.3)	18(66.7)		
Secondary	34(26.2)	20(64.5)	11(35.5)		
Tertiary	56(43.1)	16(29.6)	38(70.4)		
Employment status					
Employed	88(67.7)	31(36.9)	53(63.1)	0.110	0.740
Unemployed	42(32.3)	16(40.0)	24(60.0)		

= statistically significant

Table 2. Association between the degrees of therapy adherence with BP control

	Controlled BP %	Uncontrolled BP %	X^2	p value
Low adherence	24.1	75.9	9.030	0.01*
Middle adherence	53.1	46.9		
High adherence	47.1	52.9		
Middle adherence	53.1	46.9	1.228	0.541
High adherence	47.1	52.9		

= statistically significant

Most of the participants were on more than one BP drug for the treatment of their hypertension (90.8%). More patients on monotherapy had BP control than those on more than one anti-hypertensive medication (50% versus 36.6%). This however, was not statistically significant (p=0.363). In the multiple logistic regression analysis (Table 3), having a formal education (OR = 0.14, [95%] CI = 0.030 to 0.688) was associated with higher levels of awareness of the nature of a stroke. The age, gender, and employment status of the patients failed to predict the level of awareness of the nature of a stroke.

3.4 Hypertension as a Stroke Risk Factor and Medication Adherence

This study showed that the duration of hypertension was a significant predictor of its awareness as a risk factor for stroke. The educational and employment status however failed to positively influence the subjects' awareness of hypertension as a risk factor for strokes (Table 4). We also found that duration of hypertension significantly predicted the likelihood of anti-hypertensive medication adherence (p=0.03, OR: 0.377, CI: 0.153-0.934). This study however showed that marital status (p=0.122, OR: 2.255), educational status (p=0.769, OR: 1.254), and the knowledge that hypertension as a risk factor for stroke (p=0.792, OR: 0.792) did not predict a high adherence to anti-hypertensive drugs. Interestingly, 80.8% of patients on anti-hypertensive agents took their medication a day before their next clinic appointment. We also found that almost half of the subjects discontinued their anti-hypertensive medication when the felt that their BP was well controlled (Table 5).

4. DISCUSSION

Data from this study indicates that most of the respondents knew what a stroke was (90.8%). They also knew that hypertension was a risk factor for stroke (77.7%). This was far higher than that reported by Donkor et al [22] where

majority of their respondents (66%) could not recognize that hypertension was a risk factor for stroke. The difference in the level of awareness of hypertension as a risk factor for stroke may be due to the fact that while this study was a hospital-based study, that of Donkor et al was a community-based study. Poor community awareness of stroke risk factors has also been reported by Ayanniyi et al [23] in Osogbo South-Western Nigeria. So although a majority of the respondents knew what a stroke was, fewer numbers of them knew that hypertension was a risk factor for stroke. This could partly explain the rising incidence of stroke among the population.

Predictors of stroke knowledge in this study appear to be similar to those in other studies. Education was a key determinant of the knowledge of the nature of a stroke (p=0.015). This was not unexpected as educational status is a factor that often influenced knowledge, beliefs, attitudes and practices relating to health and other domains of life. This finding was similar to the outcome of studies carried out by Wahab et al [24] but in contrast to that conducted in Ghana [22]. The contrast in awareness levels between this study and that reported by Wahab et al [24] on the one-hand and Donkor et al [22] probably stems from the fact that the former been a hospital-based study led to the respondents having greater contact with health-care providers. Having a stroke risk factor (i.e., hypertension) and its duration was also a determinant in the recognition of hypertension as stroke risk factor (Table 4). This was similar to that reported by Donkor et al, [22] and has also been reported by Pontes-Neto et al [25].

Hypertension is one of the major risk factors for cardiovascular diseases, with their attendant morbidity and mortality. For patients with high blood pressure, adherence to medication is an important factor in achieving blood pressure control and in preventing damaging complications to body systems. However, due to the often asymptomatic nature of hypertension in the early stages of the disease, patients' adherence to their prescribed medications is often a problem.

Table 3. Predictors of stroke awareness through multivariate regression analysis

Predictors	B	Odds ratio	95% CI limit		p-value
			Lower	Higher	
Age	-0.017	0.983	0.936	1.032	0.486
Sex (male)	-0.175	0.840	0.208	3.390	0.806
Employment status	-0.718	0.488	0.129	1.837	0.288
Education	-1.944	0.143	0.030	0.682	0.015*

= statistically significant

Table 4. Predictors of awareness of hypertension as stroke risk factor through multivariate regression analysis

Predictors	B	Odds ratio	95% CI limit		p-value
			Lower	Higher	
Age	0.640	1.897	0.672	5.354	0.816
Duration	-1.455	0.233	0.084	0.650	0.005*
Employment status	-0.847	0.429	0.166	1.109	0.081
Education	1.124	3.077	0.800	11.829	0.102

