Original Research Article

Effect of telephone calls and text message reminder interventions on the adherence to antiretroviral drugs among HIV/AIDS clients receiving care in Sokoto state, Nigeria

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ABSTRACT

Background: Adherence to antiretroviral therapy (ART) has been proven to be a good predictor of clinical outcome among patients on ART. This study aimed to assess the effect of phone reminder interventions on the knowledge of Human immunodeficiency syndrome (HIV)/ Acquired immunodeficiency syndrome (AIDS), ART and adherence to ART drugs among non-adherent patients receiving care in Sokoto State.
Methods: A quasi-experimental study was conducted among 196 non-adherent HIV patients between February and July 2017. The intervention group received monthly telephone calls and weekly text messages for twelve weeks while the control group received only standard of care. Self-report adherence, forgetfulness to take ART and knowledge of HIV/AIDS and ART were measured pre- and post- intervention. Data were processed and analysed using IBM Statistical package for social sciences (SPSS) version 22 computer statistical software package.
Results: At baseline, although majority of participants in both groups had good knowledge of HIV/AIDS, ART drug adherence, they were both non-adherent to ART and it was mainly due to forgetfulness. At post intervention, respondents with good knowledge and adherent to ART were significantly higher in the intervention group. There was also a significantly lower proportion of forgetfulness among the intervention group compared with control group (χ^2=47.57, p<0.001).
Conclusion: The interventions were found to be effective. The Federal Ministry of Health (FMoH) with the support of implementing partners need to integrate these interventions into clinical setting as part of comprehensive care for HIV care and treatment to assist in improving their knowledge of HIV/AIDS, ART and adherence to ART.

Keywords: Non-adherence, ART, HIV/AIDS, Telephone call, Text message reminders, Sokoto

INTRODUCTION

Human immunodeficiency syndrome (HIV) infection has spread over the last 30 years and has a great impact on health, welfare, employment and criminal justice sectors; affecting all social and ethnic groups throughout the world.[1] Recent epidemiological data by World Health Organization (WHO) indicate that HIV remains a public health issue that persistently drains the global economic sector having claimed more than 25 million lives over the last three decades.[2] Nigeria has the second largest HIV epidemic in the world and one of the highest rate of new

infection in sub-Saharan Africa.[3] Although HIV prevalence among adults is remarkably small (1.5%) compared to other sub-Saharan African countries such as South Africa (20.4%) and Zambia (11.3%), the size of Nigeria's population means 1.9 million people were living with HIV in 2018 and about 55% of adults are on antiretroviral treatment, who need to adhere (≥95%) to their ART to achieve a successful HIV/AIDS care and treatment.[4] Recent drops in prevalence in the country has been attributed to better surveillance.[5]

The development and availability of antiretroviral therapy (ART) became a turning point in the control and prevention of the epidemic.[6] These present significant challenges to both patients and health-care providers with respect to adherence. Medication adherence is the term used to describe the patient's behavior of taking drugs correctly; the right drug, in the right dose, with the right frequency, and at the right time. Without adequate adherence, antiretroviral agents are not maintained at sufficient concentrations to suppress HIV replication in infected cells and to lower the plasma viral load (preferably to undetected levels of <20 copies/ml).[7] Previous studies revealed that about 35-75% of patients on ART are non-adherent with their medication.[8-10] Research reveals that a minimum of 95% adherence is necessary to achieve (or predict) virological success in patients receiving Highly active antiretroviral therapy (HAART).[11]

Non-adherence to ART results in inadequate suppression of viral replication in the body which allows the virus to continuously replicate and deplete the T-helper cells; this destroys the immune system and allows the disease to progress at a faster rate.[12] It is associated with repeated hospital admissions, development of opportunistic infections, poor quality of life, loss of productivity and premature mortality.[12,13] This in turn leads to ongoing viral replication, development of resistance (and cross resistant) to antiretroviral medications and increased vertical transmission.

In general, the most important factors that affect adherence are patient-related.[14-17] The most common reasons given by patients for non-adherence include: forgetfulness or busy; away from home; change in daily routine and side effects.[14] The commonest reason for non-adherence to ART reported from several studies was forgetfulness.[6,7,9] This implies that majority of non-adherent patients need medication adherence devices such as reminders, calendars, and strategies such as patient education and counselling to remind them to take their ART medications. There have been reported improvements in adherence to ART in studies done in Jos, Cameroon, Kenya, India and USA.[18-22] A number of researchers have made the assertions that a combination of two or more interventions give far better results than a single intervention, and that interventions targeted at non-adherents give better outcomes than those that do not.[23,24]

This study therefore aims to determine the effect of telephone calls and text message reminder interventions in improving knowledge of HIV/AIDS and treatment adherence among non-adherent HIV patients on HAART. The result of the study, if found effective, can help strengthen the evidence for its integration into the National ART Guideline in the Management of HIV/AIDS in Nigeria.

METHODS

The study was carried out in two health facilities in Sokoto State, Nigeria. Usmanu Danfodiyo University Teaching Hospital (UDUTH), the intervention site, is a tertiary health facility with 700 bed capacity, serving as referral centre to several hospitals within the North-Western region. It offers general and specialty services to patients at the general Outpatient department (OPD) and various specialty outpatient clinics including free and comprehensive ART care and treatment. UDUTH, Sokoto runs its ART clinics every day (Mondays to Fridays) with about 250 patients seen on weekly basis at the ART clinic (45-55 patients per day). It has a total number of about 4,500 patients in care.

