Original Article

Social Support, Treatment Adherence and Outcome among Hypertensive and Type 2 Diabetes Patients in Ambulatory Care Settings in southwestern Nigeria

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Ghana Med J 2017; 51(2): 64-77 DOI: http://dx.doi.org/10.4314/gmj.v51i2.4

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Conflict of interest: None Declared

SUMMARY

Objectives: To evaluate available and desired sources and types of social-support among hypertensive and type-2-diabetes (T2D) patients. Associations of medication adherence and clinical outcome with access to most available social-support and medicine affordability were subsequently investigated.

Design: Cross-sectional questionnaire-guided interview among 250-hypertensive and 200-T2D patients, and review of medical records to retrieve disease-specific clinical parameters.

Settings: University College Hospital and Ring-Road State Hospital, Ibadan, southwestern Nigeria.

Participants: Adults out-patients with hypertension, T2D, and T2D comorbid with hypertension were enrolled, while in-patients were excluded.

Results: Family source of support was the most available [hypertensive (225; 90.0%); T2D (174; 87.0%)], but government and non-governmental organisation support were largely desired, with financial support preferred, 233(93.2%) hypertensive and 190(95.0%) T2D, respectively. Adherent hypertensive patients with or without access to family support were (127; 56.4%) versus (18; 72.0%), p=0.135; while for T2D were (103; 59.2%) versus (21; 80.8%), p=0.035. Mean systolic blood pressure of hypertensive and fasting plasma glucose of T2D with access to family and financial support were better than their counterparts without access (p>0.05). Hypertensive (110; 76.4%) and T2D (87; 87.0%) participants who consistently afford medicine expenses had significantly better adherence and outcome (p<0.05).

Conclusions: Family source of support is the most accessible, but government and non-governmental organisation support were largely desired. Access to family support did not positively influence medication adherence, while access to financial support marginally impacted on outcome among hypertensive and T2D patients. However, unwavering tendency for therapy affordability significantly influenced adherence and outcome, thus, the need for expanded social-support system in order to consistently ensure improved outcome.

Funding: None declared

Keywords: Social support system, Type 2 diabetes, Hypertension, Treatment adherence and outcome, Out-patients

INTRODUCTION

Chronic non-communicable diseases such as diabetes and hypertension pose major challenges for healthcare systems in economically developing and developed countries.[1,2,3] World health statistics reported that one-in-three and one-in-ten adults worldwide have an elevated blood pressure and blood glucose, respectively.[4]

In Nigeria, hypertension is the most common cardiovascular disease and a major risk factor for stroke, heart disease and kidney failure[2,5], while more than 1.6 million cases of diabetes are reported in Nigeria indicating a country with highest burden of diabetes in Africa.[5,6]

Non-adherence to medication among patients with chronic diseases is a common cause of suboptimal therapeutic outcome[7,8] resulting in increased hospitalizations, mortality and a substantial clinical and financial burden on the healthcare system.[9,10]

For more than four decades, clinical researchers in health behaviour and social scientists have been accumulating evidences on causes of increasing prevalence of poor adherence among patients with chronic diseases including hypertension and diabetes, with a view to design all-encompassing adherence-enhancing intervention to ensure full benefits of therapy.[7,8]

Myriads of factors affecting adherence have therefore been reported in literature including but not limited to poor socio-economic status, lack of family or social support network, lack of health insurance, high medication cost, cultural and lay belief about illness and treatment among other factors.[7,12,13] The preponderance of economic instability, low literacy levels, inadequate access to healthcare facilities, and low donor funding might have contributed to increasing incidence of treatment non-adherence among patients with chronic diseases.[14,15,16]

Social support system as a component of comprehensive adherence-enhancement intervention has been widely reported to positively enhance adherence and treatment outcome.[17,18] Available data seem to encourage inclusion of social support component as part of overall adherence-promoting intervention[17,18,19] and there is robust evidence linking access to social support with medication adherence and health related outcome.[17,19,20,21,22]

Social support is a multifaceted experience that help patients to remain active in their care when faced with physical, social and economic vulnerabilities.[23,24] However, concepts and measures of social support are multidimensional with different sources and types of social support reported in literature[18,20,22] including family members, friends and peers, as well as healthcare professionals and organisations.[24,25]

In general, four types of social support have been established namely functional, emotional, informational, and companionship support.[21,25,26] All these types of support vary in their perceived relevance for treatment adherence and self-management.[24,27] Patients may have varying preferences for different sources and types of social support, however, the source of support available, the amount of support, and manner of delivery may contribute to perception of support.[23,26,27]

Studies in different chronic diseases have shown that patients vary in their access or preference for different sources of social support, while accessible support vary in their effectiveness in enhancing adherence.[20,22]

Also, the theories of optimal matching by Cutroma and Russel (1990)[28] suggest that for social support to be maximally beneficial, available social support should match the support desired.

Thus, this study was designed to evaluate the most available or accessible source and types of social support system, and the desired sources and types of support among cohorts of hypertensive and type 2 diabetes patients in ambulatory healthcare settings in Ibadan, southwestern Nigeria. Medication adherence and clinical parameters were assessed, while associations of adherence and clinical outcome parameters with access to most available source and type of social support and medicine affordability were subsequently investigated.

METHODS

Study sites and setting

This study was carried out at the cardiology and endocrinology outpatient clinics of the University College Hospital (UCH) and Ring Road State Hospital (RRSH), both located in Ibadan, southwestern Nigeria. The UCH is a 900-bed federal teaching hospital affiliated with the University of Ibadan, while RRSH is a 278-bed secondary healthcare facility. Both hospitals are government-owned public healthcare facilities notable for treatment and care of different categories of ambulatory and institutionalized patients within and outside the region.

Ethical consideration

Ethical approval of the study protocol was obtained from the joint University of Ibadan/UCH Institution Review Board (NHREC/05/01/2008a).

