Full Length Research Paper

Adherence of HIV/AIDS patients to antiretroviral therapy in a tertiary health facility in Benin City

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Adherence to ART is a major predictor of the success of HIV/AIDS treatment. We assessed adherence to ART in Benin City and identified the contributing factors. In a prospective study, we evaluated adherence to ART among 125 outpatients in University of Benin Teaching Hospital, Benin City using self-reporting and pill counting methods and determined the predictors using bivariate analysis. Structured interview was used to evaluate access to medicines and patients' factors affecting treatment adherence. Adherence level of 58.1% ± 2.4% was observed which was significantly lower than those reported in many other sub- Saharan African countries. The adherence was dependent on adverse effects and educational level of patients. Poor financial status, medication adverse effects, lack of confidentiality, occupational factors and stigmatization were the major reasons given for non-adherence. All the prescribed medicines were always in stock during the study period but some patients had stock out of medicines at home. It is concluded that the level of adherence to ART in a poor resource health facility in Nigeria is comparable to levels reported from North America. Poverty, medication adverse effects, confidentiality, occupational factors, and stigma and discrimination were the major determinants of the level of adherence.

Key words: HIV/AIDS, antiretroviral therapy, adherence, access to medicines.

INTRODUCTION

Appropriate use of antiretroviral therapy (ART) has improved the health of many human immunodeficiency virus (HIV) positive individuals who otherwise may have died. Notably, the efficacy of any treatment depends on sustained high levels of adherence to ART (Deeks et al., 1997; Saag and Schooley, 1998; Altice et al., 2001; Mannheimer et al., 2005; Mill et al., 2006). But ART regimens are often complicated and can include varying dosing schedules, dietary requirements, and adverse effects (Ferguson et al., 2002). Adherence is a major predictor of the survival of individuals living with HIV/AIDS (Mill et al., 2006) and poor adherence to treatment remains a major obstacle in the fight against HIV/AIDS. In earlier studies in Nigeria, varying levels of adherence have been reported. For example, the levels reported for studies conducted in Kano (northern Nigeria), Niger Delta and Sagamu (Southern Nigeria) are 49.2% (Nwauche et al., 2006), 80% (Mukhtar et al., 2006) and >85% (Idigbe

et al., 2005), respectively. Different levels have also been reported in several countries in sub-Saharan Africa and North America (Mill et al., 2006).

From the perspective of public health and service delivery, treatment non-adherence undermines the efficient distribution of resources (Burgoyne et al., 1983; Bebbington, 1995; McDonald et al., 2002) and huge expenditure by international organizations including the United States President's Emergency Plan for AIDS Relief (PEPFAR), the Global Fund and the World Bank (Pennington, 2007). It also has negative impact on the effectiveness of therapeutic interventions in HIV/AIDS management, and contributes to the disease progression (Weiser et al., 2003). In sub-Saharan Africa, concerns about adherence problems have been an important consideration in expanding access to ART (Mill et al., 2006). Generally, the factors that influence adherence to antiretroviral therapy (ART) fall into three categories namely, patient-related (psychosocial and educational) factors, patient-provider factors (interaction with physicians and other health workers and access to medications) and clinical factors (pill burden, dosing frequency and adverse effects of medications) (Esch, 2001; Weiser et al., 2003).

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It was reported in 2003 and 2006 that adherence to ART is much better in Africa than in North America, with pooled analyses of patients showing adequate adherence in 55% of the patients in North America as against 77% of those in Africa (Kaiser et al., 2003; Mill et al., 2006); The continuing impact of poor knowledge of HIV/AIDS and significant discrimination still prevalent among youths in Benin City (Ojieabu et al., 2008) affect adherence and necessitates continuous assessment of adherence to ART in this area. Therefore, the main purpose of this study is to assess the current rate of adherence to ART in a major HIV/AIDS treatment center in Benin City and identify the factors contributing to non-adherence. We specifically wanted to investigate whether the adherence in Benin City is comparable to those previously reported in other parts of Nigeria and other countries despite the expected impact of identified relatively poor knowledge and stigmatization of many youths in the communities.

METHODS

This study was carried out in a nationally designated HIV/AIDS Treatment Center (HTC) in University of Benin Teaching Hospital, Benin City (UBTH) located in southern part of Nigeria. UBTH is a 550-bed tertiary health facility with an annual outpatient turnover of approximately 200,000 patients and over 20 health departments offering both secondary and tertiary health care to residents of Edo State and neighboring States (Provinces) . Established by the Federal Government of Nigeria (FGN) in 2002 with an initial enrolment of 25 patients, HTC had patient enrollment of 3,500 at the time of this study. The center currently receives funding from both FGN and the United States President's Emergency Fund for Aids Relief (PEPFAR).