Specialist Hospital Sokoto (SHS), the control site, is a secondary health care facility in Sokoto. The hospital offers free and comprehensive HIV care services including ART for HIV-infected patients. It has a 540-bed capacity and serves the people living in the Sokoto metropolis and its environment including the bordering country, Niger Republic. It has a total number of about 6,000 HIV-infected patients currently receiving ART care. Specialist Hospital also runs its ART clinics every day (Mondays to Fridays) with about 210 patients seen at the ART clinic (40-50 patients per day). Both health facilities are supported by Management Science for Health (MSH).

Study design

The study employed a "quasi-experimental" design comparing the study and control groups (non-randomization with pre and post intervention study design). This was carried out between February and July 2017.

Study population

These were HIV positive patients on treatment that were non-adherent to their ART (including patients that missed their appointment and not taking ART and cases of lost to follow-up (LTFU) that were tracked back into care) in the selected health facilities in Sokoto State.

Inclusion criteria

All non-adherent (<95% adherent) patients aged 18 years and above, receiving HAART for at least six months in the selected health facilities.

Exclusion criteria

This included patients that were severely ill; patients on ART who were on admission since drug adherence would be ensured through provider administered treatment; those who had another member of their household already recruited into the study (to minimize treatment diffusion); patients that had HIV-coinfections example, tuberculosis (TB) since there will be a strategy in place to optimize their adherence status.

Sample size determination

The minimum calculated sample size was 78 (each group) using the formula to compare two proportions in two independent study samples, a prevalence of non-adherence to ART from previous study to be 37.2% 9 and based on hypothesis of 20% decrease in the prevalence of non-adherence to ART with a significance level set at 5%.[25] Allowing for 20% attrition rate, the sample was adjusted to 98 in each group.[26]

Sampling method

Systematic sampling was used to select clients into the study. The study participants (intervention and control groups) were recruited for a period of five weeks at both facilities after which patients were seen every month for a period of three months (12 weeks).

The baseline data were obtained from both groups using the data collection instrument. The principal researcher assisted by research assistants carried this out. The questionnaires were coded so that they could be paired to compare each respondent's responses pre and post intervention. Mobile telephone numbers of the study participants were also obtained.

Description of the intervention

Two interventions that were administered: telephone calls (cognitive intervention) and text messages (behavioral intervention). These were administered to the respondents in the intervention group only.

The first intervention was a telephone call, which was made once a month. This was followed by a second intervention- a weekly text message that was sent out as a reminder. The principal researcher assisted by a research assistance from another health facility delivered these to the intervention group while the control group received a standard routine ART care only. Respondents in the intervention group that could not read or write were earlier educated about the text messages that will be sent- once a text comes in, they will see a box and they can show their treatment partners (spouse, friends, Treatment support specialist (TSS) etc.) to assist in reading it.

Intervention group

The phone reminders- mobile telephone calls and text messages, included: a greeting and the hope that the patient was feeling well followed by inquiry whether medications were taken as prescribed. This was done by asking if they took their previous day's medications (telephone calls) and through text messages sent. The telephone calls were interactive since it required the patient to respond to questions about the previous day's pill doses. A maximum of three more calls were made over the ensuing 24 hours until a response is obtained. In order to ensure that the intervention group received the text messages and a possibility of any clarifications from them, two measures were put in place: Firstly, the researcher's phone contact was added to every message; secondly, study participants were encouraged to call, send a Short message service (SMS) or a missed call on receipt of the text and when further information is needed; thirdly, the delivery reports were used to know who received or did not receive the text message. These messages were sent out through an Internet based bulk SMS facility known as 'Smart SMS Solutions' (www.smartsmssolutions.com).

Control group

The control group received routine ART care only. Routine ART care consisted of:

- Group health education and information on varying topics such as the methods of transmission of HIV, importance of adherence to ART, dietary advice and nutrition information, as conducted by the adherence counsellor and/or nurse. This occurs in the morning at the reception of the clinic before the commencement of daily consultation;

- Adherence counselling by the doctors (during clinic consults) and pharmacists (while dispensing ARV), adherence counsellors, TSS and Home base care staff (at the clinic and during home visits) to patients to take their medications as prescribed and agreed upon;

- Quarterly assessment of CD4 count (and other test like: Hepatitis B surface antigen (HBsAg), Liver function test (LFT), Electrolyte/urea/creatinine (E/U/Cr), Packed cell volume (PCV) such that patients with decreasing CD4 count are questioned about their adherence and further managed based on their responses. It may also include other test like viral load, sputum Acid fast bacilli (AFB) (or geneXpert) test.

The post-intervention survey was conducted in both groups (intervention and control) twelve weeks after the first set of interventions are administered. This was to enable comparison of data from both groups and demonstrate the effect of an intervention programme. The instruments of data collection used at baseline was re-administered at post-intervention.

Outcome variables

Self-reported adherence[1]: This was calculated based on client self-report of number of pills missed in the past seven days. The formula used for calculating adherence was the number of doses taken/number of doses prescribed×100%.[27] A cut-off of 95% was used to distinguish those who were adherent from those who were not. Adherence was assessed at recruitment (before the commencement of the intervention), and at post intervention.

Adherence to ART was also measured using a modified eight item Morisky Medication Adherence Scale (MMAS-8) to assess treatment adherence in a positive, non-judgmental atmosphere, delivered in a trusting relationship in order to understand what was actually happening with the respondent's adherence practice rather than what the respondent thinks the interviewer wants to know.