Study design

A prospective cross-sectional questionnaire-guided interview among 250 ambulatory hypertensive and 200 type 2 diabetes patients was carried out between January and March, 2016. A review of patients' medical records was subsequently done to retrieve disease-specific clinical outcome parameters including blood pressure and blood glucose using pre-piloted data collection form.

Sample size determination

Representative sample size was determined based on estimated population of regular hypertensive and type 2 diabetes attendee at the weekly cardiology and endocrinology clinics of the hospitals for the 12 consecutive weeks, at 95% confidence level and 5% margin of error. Allowing for a 10% non-response rate, a target sample size of 200 type 2 diabetes and 250 hypertensive participants was calculated using a sample size calculator (www.surveysystem.com/sscalc.html).

Inclusion and exclusion criteria
Adult patients with primary diagnosis of hypertension, type 2 diabetes (T2D) and T2D comorbid with hypertension who consented to participate in the study were enrolled. Patients must also have been on therapy for at least three months prior to the time of study. Hypertensive and type 2 diabetes patients who were booked for inpatient admission, and who declined participation were excluded.

Patients' sampling process
Eligible patients were consecutively selected from the list of hypertensive and T2D patients who attended the weekly cardiology and endocrinology outpatient clinics of the hospitals. Patients were approached for participation while they were waiting to see physician on the clinic days. Purpose and objectives of the study were explained verbally to individual patient after which voluntary informed consent was individually obtained to signify intention to participate in the study. Patients were informed that participation is voluntary and were assured of anonymity and confidentiality of responses. Only consented patients at every clinic day were enrolled and administered the questionnaire.

Elderly patients were assisted by caregivers who accompanied them to the hospital, while clarifications were made for those who did not understand English language. Translation and back-translation information in the study instrument were done to ensure response consistency.

Design and construction of data collection instruments
The questionnaire comprised largely of open-ended and closed-ended questions divided into five sections. Section A clarified socio-demographic characteristics and average monthly income. Section B evaluated participants' opinion on need for social support system, and most available or accessible source and types of social support. Section C comprised questions that explored information on desired source and types of social support system by patients.

Section D contained questions that explored disease and medication-related information including information on affordability of prescribed therapies, measure taken in case of medicine unaffordability, as well as coping mechanism for therapy expenses. Opinion on average monthly expenses on medications, and access to National Health Insurance Scheme (NHIS) were also explored among others.

Section E comprised 4-item validated questions in Morisky Adherence Predictor Scale[29] administered in dichotomous (Yes/No) response options. Adherence versus non-adherence in this study was defined according to Adisa *et al*.[16] A total score of < 1 to all the 4-item questions on the scale indicates adherence or total commitment to medication-taking, while a total score ≥1 suggests non-adherence. Pre-piloted data collection form was used to capture disease-specific clinical parameters documented in individual patient's case note. Average of two most recent consecutive blood pressure and blood glucose (fasting plasma glucose, glycosylated haemoglobin) readings was retrieved for individual participant. Binary categorisation of optimal and suboptimal treatment outcome was subsequently developed.

Optimal treatment outcome with respect to blood pressure (BP) control for hypertensive patients was defined as systolic blood pressure (SBP) ≤ 140 mmHg and diastolic blood pressure (DBP) ≤ 90 mmHg[30], while for type 2 diabetes, optimal BP control was defined as SBP ≤ 130 mmHg and DBP ≤ 80 mmHg to ensure tight BP control.[30] Blood pressure values above these ranges were considered as suboptimal BP control.

Also, optimal treatment outcome for glycaemic control was defined as fasting plasma glucose (FPG) ≤ 6.1 mmol/L[31,32] or glycosylated haemoglobin (HbA1c) ≤ 7%, while FPG > 6.1 mmol/L or HbA1c > 7% indicates suboptimal glycaemic control.

Validation and pre-test of data collection instruments
The instruments for data collection were assessed for content validity and pretested among ten randomly selected type 2 diabetes and/or hypertensive in-patient chosen from the University College Hospital, Ibadan. Feedback from validity assessment and pre-test led to modifications of some question-item to remove ambiguity and ensure better comprehension by participants.

Data analysis
Data were sorted, coded and entered into Predictive Analytics Software version 20.0 for management and analysis. Descriptive statistics including frequency, percentage, and mean ± standard deviation were used to summarise data. Categorical variables were evaluated using Chi-square or Fischer's exact test as appropriate, while Independent sample t-test was used to evaluate continuous variables at $p < 0.05$ considered significant.

RESULTS

A total of 250 primarily diagnosed hypertensive and 200 type 2 diabetes (T2D) participated in the study. Out of the T2D, 76 (38.0%) had comorbid hypertension. Majority of the participants were above 60 years of age.

The mean ages for hypertensive and T2D were 62.8 ± 11.9 and 63.7 ± 12.4 years, respectively. In both disease categories, there were more females [(142; 56.8%) hypertensive; (127; 63.5%) T2D] than males. Participants mostly had primary or no formal education.

Table 1 Socio-demographic characteristics of participants

Variables	Frequency (%)	
	Hypertension (n = 250)	**Type 2 Diabetes (n = 200)**
Age (years)		
30 – 40	8 (3.2)	4 (2.0)
41 – 50	31 (12.4)	32 (16.0)
51 – 60	70 (28.0)	35 (17.5)
61 – 70	79 (31.6)	69 (34.5)
Above 70	62 (24.8)	60 (30.0)
Sex		
Male	108 (43.2)	73 (36.5)
Female	142 (56.8)	127 (63.5)
Occupation		
Retirees	115 (46.0)	70 (35.0)
Traders	65 (26.0)	61 (30.5)
Civil servants	28 (11.2)	29 (14.5)
Farmers	23 (9.2)	20 (10.0)
Artisans	19 (7.6)	20 (10.0)
Educational qualification		
No formal education	62 (24.8)	52 (26.0)
Primary	83 (33.2)	53 (26.5)
Secondary	46 (18.4)	55 (27.5)
Tertiary	59 (23.6)	40 (20.0)
Marital status		
Single	4 (1.6)	0 (0.0)
Married	189 (75.6)	157 (78.5)
Widowed	56 (22.4)	39 (19.5)
Divorced	1 (0.4)	2 (1.0)
Separated	0 (0.0)	2 (1.0)
Average monthly income in Naira (US $)		
< 10000 (23.8)	81 (32.4)	68 (34.0)
10000 – 49000 (23.8 – 116.7)	79 (31.6)	66 (33.0)
50000 – 100000 (119.0 – 238.1)	37 (14.8)	20 (10.0)
> 100000 (238.1)	10 (4.0)	13 (6.5)
No defined/stable income	43 (17.5)	33 (16.5)
Mean number of years on medication	5.98 ± 4.5	6.10 ± 4.5