Patient population

Based on the total number of patients enrolled in HTC (3,500), a reported average adherence in Africa of 77% (Kaiser, 2003; Mill et al., 2006), and degree of accuracy of 0.1, we calculated a sample size of 95 patients as previously described by Araoye (2004). We then recruited a consecutive sample of 125 patients with positive enzyme-linked immunosorbent assay (ELISA) test results at 0 month (baseline) for a 3 months follow-up, having added additional patients to account for loss on follow-up (Brown, 1995). Included in the sample were male and female (18 – 60 years old) outpatients diagnosed to be having HIV/AIDS (using both laboratory and clinical data) that were attending HIV/AIDS clinic between February and March 2007, and refilled their prescription in the pharmacy section of the HTC. All the patients had been on ART and were regular at clinics for not less than 6 months prior to the study, had no major disability, and consented to participate in the study. Patients were excluded if they were pregnant or had a history of serious cardiovascular illness, diabetes and/or cancer (excluding non-melanoma skin cancer) within the previous 2 years. Twenty-three patients who did not come forward to refill their prescriptions any month within the study period (3 months) were not included in the computed adherence data.

Study design

Following appropriate approval from the hospital authorities, informed consent was obtained from all patients that participated in this study at the time of enrollment. A pre-tested structured questionnaire was designed and used for the collection of socio-demographic, clinical and treatment variables, as well as information on adherence and access to medicines. The questionnaire contained open-ended and/or closed questions. Reliability of the data obtained with the questionnaire was assured by administering the questionnaire twice to a set of 25 patients selected at random and the pre-test and post-test reliability coefficients determined using Cronbach's alpha (Ojieabu et al., 2008) that ranged from 0.77 to 0.92. The data for the 25 patients were not included in the final computed data reported.

Socio-demographic data were obtained at enrollment for the study from the medical records and interview of the patients. Clinical variables including patients' HIV status, physicians' impressions, CD4 counts, and medications being taken were also obtained from patients' medical records. The pharmacist interviewed all patients about other medications they were taking which were not in their medical records as well as their medication-related problems. Patient counseling was done for each patient every month when they came to refill their prescriptions using standard procedure.

Outcome measures

Adherence to medication was assessed at the end of each month for 3 months using both tablet counting and self-reporting methods. In the first method, pharmacy medication records for patients were matched by the pharmacist against the not-yet-used medicines brought to the pharmacy by the patients as a routine for refill of prescriptions by patients and the number of doses that ought to have been taken that were missed were recorded. Patient's self-reporting method was carried out as previously described by Weiser et al. (2003). In this method, patients were interviewed about their adherence over the previous day, previous week and previous month successively in an attempt to minimize recall bias. In both the tablet counting and self-reporting methods, adherence was defined as taking 95% of prescribed doses over the previous month which corresponded to missing no more than one dose in a 10-day period (in a 2 times a day dosing regimen), one dose per week (in a 3 times a day regimen) or one dose per day (in a once daily dose regimen). Patients were classified as non-adherent if they missed more than 5% of their doses in at least one of the three categories or if they indicated missed doses in all three categories. For non-adherent patients, the number of patients that stopped their medications for a period of at least 2 weeks (treatment gap) was determined and reasons for their non-adherence were sought by the pharmacist through structured interview (Weiser at al., 2003). In each of the methods, the average adherence was determined and the data was compared with those reported from studies conducted in other parts of Nigeria (Nwauche et al., 2006; Mukhtar et al., 2006; Idigbe et al., 2005), Africa countries and North America (Kaiser, 2003; Mill et al., 2006).

Access to medicines was evaluated by examining pharmacy records of antiretroviral drugs and other medicines (antibiotics, and multivitamins/hematinics) often prescribed by the attending physicians for the patients. The average stock-out duration (SOD) for the medicines was evaluated as the average number of days in the 3 months (study period) each medication was out-of-stock. In order to introduce availability of the medicines for each patient, stock out duration for patients in treatment center (SOD^{pt}) and at home (SOD^{ph}) were introduced as the average number of days per patient the required medicines could not be dispensed to each patient in the treatment center (SOD^{pt}) or available for use at home (SOD^{ph}) because of stock-out. Patients who ran out of their medications at home were interviewed on the reasons why the medicines were not available for use. The data obtained were recorded as appropriate.

Statistical methods

Data collected were entered into Microsoft Excel (Microsoft Inc USA) and double checked to ensure accuracy. Statistical calculations were performed with Systat™ for Windows, version 10.2 (Systat Software Inc., USA). Descriptive (frequency and percentages), correlation and nonparametric statistics were employed in presentation of data. Logistic regression models were used to determine the predictors of adherence relative to sociodemographic and clinical/treatment variables. Proportional data were compared using chi-square test or Fisher's exact test, as appropriate. The criterion for statistical significance was 95% confidence interval and 2-tailed $p < 0.05$.