Knowledge of HIV/AID, ART and adherence to ART. This was assessed in four parts: knowledge of HIV/AIDS; knowledge of ART; knowledge of adherence to ART and comprehensive knowledge of HIV/AIDS. The knowledge of HIV/AIDS was assessed with six questions; knowledge of ART was assessed with twelve questions; knowledge of adherence to ART was assessed with three questions and comprehensive knowledge of HIV/AIDS was assessed with five questions making a total of twenty six questions. Each question is followed by a "Yes" and "No" option with the "Yes" scored 1 while the "No" score 0. The score of each participant was converted to percentage. Total knowledge score was graded as (poor (<50%), fair (50-74.9%) and good (≥75%))28 and was recoded into two groups (good knowledge (≥75%) and fair knowledge (<75%)).

Date analysis

All data obtained from the study were entered, cleaned, and processed using IBM Statistical package for social sciences (SPSS) version 22 computer statistical software package and analyzed using descriptive and inferential statistics. Level of significance was set at $p<0.05$ at 95% confidence interval (CI).

Ethical consideration

Approval for the study was obtained from the ethical committee of Usmanu Danfodiyo University Teaching, Sokoto. Permission to carry out the study was obtained from the Chief Medical Directors of both hospitals. Informed consent was obtained from the study participants prior to recruitment.

RESULTS

The ages of the respondents in the intervention and control group ranged from 18 to 65 years with majority of them being female (73.5% and 75.5%). There were no statistically significant differences in age, sex and marital status of respondents in both groups. The proportion of Muslims in the control group were significantly more than Christians compared with those in the intervention group ($p<0.001$). Majority of the civil servants (72.2%) were in the intervention group compared with 27.8% in the control group. On the contrary, 68.3% of the housewives were in the control group compared with 31.7% in the intervention group and these differences were statistically significant ($p=0.010$) (Table 1).

Table 1: Socio-demographic characteristics of respondents.

Variables	Intervention group (n=98) N (%)	Control group (n=98) N (%)	Test statistics, P value
Age grouping in years			
15-25	14 (14.2)	16 (16.3)	
26-35	32 (32.7)	33 (33.7)	χ^2=2.24
36-45	37 (37.8)	35 (35.7)	p=0.691
46-55	10 (10.2)	10 (10.2)	
56-65	5 (5.1)	4 (4.1)	
Mean age±SD	35.62±9.57	35.76±10.27	t=0.094, p=0.925
Sex of respondents			
Male	26 (26.5)	24 (24.5)	χ^2=0.04
Female	72 (73.5)	74 (75.5)	p=0.836
Tribe of respondents			
Hausa	61 (62.2)	75 (76.6)	
Fulani	3 (3.1)	2 (2.0)	χ^2=10.21
Yoruba	3 (3.1)	2 (2.0)	p=0.037*
Igbo	12 (12.2)	1 (1.0)	
Others	19 (19.4)	18 (18.4)	

Continued.

Variables	Intervention group (n=98) N (%)	Control group (n=98) N (%)	Test statistics, P value
Marital status			
Single	22 (22.4)	20 (20.4)	LR=4.26 p=0.512
Married	48 (49.0)	44 (44.9)	
Separated	3 (3.1)	10 (10.2)	
Divorced	5 (5.1)	6 (6.1)	
Widowed	20 (20.4)	18 (18.4)	
Education of respondents			
None	10 (10.3)	4 (4.0)	χ^2=42.80 p<0.001*
Quranic only	10 (10.3)	52 (53.1)	
Primary	12 (12.4)	10 (10.2)	
Secondary	30 (30.9)	17 (17.3)	
Tertiary	35 (36.1)	15 (15.4)	
Religion of respondents			
Christianity	30 (30.4)	8 (9.0)	χ^2=12.4, OR=4.4 p<0.001*
Muslim	68 (69.6)	90 (91.0)	
Occupation of respondents			
Students	6 (42.9)	8 (57.1)	χ^2=16.72 p=0.010*
Unemployed	16 (60.0)	10 (40.0)	
Housewife	14 (31.7)	28 (68.3)	
Farmers	0 (0.0)	6 (100.0)	
Civil Servants	14 (72.2)	5 (27.8)	
Business	41 (53.2)	36 (46.8)	
Others	4 (57.1)	3 (42.9)	

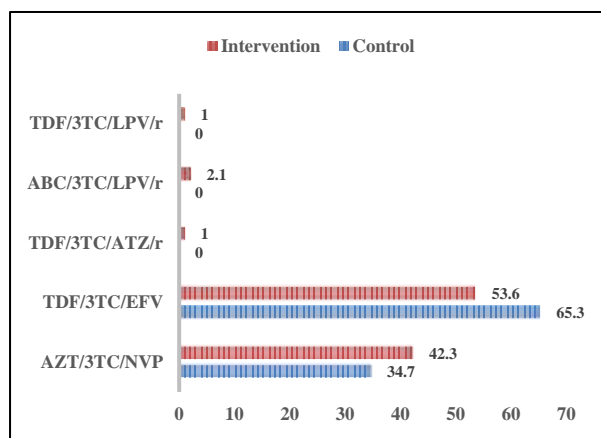*p <0.05; likelihood ratio (LR)

Figure 1: ART regimen of respondents in both groups.