US $ = United State Dollar

The mean duration on treatment for hypertensive participants was 6.0 ± 4.5 years, and 6.1 ± 4.5 years for T2D.

A larger proportion of patients earned average monthly income of less than NGN 50000.00 (US$ 119.0).

Two hundred and forty-seven (98.8%) hypertensive and 195 (96.5%) T2D patients were on greater than one medication. Details of socio-demographic characteristics are shown in Table 1.

Nearly all participants indicated the need for social support system for their care. A substantial proportion, 225 (90.0%) hypertensive and 186 (93.0%) T2D patients cited in different combinations support from the government, while 224 (89.6%) hypertensive and 186 (93.0%) T2D mentioned non-governmental organisations as the most desired sources of social support.

Table 2 Desired source and types of support system versus the available source of social support among participants

Variables	Response, N (%)	
	Hypertensive	**Type 2 diabetes**
Desired source of social support		
Government	225 (90.0)	186 (93.0)
Non-governmental organisations	224 (89.6)	186 (93.0)
Healthcare provider	69 (27.6)	6 (3.0)
Patient's disease association	22 (8.8)	72 (36.0)
Employer	11 (4.4)	3 (0.7)
Family	3 (1.2)	1 (0.5)
Religious affiliation	1 (0.4)	0 (0.0)
Desired types of support		
Financial	233 (93.2)	190 (95.0)
Informational (Health-related)	123 (49.2)	87 (43.5)
Emotional	60 (24.0)	29 (14.5)
Most available/accessible source of social support		
Family	225 (90.0)	174 (87.0)
Religious affiliation	14 (5.6)	8 (4.0)
Healthcare provider	11 (4.4)	4 (2.0)
Patient's disease association	9 (3.6)	2 (1.0)
Government	7 (2.8)	11 (5.5)
Employer	1 (0.4)	0 (0.0)
Non-governmental organisations	0 (0.0)	0 (0.0)
Types of support obtained from the available source		
Financial	212 (84.8)	130 (65.0)
Emotional	83 (33.2)	82 (41.0)
Informational (Health-related)	57 (22.8	15 (7.5)

Multiple responses were merged together in some cases, but analysis is based on the total number of participants in each disease category (N = 250 for hypertensive; N = 200 for type 2 diabetes), N = number

Family support was mentioned in different combinations as the most available source of social support by participants [hypertensive (225; 90.0%); T2D (174; 87.0%)]. Financial support was the most desired functional type of support from preferred source(s) by participants [hypertensive (233; 93.2%); T2D (190; 95.0%)]..

Details of different sources and types of support available to and desired by participants are shown in Table 2

Table 3 Summary of participants' responses to modified Morisky Adherence Predictor Scale

	Response, N (%)			
Questions	**Hypertensive (N = 250)**		**Type 2 diabetes (N = 200)**	
	Yes	**No**	**Yes**	**No**
1.Do you sometimes forget to take your medicines?	60 (24.0)	190 (76.0)	69 (24.5)	151 (75.5)
2. When you do not have enough money to buy your medicine, do you stop taking your medicine?	96 (38.4)	154 (61.6)	127 (63.5)	73 (36.5)
3. Sometimes if you feel better, do you stop taking your medicines?	18 (7.2)	232 (92.8)	11 (5.5)	189 (94.5)
4. Sometimes if you feel worse after taking your medicines, do you stop taking your medicines?	34 (13.6)	216 (86.4)	29 (14.5)	171 (85.5)
Distribution of total score	**Hypertensive**		**Type 2 diabetes**	
0	145 (58.0)		124 (62.0)	
1	34 (13.6)		14 (7.0)	
2	46 (18.4)		43 (21.5)	
3	9 (3.6)		10 (5.0)	
4	16 (6.4)		9 (4.5)	
Cut-off				**Category**
< 1	145 (58.0)		124 (62.0)	Adherent
≥1	105 (42.0)		76 (38.0)	Non-adherent

N = number

Table 4: Participants' response on therapy affordability, coping mechanism for medicine expenses and measure taken for medicines unaffordability