RESULTS

Of the 125 patients recruited for the study, 23 (18.4%) of them did not come to refill their prescriptions at the end of each of the 3 months and were excluded. The sociodemographic characteristics of the remaining 102 patients (mean age: 36.3±7.9 yr; range: 20 – 56 yr) are given in Table 1. Majority of the patients were females and 25- 49 years old. Some of the patients (33.3%) were married and Christianity was their major religion. While as many as 28.4% of them had no dependants, some patients (12.8%) had between 5 and 12 dependants. The proportion of patients that had primary or no formal education (17.7%) was significantly smaller than those with at least secondary education (p = 0.027; odd ratio = 0.184). As many as 14.7% of them were unemployed and 14.7% were business executives. The rest were petty traders, government workers or self employed.

Monthly income (salaries, interests from businesses used for upkeep, grants/contributions received from friends, relatives and other sources) less than ₦10,000.00 (US $85.84) was earned by as many as 42.2% of the patients. There was no significant difference between the income of males as compared to those of the females (p>0.05). As many as 17.6% of the patients drank limited quantities of alcohol. Unlike some of the males, the female patients had no history of smoking and did not smoke during the study period.

Clinical variables

The clinical variables are given in Table 2. Services for measuring CD4 count were available in the HIV/AIDS Treatment Center at no cost to the patients. Prior to the study, patients paid ₦600.00 (US $5.15) for each test. In the treatment center, the routine frequency of determination of CD4 count for patients varied from two to four times a year per patient. For over 19.6% of the pa-tients, the CD4 count could not be recorded at the end of the third month because they were not done by those patients as requested by the attending physicians. Major reasons given by such patients that were interviewed include unnecessary time wastage in the laboratory to do the test (since there was only one laboratory for such purpose) and their feeling that doing the test was not

important. The CD4 counts for 44.1% of the patients included in this study were higher than 350 cell/microlitre. Patients with counts below 200 cells/microlitre were on the minority (16.7%).

Persistent cough (27.5%), skin rashes (22.5%), and prolonged fever (26.4%) topped the list of the subjective clinical signs and symptoms presented by the patients during the study period. Other clinical features presented included diarrhea, oral thrush, insomnia, headache, body pain, stomach upset, neuropathy, eye infection, weakness and weight loss.

Treatment variables

In the treatment center, antiretroviral drugs, fluconazole, co-trimoxazole and anti- tuberculosis medications were dispensed free of charge to the patients under PEPFAR and/or FGN programmes but each patient paid ₦1, 000.00 (US $8.58) for the supply of a month's course of mutivitamins. Any other medications prescribed for any patient were purchased by the patients. At the time of recruitment for the study, all the patients were on first line ART. However, one of the patients was switched to truvada + lamivudine + kaletra combination due to poor response to the first line medication at the end of the first month while all other patients continued with their first line therapy during the 3 months follow-up period. The proportion of patients that used the 6 different antiretroviral drugs combinations were 62.7% (stavudine/ lamivudine/nevirapine),3.9%(stavudine/lamivudine/efavirenz), 22.5% (zidovudine/ lamivudine/nevirapine, 6.9% (zidovudine/lamivudine/efavirenz),2.9%(lamivudine/truvda/nevirapine), and1.0%(truvada/lamivudine/kaletra). All patients received multivitamins while some patients were also placed on antibiotics (ciprofloxacin, 2.9%; ofloxacin, 10.8%; metronidazole, 8.8% and co-trimoxazole, 11.7%), anti-tuberculosis medications - isoniazid, ethambutol, rifampicin and pyrazinamide – (11.8%) and antifungal medications – ketoconazole, nystatin and fluconazole – (29.4%).

The average monthly expenses on treatment per patient was ₦3,014.47 ± ₦3,484.12 or US $25.87 ± $29.91). This included cost of transportation to hospital and cost of prescribed medication other than the medicines which were usually dispensed to the patients free of charge in the center.

Adherence to antiretroviral therapy

The result of the assessment of adherence to ART is summarized in Table 3. From the patients' self-reporting assessment, 58.1% of the patients were adherent to their medications. This proportion was not significantly different from the proportion obtained using the pill count method (pharmacist's assessment) but significantly higher (p<0.001; odd ratio, OR = 0.707; 95% confidence interval, CI = 0.592 – 0.844) than that reported in the re-

Table 1. Socio-demographic characteristics of HIV positive patients receiving treatment in a designated HIV/AIDS Treatment Center in Benin City.