Majority of the respondents in the intervention and control group were mainly on Atripla- tenofovir disoproxil fumarate, Lamivudine, Efavirenz (TDF/3TC/EFV) (53.6% and 65.3%) and Combipack- Zidovudine, Lamivudine, Nevirapine (AZT/3TC/NVP) (42.3% and 34.7%) and there was no significant difference in the type of medications received by the respondents in the two groups (p = 0.122) (Figure 1).

The mean knowledge of HIV/AIDS in both groups were not significantly different at the beginning of the study (t=-1.34, p=0.181). However, the mean comprehensive knowledge of HIV/AIDS at the beginning of the study was significantly higher among the respondents in the control group than those in the intervention group (t=2.97, p=0.003) (Table 2).

The mean knowledge of ART in both groups were not significantly different at the beginning of the study (t=-0.84, p=0.402). However, the mean knowledge of Adherence to ART at the beginning of the study was significantly higher among the respondents in the intervention group than those in the control group (t=-2.05, p=0.042) (Table 3).

The mean adherence level to ART at the beginning of the study was not significantly different in both groups (t=-0.639, p=0.524). The mean adherence level using MMAS-8 of respondents in the intervention and control groups was 5.04±1.35 and 3.81±1.60 respectively and this difference was statistically significant (χ^2=52.85, p<0.001). However, there was no statistically significant difference in forgetfulness in both groups (χ^2=2.67, p=0.102) (Table 4).

The reasons given by the respondents for missing ART medications at baseline in the intervention and control group were mainly forgetfulness (78.6% and 85.7%, p=0.192); being away from home (25.5% and 31.6%, p=0.343) and felt asleep (25.5% and 34.7%, p=0.161). The differences in the responses were not statistically significant (Table 5).

Table 2: Respondent's knowledge of HIV/AIDS at baseline.

Variables	Group		
	Intervention, n= 98 Correct responses N (%)	Control, n=98 Correct responses N (%)	[a]Test Statistics, p value
Knowledge of HIV/AIDS			
HIV is caused by a virus and has no cure for now	85 (86.7)	73 (75.3)	$x2=4.18$, $p=0.04$*
HIV is an intervention to scare people	45 (45.9)	46 (46.9)	$x2=0.02$, $p=0.89$
An unscreened blood transfusion can result in HIV/AIDS	91 (95.8)	93 (94.9)	$x2=0.09$, $p=0.77$
Unprotected sexual intercourse between a man and woman can result in HIV	96 (98.0)	93 (95.9)	$x2=0.71$, $p=0.40$
Multiple sexual partners increases the risk of HIV infection	96 (98.0)	92 (94.8)	$x2=1.37$, $p=0.24$
HIV can be transmitted through breast feeding	87 (91.6)	83 (94.3)	$x2=0.52$, $p=0.47$
Mean knowledge of HIV/AIDS ± SD	85.0±13.6	81.6±21.1	$p=0.181$, $t=-1.34$
Comprehensive knowledge of HIV/AIDS			
Consistent use of condom during sexual intercourse can reduce the chances of getting HIV	91 (94.8)	93 (97.9)	$x2=1.30$, $p=0.25$
Having just one HIV negative and faithful partner can reduce the chances of getting HIV	91 (92.9)	90 (95.7)	$x2=0.74$, $p=0.39$
A healthy-looking person can have HIV	88 (91.7)	85 (89.5)	$x2=0.27$, $p=0.60$
HIV can be transmitted by mosquito bites	56 (58.3)	68 (70.8)	$x2=3.28$, $p=0.07$
HIV can be transmitted by supernatural means	55 (56.7)	74 (77.9)	$x2=9.78$, $p=0.002$*
Mean comprehensive knowledge of HIV/AIDS ± SD	77.8±18.8	85.4±17.0	$p=0.003$* $t=2.97$

[a]Pearson's chi-square test;   *$p<0.05$; t-independent t-test

Table 3: Respondent's knowledge of ART and adherence to ART at baseline.

Variables	Group		
	Intervention, n= 98 Correct responses n (%)	Control, n=98 Correct responses n (%)	[a]Test Statistics, p value
Knowledge of ART			
ART consist of drugs to cure HIV/AIDS	57 (58.8)	69 (71.1)	$x2=3.26$, $p=0.07$
ART consist of drugs to suppress the activity of HIV	86 (88.7)	93 (95.9)	$x2=3.54$, $p=0.06$
CD4 count is the number of HIV virus in the blood	39 (41.1)	36 (37.5)	$x2=0.25$, $p=0.62$
CD4 count is the number of body soldiers in the blood	84 (87.5)	58 (61.1)	$x2=17.50$, $p<0.001$*
Viral load is the number of HIV viruses in the blood	84 (87.5)	73 (75.3)	$x2=4.77$, $p=0.029$*
Viral load is the number of body soldiers in the blood	42 (44.2)	54 (55.7)	$x2=2.52$, $p=0.11$
ART increases the viral load	56 (58.9)	58 (61.1)	$x2=0.09$, $p=0.77$
ART increases the CD4 count	82 (86.3)	56 (60.2)	$x2=16.40$, $p<0.001$*
ART reduces the viral Load	78 (83.9)	74 (77.9)	$x2=1.08$, $p=0.29$
ART reduces CD4 count	45 (49.5)	44 (45.4)	$x2=0.32$, $p=0.58$
ART is a life-long treatment	92 (93.9)	89 (91.8)	$x2=0.33$, $p=0.57$
ART reduces risk of HIV transmission	89 (92.7)	96 (99.0)	$x2=4.76$, $p=0.029$*
Mean knowledge of ART ± SD	70.9±19.1	68.7±17.3	$p=0.402$ $t=-0.84$