Variables	**Response, N (%)**			
	Hypertensive		**Type 2 diabetes**	
Medicine affordability	**Yes**	**No**	**Yes**	**No**
Ability to consistently afford the cost of prescribed medicines	144 (57.6)	106 (42.4)	100 (50.0)	100 (50.0)
Measure taken in case of medicine unaffordability	**N = 106**		**N = 100**	
Delay the use of medication	38 (35.8)		50 (50.0)	
Use herbal preparation as alternative	19 (17.9)		8 (8.0)	
Reduce the dose to be taken	11 (10.4)		8 (8.0)	
Do not buy prescribed medicines at all	6 (5.7)		8 (8.0)	
Skip doses of medication	1 (0.9)		3 (3.0)	
Delay the use of medication + Skip doses of medication	25 (23.6)		23 (23.0)	
Delay the use of medication + Use herbal preparation as alternative	3 (2.8)		0 (0.0)	
Delay the use of medication + Do not buy prescribed medication at all	2 (1.9)		0 (0.0)	
Delay the use of medication, skip doses + use herbal preparation as alternative	1 (0.9)		0 (0.0)	
Summary of responses	***N = 112***		***N = 100***	
Delay and skip doses of medication	70 (62.5)		76 (76.0)	
Use herbal preparation as alternative	23 (20.5)		8 (8.0)	
Reduce the dose to be taken	11 (9.8)		8 (8.0)	
Do not buy prescribed medicines at all	8 (7.1)		8 (8.0)	
Coping mechanism for therapy expenses	**N = 212**		**N = 129**	
Borrow money from family and friends	95 (44.8)		52 (40.3)	
Reduced expenses on feeding/clothing for the family	42 (19.8)		36 (27.9)	
Sell personal properties	36 (17.0)		5 (3.9)	
Delay/stop children education	1 (0.5)		4 (3.1)	
Borrow money from family and friends + Reduced expenses on feeding/clothing for the family	24 (11.3)		29 (22.5)	
Borrow money from family and friends + Sell personal properties	14 (6.6)		3 (2.3)	
Summary of responses	***N = 250***		***N = 161***	
Borrow money from family and friends	133 (53.2)		84 (52.2)	
Reduced expenses on feeding/clothing for the family	66 (26.4)		65 (40.4)	
Sell personal properties	50 (20.0)		8 (5.0)	
Delay/stop children education	1 (0.4)		4 (2.5)	

Multiple responses were merged together in some cases, but analysis is based on valid response, N = number

Modified Morisky Adherence Predictor Scale (MMAPS) showed that 145 (58.0%) of hypertensive and 124 (62.0%) of T2D had a total score < 1 suggesting adherence.

Unintentional non-adherence (questions 1 and 2 on MMAPS) was common, 60 (24.0%) and 96 (38.4%), respectively among hypertensive participants; 49 (24.5%) and 127 (63.5%), respectively for type 2 diabetes (Table 3).

One hundred and six (42.4%) hypertensive and 100 (50.0%) T2D participants mentioned inability to consistently afford costs of prescribed medications. Of these, majority (70; 62.5%) of hypertensive and 76 (76.0%) of T2D cited in different combinations delaying and skipping doses of medicines as part of measures taken when costs of therapy are unaffordable.

Summarily, 133 (53.2%) hypertensive and 84 (52.2%) of T2D borrowed money from family and friends as payment coping mechanism for therapy expenses (Table 4). Forty (16.0%) of hypertensive and 16 (8.0%) T2D participants enrolled for National Health Insurance Scheme for their healthcare.

Mean systolic blood pressure (SBP) values for hypertensive patients was 136.9 ± 19.5 mmHg and 84.6 ± 12.0 mmHg for diastolic blood pressure (DBP). One hundred and fifty (60.0%) of the hypertensive participants had optimal BP control and 100 (40.0%) had suboptimal BP. Type 2 diabetes comorbid with hypertension had mean SBP of 135.5 ± 18.2 mmHg and DBP of 79.1 ± 9.2 mmHg.

Mean fasting plasma glucose (FPG) for T2D was 6.9 ± 2.0 mmol/L. Ninety (45.0%) had optimal glycaemic control with mean FPG ≤ 6.1 mmol/L, while 110 (55.0%) had suboptimal control (FPG > 6.1 mmol/L). Eighty-eight (44.0%) of the 200 T2D had glycosylated haemoglobin (HbA1c) results documented in their case notes, with mean value of 7.5 ± 1.6%. Forty-nine (55.7%) had HbA1c ≤ 7.0%, and 39 (44.3%) had HbA1c > 7.0%.

Clinical outcome parameters for hypertensive participants with or without access to financial type of support were SBP = 136.6 ± 19.1 versus 139.3 ± 21.6 mmHg, and DBP = 84.5 ± 11.2 versus 85.4 ± 16.2 mmHg, p = 0.658; while for T2D were FPG = 6.8 ± 1.8 versus 7.0 ± 2.2 mmol/L, p = 0.435 (Tables 5 and 6).

Participants who consistently afford therapy expenses had significantly better mean SBP (134.2 ± 18.4 mmHg) and FPG (6.5 ± 1.8 mmol/L) compared to those who cannot (SBP of 140.7 ± 20.3 mmHg and FPG of 7.2 ± 2.1 mmol/L). Adherent hypertensive and T2D participants had significantly better SBP (134.8 ± 19.2 mmHg) and FPG (6.3 ± 1.5 mmol/L) than their non-adherent counterparts.

Details of association of clinical outcome parameters with adherence status, access to most available source and type of social support and medicine affordability are shown in Tables 5 and 6.

Table 5 Relationship between clinical outcome parameters and relevant variables among hypertensive participants

Parameters/Variables	**Response, Mean ± SD**		**t-test**	**P – value**
Adherence status	**Adherent (N = 145)**	**Non-adherent (N = 105)**		
Mean SBP (mmHg)	134.8 ± 19.2	140.0 ± 9.6	- 2.065	0.040[a]
Mean DBP (mmHg)	83.9 ± 11.8	85.7 ± 12.3	- 1.175	0.241
Average monthly expenses on medicines (US$)	8.1 ± 6.2	11.6 ± 6.3	- 4.399	0.000[a]
Health insurance status	**Yes (N = 40)**	**No (N = 210)**		
Mean SBP (mmHg)	130.5 ± 13.6	138.2 ± 20.2	- 2.314	0.021[a]
Mean DBP (mmHg)	83.3 ± 11.0	84.9 ± 12.2	- 0.765	0.445
Average monthly expenses on medicines (US$)	9.7 ± 7.6	9.5 ± 6.2	0.134	0.893
Medicine affordability	**Yes (N = 144)**	**No (N = 106)**		
Mean SBP (mmHg)	134.2 ± 18.4	140.7 ± 20.3	- 2.645	0.009[a]
Mean DBP (mmHg)	84.4 ± 11.9	85.0 ± 12.2	- 0.383	0.702
Average monthly expenses on medicines (US$)	8.4 ± 6.4	11.1 ± 6.2	- 3.369	0.001[a]
Access to family support	**Yes (N = 225)**	**No (N = 25)**		
Mean SBP (mmHg)	136.9 ± 19.9	137.9 ± 15.6	- 0.252	0.801
Mean DBP (mmHg)	84.4 ± 12.04	86.6 ± 11.8	- 0.858	0.382
Average monthly expenses on medicines (US$)	9.8 ± 6.5	6.6 ± 4.9	2.453	0.015[a]
Access to financial support	**Yes (N = 214)**	**No (N = 36)**		
Mean SBP (mmHg)	136.6 ± 19.1	139.3 ± 21.6	- 0.769	0.440
Mean DBP (mmHg)	84.5 ± 11.2	85.4 ± 16.2	- 0.443	0.658
Average monthly expenses on medicines (US$)	9.7 ± 6.4	8.9 ± 7.0	- 0.680	0.497