= statistically significant

Table 5. Frequency of response to 8-item Morisky medication adherence scales

Scale item	Yes (%)	No (%)
1. Do you sometimes forget to take your BP drugs?	50.8	49.2
2. In the last 2wks, was there any day when you did not take your BP drugs?	35.4	64.6
3. Have you ever stopped taking your medication or decreased the dose without first telling your doctor because you felt worse when you took them?	48.5	64.6
4. When you travel or leave the house do you sometimes forget to take your medication?	36.2	63.8
5. Did you take your BP medication yesterday?	80.8	19.2
6. When you feel your BP is controlled, do you sometimes stop taking your medications?	42.3	57.7
7. Have you ever felt distressed for strictly following your high BP treatment?	37.7	62.3
8. How often do you have difficulty to remember taking all your BP drugs?	Never	56.9%
	Sometimes	33.8%
	Frequently	9.2%

Research on the adherence of antihypertensive treatment has shown that patient's nonadherence to medication is related with a mix of demographic, organizational, psychological, and disease- and medication-related variables [26], [27]. The dichotomous categorization of adherence into "adherence and nonadherence" was based on the study by Morisky et al [21] where patients with high and medium adherence were considered adherent.

In the current study, the rate of nonadherence was found to be 70%. This was consistent with a study conducted in both Ghana and Nigeria in which the mean rate of nonadherence was 66.7%. A rigorous review by the World Health Organization found that, in developed countries, adherence among patients suffering chronic diseases averages only 50% [17]. At an adherence rate of about 50% found in developed countries, it is clear that there is plenty of room for improvement in patients' adherence to their prescribed medications in our clinics.

Looking closely at the level of stroke awareness and the degree of nonadherence to antihypertensive medication (70%) despite the fact that majority of them (77.7%) were aware that hypertension was a risk factor for stroke, it becomes evident that there is wide disparity between knowledge and practice among the respondents. Measures should therefore be taken in our clinics to enhance patients' adherence to medication by repeated counselling on the need to better comply with their medication, and also by helping patients organize their medication administration by urging them to tie their pill-taking to certain specified activities, such as meals. The need for the patient to appreciate the necessity to take their antihypertensive medications and own their treatment is highlighted by the fact that 80.8% of the respondent took their blood pressure-lowering drugs a day before their next clinic appointment probably because they knew they will be asked about compliance by the health-care provider (Table 5). Thus, the use of the MMAS-8 allows not only for the determination of the level of adherence but also helps to identify the causes for nonadherence. A binary logistic regression analysis performed to assess the predictors of blood pressure control showed that

the level of adherence was a determinant of blood pressure control (Table 2). This might also explain why 62.1% of the patients had uncontrolled blood pressure.

This study showed that there was a statistically significant relationship between antihypertensive treatment adherence and time (duration) since the diagnosis of hypertension was made (p=0.035) (Table 6). This finding is in concert with the report by Mazzaglia et al [*28*]. These studies have shown that newly diagnosed patients with hypertension are more likely to report nonadherence to their treatment. Recently diagnosed patients who have started a new treatment usually experience the unpleasant side effects of the medication, such as increase in the frequency of urination. This might lead to the patients stopping their treatment as evident in this study where 48.5% of the respondents stopped or decreased the dose of the medication on account of unpleasant side-effects (Table 5).

Our results failed to show any statistically significant association between the knowledge of hypertension as a risk factor for stroke and antihypertensive medication adherence. This is similar to the findings reported by Alsolami et al [29] but contrary to that reported by Williams et al [30] which showed that knowledge was significant predictor of antihypertensive medication adherence.

5. CONCLUSION

Uncontrolled BP can bring about serious consequences, including higher rates of morbidity and mortality and causing a great economic burden on an already over-stretched health-care sector. Adherence to antihypertensive medication is key in effecting blood pressure control. This study has not only revealed the poor level of antihypertensive medication adherence among hypertensive patients in our practice, but has reinforced this factor as one of the reasons behind poor blood pressure control among that subject population. Although a vast majority of the respondent knew what stroke was, and a sizable proportion were aware that hypertension was a risk factor for stroke, this knowledge did not positively affect medication adherence. This is probably due to the fact that these patients did truly appreciate the severity of their illness and mostly took their medication to please the health-care provider. Generally, the findings of the study highlight the need for the health-care provider to better

counsel the patient so that they see their medical treatment as collaboration between themselves and their health-care provider. Given the high rate of nonadherence reported in this study, further research is needed to assess newer and more effective methods to improve treatment adherence among hypertensive patients in our tertiary hospital.

6. LIMITATIONS

1. This was a hospital-based study so a higher proportion of the population were likely to be more self-aware than would be expected for a community-based study.
2. Since this was a questionnaire-based study there is a possibility of some inaccurate recollection of facts by some of the respondents.

CONSENT

Not applicable.

ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Lopez AD, Mathers CD, Ezzati M, Jamison DT, Murray CJ. Global and regional burden of disease and risk factors, 2001: Systematic analysis of population health data. Lancet 2006;367(9524):1747-1557.
2. Murray CJ, Lopez AD. Mortality by cause for eight regions of the world: Global burden of disease study. Lancet. 1997; 349:1269-1276.
3. Feigin VL, et al. Worldwide stroke incidence and early case fatality reported in 56 population-based studies: A systematic review. Lancet Neurol. 2009; 8(4):355-369.
4. Feigin VL, Forouzanfar MH, Krishnamurthi R, Mensah GA, Connor M, et al. Global and regional burden of stroke during 1990–2010: Findings from the Global Burden of

Disease Study 2010. Lancet. 2014;383: 245–255.

5. Chin JH. Stroke in Sub-Saharan Africa: An Urgent Call for Prevention. Neurology. 2012;78:1007–1008.

6. Strong K, Mathers CD, Bonita R. Preventing stroke: Saving lives around the world. Lancet Neurol. 2007;6:182–187.

7. World Health Organization (2004). Global Burden of Disease (GBD) 2002 estimates. World Health Report 2004. Geneva, Switzerland: WHO.

8. Osuntokun BO, Bademosi O, Akinkugbe OO, Oyediran AB, Carlisle R. Incidence of stroke in an African City: Results from the stroke Registry Ibadan, Nigeria, 1973-1975 Stroke. 1979;10:205-207.

9. Ojini FI, Danesi MA. Pattern of neurological admissions at the Lagos University Teaching Hospital. Nig J Clin Pract. 2003;5:38-41.

10. Connor MD, Walker R, Modi G, Warlow CP. Burden of stroke in black populations in sub-Saharan Africa. Lancet Neurol. 2007;6:269-278.

11. O'Donnell MJ, Xavier D, Liu L, Zhang H, Chin S, et al. Risk factors for ischaemic and intracerebral haemorrhagic stroke in 22 countries (the Interstroke study): A case-control study. Lancet. 2010;376: 112–123.

12. Arboix A. Cardiovascular risk factors for acute stroke: Risk profiles in the different subtypes of ischemic stroke. World J Clin Cases. 2015;3(5):418-429.

13. Wahab KW. The burden of stroke in Nigeria. International Journal of Stroke 2008;3:290–292.

14. Connor MD, Walker R, Modi G, Warlow CP. Burden of stroke in black populations in sub-Saharan Africa. Lancet Neurol 2007;6:269–278.

15. Dragomir A, et al. Impact of adherence to antihypertensive agents on clinical outcomes and hospitalization costs. Medical Care. 2010;48(5):418-425.

16. Neutel JM, Smith D. Improving patient compliance: A major goal in the management of hypertension. J Clin Hypertens. 2003;5(2):127-132.

17. Sabate E. Adherence to long-term therapies: Evidence for action. World Health Organization. Accessed Jun 2016.

Available:http://apps.who.int/medicinedocs/en/d/Js4883e/6.1.3.html

18. Thinking outside the Pillbox: A system-wide approach to improving patient medication adherence for chronic disease. NEHI Publication; 2009. [cited June 2016].
Accessed June 2016.
Available:http://www.nehi.net/publications/44

19. Chobanian AV, et al. Seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. Hypertension. 2003; 42(6):1206-1252.

20. James PA, et al. Evidence-based guideline for the management of high blood pressure in adults: report from the panel members appointed to the Eight Joint National Committee (JNC8). JAMA. 2014;311(5): 507-520.

21. Morisky DE, Green LW, Levine DM. Concurrent and predictive validity of a self-reported measure of medication adherence. Medical Care. 1986;24(1):67-74.

22. Donkor ES, et al. Community awareness of stroke in Accra, Ghana. BMC Public Health. 2014;14:196.

23. Ayanniyi O, Akande O, Mustapha AF. Knowledge and perception of stroke among adults in Osogbo, Nigeria. Ann Afr Med. 2007;6(2):447-452.

24. Wahab KW, et al. Awareness of warning signs among suburban Nigerians at high risk for stroke is poor: A cross-sectional study. BMC Neurol. 2008;8:18.

25. Pontes-Neto OM, et al. Stroke awareness in Brazil: Alarming results in a community-based study. Stroke. 2008;39:292-296.

26. Gascon J, et al. Why hypertensive patients do not comply with the treatment. Results from a qualitative study. Fam Pract. 2003;21(2):125-130.

27. Chapman RH, et al. Predictors of adherence with antihypertensive and lipid-lowering therapy. Arch Intern Med. 2005; 165(10): 1147-1152.

28. Mazzaglia G, et al. Adherence to antihypertensive medications and cardiovascular morbidity among newly diagnosed hypertensive African-Americans. Archives Journal of Managed Care. 2001;7(4):389-398.

29. Alsolami F, Xiang-Yu H, Correa-Velez I. An Arabic instrument to measure medication adherence in Saudi hypertensive patients. Middle Eastern Journal of Family Medicine 2013;7(11):17-23.

30. Williams, MV, Baker DW, Parker RM, Nurss JR. Relationship of functional health literacy to patients' knowledge of their chronic disease - A study of patients with hypertension and diabetes. Archives of Internal Medicine 1998;158(2):166-172.

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