Variables	Group		
	Intervention, n= 98 Correct responses n (%)	Control, n=98 Correct responses n (%)	aTest Statistics, p value
Knowledge of adherence to ART			
ART adherence is taking drugs as agreed with doctor	95 (97.9)	94 (98.9)	x2=0.32, p=0.57
Poor ART adherence leads to rapid disease progression	91 (93.8)	79 (83.2)	x2=5.37, p=0.02*
Excessive alcohol intake affects adherence to ART	90 (93.8)	78 (83.0)	x2=5.38, p=0.02*
Mean knowledge of Adherence to ART ± SD	93.9±18.1	88.1±21.1	p=0.04*, t=-2.05

aPearson's chi-square test;   *p<0.05; t-independent t-test

Table 4: Self-reported adherence to ART and Morisky medication adherence scale- 8 (MMAS- 8) of the respondents at baseline.

Variables	Intervention, n= 98 Mean±SD	Control, n= 98 Mean±SD	aTest statistics, p=value
Doses of ART missed in the past 1 day	1.12±0.44	1.10±0.35	t=-0.314, p=0.754
Doses of ART missed in the past 3 days	1.49±1.04	1.49±1.00	t=0.005, p=0.996
Doses missed in the past 7 days	1.92±2.24	1.87±1.77	t=-0.177, p=0.860
Adherence level	79.94±22.78	77.92±21.71	t=-0.639, p=0.524
Morisky medication adherence scale- 8 (MMAS- 8) of respondents (positive behaviour)	Intervention, n=98 Positive behaviour n (%)	Control, n=98 Positive behaviour n (%)	bTest Statistics, p value
Do you sometimes forget to take your medicine? (No)	18 (18.4)	10 (10.2)	χ^2=2.67, p=0.102
People sometimes miss taking their medications for reasons other than forgetting. Thinking over the past one week, were there any day when you did not take your medicine? (No)	6 (6.2)	4 (4.1)	χ^2=0.442, p=0.515
Have you ever cut back or stopped your medicine without telling your doctor because you felt worse when you took it? (No)	86 (89.6)	82 (85.4)	χ^2=0.762, p=0.383
When you travel or leave home, do you sometimes forget to bring along your medicine? (No)	67 (68.4))	46 (47.4))	χ^2=8.78, p=0.003*
Did you take all your medicine yesterday? (Yes)	63 (64.3)	48 (49.0)	χ^2=4.67, p=0.031*
Taking medicine every day is a real inconvenience for some people. Do you ever feel hassled/bothered about sticking to your plan? (No)	84 (87.5)	71 (75.5)	χ^2=4.53, p=0.033*
When you feel like your symptoms are under control, do you sometimes stop taking your medicine? (No)	93 (94.9)	77 (79.4)	χ^2=10.50, p=0.001*
How often do you have difficulty remembering to take all your medicine?			
Never	41 (42.3)	5 (5.1)	χ^2=52.85
Once a while	37 (38.1)	30 (30.6)	p<0.001*
Sometimes	16 (16.5)	51 (52.0)	
Usually	2 (2.1)	10 (10.2)	
All the times	1 (1.0)	2 (2.0)	
Mean adherence using MMAS- 8 (SD)	5.04±1.35	3.81±1.60	p<0.001*, t=-5.83

aTest statistics- independent t-test; bTest statistics- chi-square test.

Table 5: Reasons for missing ART at baseline.

Reasons for missing ART at baseline	Group		ᵃTest Statistics, p value
	Intervention, n=98 N (%)	Control, n=98 N (%)	
Forgetfulness	77 (78.6)	84 (85.7)	χ2=1.70, p=0.192
Being busy	9 (9.2)	20 (20.4)	χ2=4.89, p=0.027*
Change in daily routine	2 (2.0)	2 (2.0)	χ2=0.00, p=1.00
Being away from home	25 (25.5)	31 (31.6)	χ2=0.90, p=0.343
Felt asleep	25 (25.5)	34 (34.7)	χ2=1.96, p=0.161
Felt sick/ill	6 (6.1)	9 (9.2)	χ2=0.65, p=0.420
Quarrel with family member	2 (2.0)	3 (3.1)	χ2=0.21, p=0.651
Inconvenient dosing time	1 (1.0)	3 (3.1)	χ2=1.02, p=0.312
Didn't want others to notice	6 (6.1)	11 (11.2)	χ2=1.61, p=0.204
Felt healthy	1 (1.0)	3 (3.1)	χ2=1.02, p=0.312
Fasting/went for holy water	5 (5.1)	1 (1.0)	χ2=2.75, p=0.097
Too many pills to take	2 (2.0)	3 (3.1)	χ2=0.21, p=0.651
Taking the drugs remind me of my HIV	3 (3.1)	1 (1.0)	χ2=1.02, p=0.312
People told me that the drug is harmful	1 (1.0)	1 (1.00)	χ2=0.00, p=1.00
ᵇOthers	10 (10.2)	6 (6.1)	χ2=1.09, p=0.297

ᵃPearson's chi-square test; ᵇOthers included- lost her medications, medication caused vomiting, son was sick, took local medications, missed appointment and misplaced purse.

Table 6: Post intervention knowledge of HIV/AIDS among respondents in the intervention and control groups.