SBP = Systolic Blood Pressure, DBP = Diastolic Blood Pressure; SD = Standard deviation, [a]Significant difference with independence sample t-test, Level of significance p < 0.05, N = Number, US$ = United States Dollar

Table 6 Relationship between clinical outcome parameters and relevant variables among type 2 diabetes

Parameters/Variables	Response, N; Mean ± SD		t-test	p – value
Adherence status	**Adherent**	**Non-adherent**		
Mean Fasting Plasma Glucose (mmol/L)	124; 6.3 ± 1.5	76; 9.3 ± 2.3	-5.419	0.000[a]
Glycated haemoglobin (%)	47; 7.2 ± 1.3	41; 7.9 ± 1.8	- 2.102	0.038[a]
Mean SBP (mmHg)	46; 132.4 ± 16.8	30; 140.2 ± 19.5	- 1.848	0.069
Mean DBP (mmHg)	46; 77.0 ± 8.4	30; 82.4 ± 9.5	- 2.562	0.012[a]
Average monthly expenses on medications (US$)	124; 10.2 ± 6.9	76; 17.1 ± 8.9	- 6.084	0.000[a]
Health insurance status	**Yes**	**No**		
Mean Fasting Plasma Glucose (mmol/L)	16; 6.2 ± 1.3	184; 6.9 ± 2.0	- 1.391	0.166
Glycated haemoglobin (%)	10; 7.2 ± 0.8	78; 7.6 ± 1.6	- 0.700	0.486
Mean SBP (mmHg)	3; 113.3 ± 6.5	73; 136.4 ± 17.9	- 2.209	0.030[a]
Mean DBP (mmHg)	3; 68.3 ± 5.8	73; 79.6 ± 9.1	- 2.118	0.037[a]
Average monthly expenses on medications (US$)	16; 9.7 ± 7.4	184; 13.1 ± 8.5	-1.567	0.119
Medicine affordability	**Yes**	**No**		
Mean Fasting Plasma Glucose (mmol/L)	100; 6.5 ± 1.8	100; 7.2 ± 2.1	- 2.618	0.010[a]
Glycated haemoglobin (%)	39; 7.3 ± 1.3	49; 7.7 ± 1.8	- 0.979	0.330
Mean SBP (mmHg)	39; 137.8 ± 16.6	37; 133.0 ± 19.5	1.179	0.242
Mean DBP (mmHg)	39; 79.4 ± 8.7	37; 78.8 ± 9.8	0.319	0.750
Average monthly expenses on medications (US$)	100; 8.8 ± 6.6	100; 16.9 ± 8.3	-7.598	0.000[a]
Access to family support	**Yes**	**No**		
Mean Fasting Plasma Glucose (mmol/L)	174; 6.8 ± 1.9	26; 7.4 ± 2.4	-1.591	0.113
Glycated haemoglobin (%)	77; 7.5 ± 1.6	11; 7.5 ± 1.5	0.098	0.922
Mean SBP (mmHg)	68; 135.4 ± 18.2	8; 135.7 ± 19.4	-0.037	0.970
Mean DBP (mmHg)	68; 79.2 ± 9.3	8; 78.1 ± 8.4	0.321	0.749
Average monthly expenses on medications (US$)	174; 12.5 ± 8.2	26; 15.1 ± 10.0	-1.434	0.153
Access to financial support	**Yes**	**No**		
Mean Fasting Plasma Glucose (mmol/L)	129; 6.8 ± 1.8	71; 7.0 ± 2.2	-0.763	0.435
Glycated haemoglobin (%)	57; 7.4 ± 1.4	31; 7.8 ± 1.9	-1.308	0.194
Mean SBP (mmHg)	47; 136.4 ± 16.7	29; 133.9 ± 20.5	0.594	0.554
Mean DBP (mmHg)	47; 79.1 ± 8.7	29; 79.1 ± 10.1	-0.002	0.999

SBP = Systolic Blood Pressure, DBP = Diastolic Blood Pressure; SD = Standard deviation, [a] Significant difference with independence sample t-test, Level of significance $p < 0.05$, N = Number, US$ = United States Dollar

Table 7 Relationship between relevant variables and participants' adherence status