Variables	Group		ᵃTest statistics, p value
	Intervention, n= 90 Post intervention N (%) Correct response	Control, n= 79 End of study N (%) Correct response	
Knowledge of HIV/AIDS			
HIV is caused by a virus and has no cure for now	79 (88.8)	72 (93.5)	χ2=1.13, p=0.288
HIV/AIDS is an intervention to scare people	75 (83.3)	45 (57.7)	χ2=13.46, p<0.001*
An unscreened blood transfusion can result in HIV/AIDS	83 (94.3)	75 (94.9)	χ2=0.03, p=0.860
Unprotected sexual intercourse between a man and woman can result in HIV/AIDS	87 (97.8)	76 (96.2)	χ2=0.35, p=0.555
Multiple sexual partners increases the risk of HIV infection	89 (98.9)	76 (98.7)	p=1.000
HIV can be transmitted through breast feeding and the risk of MTCT can be reduced if the mother takes ART during pregnancy	86 (95.6)	65 (90.3)	χ2=1.76 p=0.185
Mean knowledge of HIV/AIDS ± SD	92.41±11.49	86.29±13.81	t=-3.144, p=0.002*
Comprehensive knowledge of HIV/AIDS			
Consistent use of condom during sexual intercourse can reduce the chances of getting HIV	88 (97.8)	77 (98.7)	χ2=0.21, p=0.646
Having just one HIV-negative and faithful partner can reduce the chances of getting HIV	82 (91.1)	73 (74.8)	χ2=0.85, p=0.357
A healthy-looking person can have HIV	82 (92.1)	71 (91.0)	χ2=0.07, p=0.796

Variables	Group		ᵃTest statistics, p value
	Intervention, n= 90 Post intervention N (%) Correct response	Control, n= 79 End of study N (%) Correct response	
HIV can be transmitted by mosquito bites	77 (88.5)	58 (75.3)	χ2=4.88, p=0.027*
HIV can be transmitted by supernatural means	79 (95.2)	64 (85.3)	χ2=4.45, p=0.035*
Mean comprehensive knowledge of HIV/AIDS ± SD	90.89 ± 12.78	87.95 ± 14.89	t=-1.38, p=0.170

ᵃPearson's chi-square test; t-independent t-test; *p<0.05

Table 7: Post intervention knowledge of ART and adherence to ART among respondents in the intervention and control groups.

Variables	Group		ᵃTest statistics, p value
	Intervention, n= 98 Post intervention N (%) Correct response	Control, n= 79 End of Study N (%) Correct response	
Knowledge of ART			
ART consist of drugs to cure HIV/AIDS	69 (79.3)	62 (79.5)	χ2=0.001, p=0.978
ART consist of drugs to suppress the activity of HIV	78 (87.6)	68 (86.1)	χ2=0.09, p=0.764
CD4 count is the number of HIV virus in the blood	55 (62.4)	38 (48.1)	χ2=3.49, p=0.061
CD4 count is the number of body soldiers in the blood	76 (84.4)	56 (70.9)	χ2=4.52, p=0.033*
Viral load is the number of HIV virus in the blood	77 (86.5)	63 (79.7)	χ2=1.38, p=0.240
Viral load is the number of the body soldiers in the blood	61 (67.8)	32 (41.0)	χ2=12.10, p=0.001*
ART increases viral load	76 (84.4)	40 (51.3)	χ2=21.50, p<0.001*
ART increases CD4 count	80 (88.9)	53 (67.9)	χ2=11.11, p=0.001*
ART reduces viral load	80 (89.9)	64 (81.0)	χ2=2.69, p=0.101
ART reduces CD4 count	67 (74.4)	42 (53.2)	χ2=8.32, p=0.004*
ART is a life-long treatment	84 (94.4)	74 (93.7)	χ2=0.04, p=0.846
ART reduces risk of HIV transmission	81 (92.0)	70 (98.6)	χ2=3.52, p=0.060
Mean knowledge of ART±SD	81.85±16.53	69.83±16.58	t=-4.65, p<0.001**
Knowledge of Adherence to ART			
ART adherence is taking drugs as agreed with doctor	86 (95.6)	75 (97.4)	χ2=0.41, p=0.523
Poor ART adherence leads to rapid disease progression	88 (97.8)	69 (88.5)	χ2=5.93, p=0.015*
Excessive alcohol intake affects adherence to ART	88 (98.9)	72 (94.7)	χ2=2.39, p=0.122
Mean knowledge of Adherence to ART ± SD	97.04±11.87	91.14±15.75	t=-2.77, p=0.006*

ᵃPearson's chi-square test; t-independent t-test; *p<0.05

The mean knowledge of HIV/AIDS at post intervention was significantly higher among the respondents in the intervention group compared with control group (t=-3.144, p=0.002). However, the mean comprehensive knowledge of HIV/AIDS at post intervention was not significantly higher among the respondents in the intervention group compared with control group (t=-1.38, p=0.170) (Table 6).

The mean knowledge of ART at post intervention was significantly higher among the respondents in the intervention group compared with control group (t=-4.65, p=0.00). Similarly, the mean knowledge of adherence to ART at post intervention was significantly higher among the respondents in the intervention group compared with control group (t=-2.77, p=0.006) (Table 7).

Table 8: Post intervention knowledge of HIV/AIDS, ART and its adherence among respondents in the intervention and control groups.

Graded knowledge	Group		ᵃTest Statistics, p value
	Intervention, n= 98 N (%)	Control, n=98 N (%)	
Pre-intervention knowledge of HIV/AIDS, ART and its adherence			
Poor knowledge (<50%)	1 (1.0)	2 (2.0)	$\chi 2=0.470$ p=0.79
Fair knowledge (50-74.9%)	48 (49.0)	45 (45.9)	
Good knowledge (≥75%)	49 (50.0)	51 (52.0)	
Mean overall knowledge± SD	78.14 ± 13.30	76.18 ± 14.50	t=-0.988, p=0.33
Post-intervention knowledge of HIV/AIDS, ART and its adherence			
Poor knowledge <50%	0 (0.0)	2 (2.5)	$\chi 2=8.28$ p=0.016*
Fair knowledge (50-74.9%)	11 (12.2)	20 (25.3)	
Good knowledge (≥75%)	79 (87.8)	57 (72.2)	
Mean overall knowledge score± SD	87.78±12.27	79.36±11.21	t=-5.09, p<0.001*

ᵃPearson's chi-square test; *p<0.05; t-independent t test.

Table 9: Post intervention adherence to ART among respondents in the intervention and control groups.

Variables	Group		ᵃTest statistics, p value
	Intervention, n= 90 Post intervention N (%)	Control, n=79 End of study N (%)	
Self -reported Adherence to ART			
Adherent (≥95%)	71 (78.9)	21 (26.6)	$\chi 2=46.41$ p<0.001*
Non-adherent (<95%)	19 (21.1)	58 (73.4)	
Mean adherence level± SD	96.98 ± 6.42	88.15 ± 9.89	t=6.96, p<0.001*
Adherence to ART using MMAS- 8			
High adherence (8)	58 (64.4)	17 (21.5)	p<0.001*
Medium adherence (6-7)	23 (25.6)	23 (29.1)	
Low adherence (<6)	9 (10.0)	39 (49.4)	
Mean adherence level± SD	6.60 ± 1.37	5.27 ± 1.22	t=6.84, p<0.001*

ᵃPearson's chi-square test; t-independent t-test; *p<0.05

Table 10: Post intervention reasons for non - adherence to ART among respondents in the intervention and control group.

Reasons for missing ART	Group		ᵃTest statistics, p value
	Intervention, n= 90 Post intervention, N (%)	Control, n=79 End of study N (%)	
Forgetfulness (yes)	11 (12.2)	50 (63.3)	$\chi 2=47.57$, p<0.001*
Being busy (yes)	1 (1.1)	21 (26.6)	$\chi 2=24.11$, p<0.001*
Change in daily routine (yes)	1 (1.1)	0 (0.0)	$\chi 2=0.88$, p=1.000
Being away from home (yes)	3 (3.3)	8 (10.1)	$\chi 2=3.19$, p=0.074
Felt asleep (yes)	6 (6.7)	40 (50.6)	$\chi 2=41.05$, p<0.001*
Felt sick/ill (yes)	0 (0.0)	4 (5.4)	$\chi 2=4.73$, p=0.030*
Didn't want others to notice (yes)	1 (1.1)	4 (5.1)	$\chi 2=2.29$, p=0.130
Too many pills to take (yes)	1 (1.1)	0 (0.0)	p=1.000

ᵃPearson's chi-square test; *p < 0.05

At pre-intervention, there was no significant difference between the overall graded knowledge (χ^2=0.470, p=0.791) of respondents among the intervention and control groups. The mean knowledge scores of respondents in the intervention and control groups were 78.14 and 76.18 respectively.

There was no statistically significant difference between the mean knowledge scores of both groups at baseline (t=-0.988, p=0.325). The proportion of respondents who had good overall knowledge (knowledge score ≥75%) at post intervention was statistical significantly higher in the intervention group when compared with the control group (χ^2=8.28, p=0.016). The mean overall knowledge score at post intervention was significantly higher among the respondents in the intervention group compared with control group (t=-5.09, p=0.001) (Table 8).

The proportion of respondents who adhered to ART (≥95%) using self-report at post intervention was statistical significantly higher in the intervention group when compared with the control group (χ^2=46.41, p<0.001). The mean adherence to ART at post intervention was 96.98 and 88.15 in the intervention and control group respectively and the difference was statistically significant (t=6.96, p<0.001). Using MMAS- 8 scale to measure adherence to ART, the proportion of the respondents who adhered to ART (high adherence score of 8) at post intervention was statistical significantly higher in the intervention group when compared with the control group (p<0.001) (Table 9).

There was a statistical significantly lower prevalence of forgetfulness (χ^2=47.57, p<0.001), being busy (χ^2=24.11, p<0.001), fallen asleep (χ^2=41.05, p<0.001) and felt sick/ill (χ^2=4.37, p=0.030) as the reasons for missing ART at post intervention in the intervention group compared with the control group (Table 10).

DISCUSSION

Adherence to ART has been proven to be a good predictor of clinical outcome among patients on ART.[29,30] To achieve the nearly perfect adherence apparently necessary for optimal effects of ART, individuals often require assistance in form of interventions.[31] The knowledge of the components of adherence to ART were good in both the intervention and control group. Almost all (97.9% and 98.9%) the respondents in the intervention and control groups respectively knew that adherence to ART is taking drugs as agreed with doctor. Majority (93.8% and 83.2%) of the respondents in the intervention and control groups respectively knew that poor adherence leads to rapid disease progression, though the difference was statistically significant (p=0.02). Majority of the respondents in both groups also knew that excessive alcohol intake affects adherence to ART, though the difference was significantly higher among the respondents in the intervention group compared with control group (p=0.02).