Variables	Responses, N (%)			
	Hypertensive (N = 250)		**Type 2 diabetes (N = 200)**	
Average monthly income, Naira (US$)	**Adherent**	**Non-adherent**	**Adherent**	**Non-adherent**
< 10000 (23.8)	41 (50.6)	40 (49.4)	35 (51.5)	33 (48.5)
10000 – 49000 (23.8 – 116.7)	49 (62.0)	30 (38.0)	43 (65.2)	23 (34.8)
50000 – 100000 (119.0 – 238.1)	29 (78.4)	8 (21.6)	18 (90.0)	2 (10.0)
> 100000 (238.1)	8 (80.0)	2 (20.0)	12 (92.3)	1 (7.7)
No defined/stable income	18 (41.9)	25 (58.1)	16 (48.5)	17 (51.5)
	X^2 =15.23; p = 0.004[a]	**X^2 = 17.76; p = 0.001[a]**		
Health insurance status				
Yes	26 (65.0)	14 (35.0)	16 (100.0)	0 (0.0)
No	119 (56.7)	91 (43.3)	108 (58.7)	76 (41.3)
	X^2 = 0.96; p = 0.328	**X^2 = 10.66; p = 0.001[a]**		
Medicine affordability				
Yes	110 (76.4)	34 (23.6)	87 (87.0)	13 (13.0)
No	35 (33.0)	71 (67.0)	37 (37.0)	63 (63.0)
	X^2 = 47.14; p = 0.000[a]	**X^2 = 53.06; p = 0.000[a]**		
Access to family support				
Yes	127 (56.4)	98 (43.6)	103 (59.2)	71 (40.8)
No	18 (72.0)	7 (28.0)	21 (80.8)	5 (19.2)
	X^2 = 2.24; p = 0.135	**X^2 = 4.47; p = 0.035[a]**		
Access to financial support				
Yes	125 (58.4)	89 (41.6)	78 (60.5)	51 (39.5)
No	20 (55.6)	16 (44.4)	46 (64.8)	25 (35.2)
	X^2 = 0.10; p = 0.748	**X^2 = 0.36; p = 0.547**		

[a] Significant difference with Chi-square (X^2), Level of significance $p < 0.05$, N = number, US$ = United States Dollar

Table 8 Relationship between relevant variables and treatment outcome

Variables	Responses, N (%)			
	Hypertensive (N = 250)		Type 2 diabetes (N = 200)	
Average monthly income, Naira (US$)	**Optimal**	**Sub-optimal**	**Optimal**	**Sub-optimal**
< 10000 (23.8)	48 (59.3)	33 (40.7)	34 (50.0)	34 (50.0)
10000 – 49000 (23.8 – 116.7)	42 (53.2)	37 (46.8)	27 (40.9)	39 (59.1)
50000 – 100000 (119.0 – 238.1)	31 (83.8)	6 (16.2)	13 (65.0)	7 (35.0)
> 100000 (238.1)	6 (60.0)	4 (40.0)	8 (61.5)	5 (38.5)
No defined/stable income	23 (53.5)	20 (46.5)	8 (24.2)	25 (75.8)
	X^2 = 11.04; p = 0.026[a]		**X^2 = 11.55; p = 0.021[a]**	
Health insurance status				
Yes	30 (75.0)	10 (25.0)	8 (50.0)	8(50.0)
No	120 (57.1)	90 (42.9)	82 (44.6)	102 (55.4)
	X^2 = 4.46; p = 0.035[a]		**X^2 = 0.18; p = 0.675**	
Medicine affordability				
Yes	97 (67.4)	47 (32.6)	52 (52.0)	48 (48.0)
No	53 (50.0)	53 (50.0)	38 (38.0)	62 (62.0)
	X^2 = 7.67; p = 0.006[a]		**X^2 = 3.96; p = 0.047[a]**	
Access to family support				
Yes	134 (59.6)	91 (40.4)	80 (46.0)	94 (54.0)
No	16 (64.0)	9 (36.0)	10 (38.5)	16 (61.5)
	X^2 = 0.19; p = 0.667		**X^2 = 0.516; p = 0.472**	
Access to financial support				
Yes	130 (60.7)	84 (39.3)	60 (46.5)	69 (53.5)
No	20 (55.6)	16 (44.4)	30 (42.3)	41 (57.7)
	X^2 = 0.35; p = 0.556		**X^2 = 0.335; p = 0.562**	

Blood pressure (BP) ≤140/90 mmHg for hypertensive patients, fasting plasma glucose (FPG) ≤ 6.1 mmol/L and BP ≤ 130/80 mmHg for type 2 diabetes patients were considered as optimal treatment outcome. Values above these ranges were considered as suboptimal control. [a] Significant difference with Chi-square (X^2), Level of significance p < 0.05, N = number, US$ = United States Dollar.

Summarily, there were no statistically significant differences in therapy adherence status and treatment outcome of hypertensive participants with or without access to family support (p > 0.05), while a significant difference (p = 0.035) exists in therapy adherence, but not in treatment outcome (p = 0.472) among T2D participants with or without access to family support (Tables 7 and 8).

Higher proportions of hypertensive (110; 76.4%) and T2D participants (87; 87.0%) who consistently afford medicine expenses had significantly better therapy adherence (p = 0.000), and considerably achieved optimal treatment outcome (p < 0.05).

Detailed summary of associations of medication adherence status and treatment outcome with medicine affordability and access to most available source and type of social support are shown in Tables 7 and 8.

Significant differences were observed between average monthly income, educational qualification, as well as occupational status of participants' and ability to consistently afford medication costs (p < 0.05) Table 9. Participants above the age range of 60 years constituted majority of those who cannot consistently afford therapy expenses. Also, average monthly income (Table 7), educational qualification as well as occupational status of hypertensive and T2D participants significantly influenced their therapy adherence (Table 9).

Adherence was significantly better among hypertensive participants within the ages of 30 – 60 years compared to those above the age of 60 years (p < 0.05). Details of relationship between participants' socio-demographic characteristics, therapy adherence and medicine affordability are shown in Table 9.

DISCUSSION

A substantial proportion of participants in this study were above 60 years. This possibly buttress the fact that chronic non-communicable diseases including hypertension and type 2 diabetes (T2D) are common among older adults who may largely be considered as vulnerable group to cardiovascular and metabolic diseases,[2,4,33,34] as well as constituting a special population requiring various types of formal and informal support.[18,20,23,24,35] Increased adoption of western lifestyle and physical inactivity may be contributory factors to rising incidence of chronic diseases, especially in adults above 40 years.[34,36]

More than three-quarters of studied participants mentioned support from government and non-governmental organisations (NGO) as the most desired and preferred sources of social support, with financial support being the major functional type of support largely desired from preferred source(s).