This could be as a result of the counselling about ART, its benefits and the importance of adherence that the respondents are often exposed to by health care providers in the clinic. The study by Kasamu and Balogun done in Lagos, South-western Nigeria revealed that most of the respondents had good knowledge about ART.[32] Previous studies in Africa also showed good knowledge about ART.[33,34]

Their knowledge of the various components of comprehensive knowledge of HIV/AIDS was good (>90%) and comparable in both intervention and control group in that consistent use of condom during sexual intercourse can reduce HIV infection; having just one HIV-negative and faithful partner can reduce HIV infection and that a healthy looking person can have HIV. This is in concordance with the findings in studies by Awosan in North-western Nigeria and Mugoyelaand in Tanzania that reported high knowledge of condom use (84.3%) and faithfulness to one partner (75.5%) as preventive measures for HIV/AIDS.[35,36]

However, this study reported higher levels of misconception of the transmission of disease through mosquito bites in the intervention group (42%) and control group (30%) and through supernatural means in the intervention (43%) and control (22%) compared with that reported by Awosan in the Sokoto, North-western Nigeria (mosquito bite, 18% and supernatural means, 12.1%) and Singh (21.3%) in India.[35,37] This need to be addressed with cognitive (educational intervention) to educate the HIV patients about these misconceptions and to reiterate the common means of transmission of HIV/AIDS.

The two groups were comparable in terms of overall knowledge of HIV/AIDS, ART and adherence to ART because no statistically significant difference was seen. Respondents in both groups had good overall knowledge of HIV/AIDS, ART and adherence to ART (≥75%) in the intervention and control group at baseline. This implies that the routine health talk and counselling sessions are very effective in educating HIV patients about HIV/AIDS, ART and adherence to ART irrespective of the differences in the education, tribe, and occupation of the respondents in both groups. But this knowledge has not resulted in positive behavior in them as all of them were non-adherent to their ART medications. The findings in this study is consistent with the study done by Olowookere in the South-western Nigeria, Onyeonoro in the South-eastern Nigeria 39 and the study done in Soweto, South Africa that also reported high knowledge of HIV/AIDS, ART and adherence among PLWHA.[34,38,39]

The two groups were comparable in terms of their mean adherence levels to ART (using self-report) with the intervention and control groups having mean adherence levels of 79.94% and 77.92% respectively. This is below the required ≥95% necessary to achieve the goals of ART.[30] This is similar to previous reports in Nigeria.[8] The study further reported an assessment of adherence to ART enquiring about the reasons for missing their drugs (using MMAS- 8) to be statistically significantly higher in the intervention group than control group, although the commonest reason given by the respondents in both groups, forgetfulness, was comparable at baseline. In general, the most important factors that affect adherence

are patient-related.[14-17] Furthermore, forgetfulness is the single most important factor responsible for nonadherence which is corroborated by findings from this study.[6,7,9]

At post intervention, there were an increase of 17.6% and 52.3% in knowledge score and adherence to ART (≥95%) respectively among respondents in the intervention group over those in control group and these were statistically significant. There was also a statistically significant increase of 8.8% in the mean adherence at end line in the intervention group (96.98) over the control group (88.15). This implies that since the factor associated with non-adherence are numerous, multiple strategies involving cognitive intervention, behavioral intervention to address forgetfulness and affective intervention are needed to effectively address non-adherence to ART.

This finding is corroborated by a study done in Port Harcourt, south-southern Nigeria in 2011 among non-adherent HIV patients that reported that 76.9% of those in the intervention group had achieved adherence to drug treatment as opposed to 55.8% in the control group. This difference was significant.[40] Previous study done in Kenya using counseling and alarm devices as interventions and other earlier studies have equally demonstrated the positive effect of including SMS facilities to reinforce cognitive intervention of adherence counseling in order to improve adherence among HIV patients.[20]

Also, at post intervention, this study revealed that there was significant decrease of 74.2% and 15.8% in the proportion of respondents who forgot to take their ART medications in the intervention and control groups respectively. This is related to reasons given earlier with regards to the mode of care given to the non-adherent patient at every comprehensive ART site. However, there was a statistical significantly lower proportion of the common reasons given for missing ART which was mainly forgetfulness (p<0.001), and others were being busy (p<0.001) and fallen asleep (p<0.001) at post intervention in the intervention group compared with the control group.

This finding is similar to that reported in a study done in 2012 in Port Harcourt among non-adherent that reported a significant increase in the proportion of respondents in the intervention group over control group that did not forget to take their ART medications at post intervention.[40] It is also consistent with the report from a quasi-experimental study done in South India in 2012 that forgetfulness was the most common reason for non-adherence throughout the study as seventeen percent (17%) of the participants reported forgetfulness as a barrier at enrollment. However, this significantly decreased from baseline with time during the intervention period (17%; 10%; 6% and 3% at baseline, 1 month, 3 months, and 6 months respectively, p=0.001).[21]

CONCLUSION

The telephone calls and text messages were found to be effective in improving the knowledge of HIV/AIDS, ART and adherence to ART of the respondents. The Federal Ministry of Health (FMoH), Hospital Management with the support of implementing partners need to integrate telephone calls and text message into clinical setting as part of comprehensive care for HIV care and treatment to assist in improving their knowledge of HIV/AIDS, ART and adherence to ART. Future research is needed to model the impact of phone reminder interventions on health care systems in which a formal cost-effectiveness analysis can compare the costs to implement the interventions with the benefits of enhanced ART adherence.

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