This may perhaps be expected, since people suffering from chronic diseases will have to cater for multiple treatment expenses[7] ranging from hospital consultation fees, costs for mandatory routinedisease-specific investigations such as BP, FPG, 2-hour post-prandial plasma glucose and medication costs. These are necessary expenses constituting a significant financial burden to patients with hypertension and type 2 diabetes in many low and middle-income countries including Nigeria.[1,37,38]

Table 9 Relationship between adherence status, therapy affordability and socio-demographic characteristics of participants

Socio-demographic variables	Hypertensive, N (%)			Type 2 diabetes, N (%)		
	Medicine affordability					
Age (years)	**Yes**	**No**	**p-value**	**Yes**	**No**	**p-value**
30 – 40	8 (100.0)	0 (0.0)		2 (50.0)	2 (50.0)	
41 – 50	20 (64.5)	11 (35.5)		19 (59.4)	13 (40.6)	
51 – 60	51 (72.9)	19 (27.1)		21 (60.0)	14 (40.0)	
61 – 70	46 (58.2)	33 (41.8)		31 (44.9)	38 (55.1)	
Above 70	19 (30.6)	43 (69.4)	0.000**	27 (45.0)	33 (55.0)	0.429**
Educational qualification						
No formal education	22 (35.5)	40 (64.5)		18 (34.6)	34 (65.4)	
Primary	45 (54.2)	38 (45.8)		28 (52.8)	25 (47.2)	
Secondary	26 (56.5)	20 (43.5)		24 (43.6)	31 (56.4)	
Tertiary	51 (86.4)	8 (13.6)	0.000*	30 (75.0)	10 (25.0)	0.001*
Occupation						
Retirees	54 (47.0)	61 (53.0)		34 (48.6)	36 (51.4)	
Traders	35 (53.8)	30 (46.2)		28 (45.9)	33 (54.1)	
Civil servants	27 (96.4)	1 (3.6)		23 (79.3)	6 (20.7)	
Farmers	17 (73.9)	6 (26.1)		5 (25.0)	15 (75.0)	
Artisans	11 (57.9)	8 (42.1)	0.000*	10 (50.0)	10 (50.0)	0.004*
Average monthly income, Naira (US$)						
< 10000 (23.8)	31 (38.3)	50 (61.7)		21 (30.9)	47 (69.1)	
10000 – 49000 (23.8 – 116.7)	57 (72.2)	22 (27.8)		34 (51.5)	32 (48.5)	
50000 – 100000 (119.0 – 238.1)	30 (81.1)	7 (18.9)		18 (90.0)	2 (10.0)	
> 100000 (238.1)	10 (100.0)	0 (0.0)		11 (84.6)	2 (15.4)	
No defined/stable income	16 (37.2)	27 (62.8)	0.000**	16 (48.5)	17 (51.5)	0.000*
	Adherence status					
Age (years)	Adherent	Non-adherent		Adherent	Non-adherent	
30 – 40	8 (100.0)	0 (0.0)		2 (50.0)	2 (50.0)	
41 – 50	21 (67.7)	10 (32.3)		23 (71.9)	9 (28.1)	
51 – 60	44 (62.9)	26 (37.1)		25 (71.4)	10 (28.6)	
61 – 70	44 (55.7)	35 (44.3)		43 (62.3)	26 (37.7)	
Above 70	28 (45.2)	34 (54.8)	0.017**	31 (51.7)	29 (48.3)	0.230**
Occupation						
Retirees	53 (46.1)	62 (53.9)		42 (60.0)	28 (40.0)	
Traders	43 (66.2)	22 (33,8)		36 (59.0)	25 (41.0)	
Civil servants	22 (78.6)	6 (21.4)		25 (86.2)	4 (13.8)	
Farmers	15 (65.2)	8 (34.8)		7 (35.0)	13 (65.0)	
Artisans	12 (53.2)	7 (36.8)	0.007*	14 (70.0)	6 (30.0)	0.006*
Educational qualification						
No formal education	33 (53.2)	29 (46.8)		26 (50.0)	26 (50.0)	
Primary	36 (43.4)	47 (56.6)		36 (67.9)	17 (32.1)	
Secondary	34 (73.9)	12 (26.1)		28 (50.9)	27 (49.1)	
Tertiary	42 (71.2)	17 (28.8)	0.001*	34 (85.0)	6 (15.0)	0.001*

* Chi-square test, ** Fischer's exact test, Level of significance $p < 0.05$, N = number, US$ = United States Dollar

It is noted that family support was cited by a substantial proportion of participants as the most available source of social support, while only a few mentioned government and none cited NGO as available source(s) of support for their care. This partly suggests that government and NGO support were not distinctly felt by participants, who largely make out-of-pocket payments for all their treatment expenses.

According to the theories of optimal matching by Cutroma and Russel (1990)[28], available social support should match the support desired by patients for social support to be maximally beneficial. Thus, the need for concerted efforts to ensure availability of expanded social support system for hypertensive and type 2 diabetes so as to guarantee matching of support desired by the patients with available social support.

The social support package for patients may be in the form of waiver for clinic consultation fees and mandatory routine investigations, while ensuring a highly subsidized costs for commonly prescribed antihypertensive and antidiabetes medications. Once some of these essential costs are taken care of, patients will be substantially relieved of the continuous financial burdens, with the expectation of increased therapy adherence and treatment outcome.

In this study, adherence to medication among hypertensive and T2D participants could be adjudged as moderate compared to previous studies where adherence rates were reported to range from 25.0 to 90.0%.[16,39,40,41,42,43] This perhaps underscores the need for more proactive measures in ensuring sustained improvement in therapy adherence and outcome among patients Treatment non-adherence among patients on chronic medications including hypertensive and T2D is a significant public health concern requiring stakeholders' attention.[7,41,43]

Thus, combination of adherence-enhancing intervention incorporating newer technological advancement, patient-centered care, as well as provision of expanded social support system may be necessary. It is noted that participants' access to family support did not significantly influence their medication adherence status. The reason for this may be adduced to the fact that types of support obtained from a source largely determine the influence that such support will have on individual's treatment commitment and adherence.

Though, family support may be a useful tool for scaling-up adherence, its usefulness is context-specific and mediated by patients' subjective interpretation of the support givers motive.[35,44,45] A study has also reported that satisfaction with social support depends on the perception of the recipient and may determine the effectiveness of the association.[25]

In addition to financial type of support mostly desired by substantial number of patients, informational support comprising health-related information, advice and guidance,[25,26] from diabetes and hypertensive primary care providers should be consistent at every patient-provider's encounters so as to encourage therapy adherence, while provision of useful suggestions on measures to alleviate the socio-economic burdens of the disease should be of paramount importance to primary care providers.

Unintentional non-adherence behaviour especially forgetfulness and discontinuation of medications because of insufficient funds is common among participants compared to intentional non-adherence behaviour. This is consistent with findings of Adisa *et al*[43] which reported unintentional reasons for non-adherence as more prevalent than intentional reasons for non-adherence.

Thus, the need for healthcare provider's holistic approach focusing on different aspects of non-adherence deficits *vis a vis* knowledge, practical, and attitudinal barriers that could hinder optimal medication adherence among patients.[43]

In this study, adherent patients had significantly lower blood pressure and blood glucose profile, and were found to spend less amount on medications than their non-adherent counterparts. Previous studies have established strong correlation between medication adherence and treatment outcome.[16,46] However, the possibility of reduced number and frequency of medicine administration among adherent patients[47,48,49] compared to non-adherent counterparts may perhaps account for the reduced monthly expenses on medications by adherent patients. Also, studies have consistently linked treatment non-adherence to sub-optimal outcome with increasing overall healthcare costs including medication expenses.[7,8,9,10,15]

Expectedly, participants who were able to consistently afford therapy expenses had significantly better adherence and treatment outcome, as well as spend less amount on medications compared to those who cannot cope with the costs of therapy. Unwavering financial status to offset therapy expenses as at when due, coupled with adequate and unequivocal information from healthcare providers are important elements in ensuring sustained commitment to medication-taking with improved therapeutic outcome.

Studies have consistently reported financial constraints as a major obstacle to treatment adherence.[16,34,41] Thus, provision of financial support to hypertensive and type 2 diabetes patients by government and non-governmental organisations as desired by most participants will be a laudable gesture to alleviate financial burdens on people living with these chronic diseases.

It is worthy of note to mention that the few participants who enrolled with the National Health Insurance Scheme (NHIS) had better therapy adherence and treatment outcome compared to those without access to NHIS.

This partly suggests the need for government to intensify efforts in ensuring increased enrollment and improved service delivery with NHIS, while expanding its coverage to include the general public, as well as other employee who are not in the federal government establishments. Achieving this will go a long way to relief patients' continuous financial burdens, thereby increasing their medication-taking commitments with better therapeutic outcome.

In addition, participants within the ages of 30 – 60 years, who were civil servants with tertiary education and who earn average monthly income greater than NGN 50000.00 (US$ 119.0) constitute the larger proportion of those who consistently afford therapy expenses with better therapy adherence. These combinations of attributes are expected to favour participants' ability to afford the costs of therapy with subsequent improved adherence and treatment outcome, compared to the elderly patients above 60 years, low literacy and low-income population who may essentially requires various types of support to effectively accomplish their healthcare needs.[18,20,23,24,35]

However, a survey has found that a significant percentage of high-income respondents in their study also indicated cost-related non-adherence, despite relatively affordable copayments.[50] Thus, the issue of treatment non-adherence among patients with chronic diseases should be a concern for all, since non-adherent to therapies represents a waste of large amount of economic resources both for the patients and for the society.[15,51]

It is essential to mention that a substantial number of patients who were unable to consistently afford costs of prescribed medications engage in different adaptive measures including delaying and skipping of medication doses, as well as using herbal remedies as alternative to prescribed regimen. However, the coping mechanisms to offset therapy expenses by hypertensive and T2D participants were mentioned to include borrowing money from family and friends, reduced feeding and clothing expenses for the family, as well as selling personal properties.

Previous studies have also shown that patients with chronic diseases often adopt certain short-term inconvenient payment coping mechanisms.[52,53] Irrational drug-use behaviours and the so-called catastrophic coping mechanism of patients are important concerns that require prompt and proactive actions by relevant stakeholders, if we are to consistently ensure improved treatment outcome among patients.

Despite useful information from this study, it is limited by the fact that some of the studied variables were evaluated using self-report measure, which may have inherent limitations including memory bias and over- or under-report of some information.[54] However, studies have described self-report measure as a reliable tool in most clinical settings, especially when questions are asked in a non-judgmental and non-threatening manner.[55,56]

Another limitation may be linked to the fact that this study focused largely on functional type of support and practical barrier to adherence, while availability and influence of structural support[17,22] and other potential non-adherent deficits including knowledge and attitudinal barriers[43] on outcome could have also been explored. Thus, there may be a need for future study to consider these gaps so as to ensure far-reaching conclusions.

CONCLUSION

This study shows that family support is the most available source of support system to substantial proportions of hypertensive and type 2 diabetes patients, but formal support from the government and non-governmental organisations were most preferred.

Access to family source of support did not positively influence medication adherence, while access to financial type of support as desired by most participants marginally impacted on treatment outcome of hypertensive and type 2 diabetes patients.

However, unwavering tendency for therapy affordability significantly influenced adherence and outcome. Thus, the need for expanded social support system in order to consistently ensure improved therapeutic outcome among patients.

ACKNOWLEDGEMENT

We acknowledge and appreciate the cooperation and assistance of medical consultants and resident doctors in the endocrinology and cardiology clinics of the University College Hospital Ibadan and Ring Road State Hospital, Ibadan, as well as patients who consented to partake in this study.

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