Characteristics	Male (%)	Female (%)
Age^a		
Range	20-48	21-56
20-24	6 (5.8)	7 (6.9)
25-34	10 (9.8)	30 (29.4)
35-49	12 (11.8)	21 (20.6)
≥ 50	8 (7.8)	8 (7.8)
Total	36 (35.3)	66 (64.7)
Religion		
Christianity	32 (31.4)	61 (59.8)
Islam	2 (2.0)	3 (2.9)
Traditional/no religion	2 (2.0)	2 (2.0)
Marital status		
Single	8 (7.8)	22 (21.6)
Married	24 (23.5)	10 (9.8)
Widowed	1 (1.0)	26 (25.5)
Separated	1 (1.0)	6 (5.9)
Divorced	0	2 (2.0)
No. of dependants (adults & children)		
0	6 (5.9)	23 (22.5)
1-2	13 (12.7)	20 (19.6)
3-4	14 (13.7)	13 (12.7)
5-10	2 (2.0)	10 (9.8)
> 10	1 (1.0)	0
Level of education		
No formal education	0	2 (2.0)
Primary	2 (2.0)	14 (13.7)
Secondary	14 (13.7)	26 (25.5)
Tertiary	20 (19.6)	24 (23.5)
Occupation		
Trader	5 (4.9)	8 (7.8)
Civil servant	13 (12.7)	16 (15.7)
Self employed	13 (12.7)	17 (16.7)
Business executive	3 (2.9)	12 (11.8)
Not employed	2 (2.0)	13 (12.7)
Monthly income (Naira)		
Mean $\pm$ sd (₦)[b]	20755.11±16826.17	23079.23±21547.42
<5,000	2 (2.0)	20 (19.6)
5,000 – 10,000	8 (7.8)	11 (20.6)
>10,000 – 20,000	11 (10.8)	13 (12.7)
>20,000 – 30,000	8 (7.8)	8 (7.8)
>30,000 – 40,000	3 (2.9)	3 (2.9)
> 40,000	4 (3.9)	1 (1.0)
Substance habits		
Prior alcohol	8 (7.8)	11 (10.8)
Prior smoking	9 (8.8)	0
Current alcohol	8 (7.8)	10 (9.8)
Current smoking	2 (2.0)	0

$^a\chi^2$=4.059, df=4, p>0.05; ^{b}US \$1.00 = ₦116.50

Table 2. Clinical variables of HIV positive patients receiving treatment in a designated HIV/AIDS Treatment Center in Benin City.

Variable	Male (%)	Female (%)
CD4 count*		
<200	5 (4.9)	12 (11.8)
200 - 350	6 (5.9)	14 (13.7)
> 350	16 (15.7)	29 (28.4)
Total	27 (26.5)	55 (53.9)
Symptoms		
Diarrhoea	3 (2.9)	9 (8.8)
Skin rashes	8 (7.8)	15 (14.7)
Persistent cough	7 (6.9)	21 (20.6)
Prolonged fever	9 (8.8)	18 (17.6)
Oral thrush	0	1 (1.0)
Insomnia	0	1 (1.0)
Headache	2 (2.0)	4 (3.9)
Body pain	9 (8.8)	10 (9.8)
Stomach upset	0	4 (3.9)
Neuropathy	0	1 (1.0)
Eye infection	2 (2.0)	1 (1.0)
Weakness	1 (1.0)	6 (5.9)
Weight loss	3 (2.9)	5 (4.9)

*Values are for baseline

region (Niger Delta) in a previous study (Nwauche et al., 2006). The adherence level in our study was comparable to the average adherence levels reported in 31 studies conducted in North America but significantly lower than those reported in studies conducted in 12 other African countries. Some of the patients that were adherent (42.2%) claimed not to have missed any doses during the 3 months study period. However, the patients who had not taken any of their medications for at least 2 weeks (gaps in treatment) accounted for 26.5%. Using multiple logistic regression models, adherence was found to be dependent on side effects of medications (OR = 1.48; 95% CI = 0.92 – 1.97) and level of education of patients (OR = 1.81; 95% CI = 1.25 – 2.51) but not on age, sex, religion, family size and CD4 count. Patients who had primary or no education had lower adherence than other patients (OR = 2.23; 95% CI = 1.02 – 2.89).

For the non-adherent, the major reasons given for non-adherence were non- availability of medications due to poor financial status and inadequate family support (15.9%), medication adverse effects (59.0%), lack of confidentiality (76.7%) and occupational factors (25.0%). Dispensing of antiretroviral drugs in a common room to them in the pharmacy (as practices in the treatment center) was seen by 72.1% of the non-adherent patients as inappropriate and exposing them to discrimination (stigmatization) since patients entering the room were identifiable as HIV positive. Furthermore, some patients (11.4%) reported they were often unwilling to obtain permission from their working places to attend clinic regularly because they could not disclose their HIV status to their superiors. Medication adverse effects and stock-out

of medicines were the two reasons accounting for the gap in treatment. None of the non-adherent patients wanted to be visited at home to be given their medica-tions because of fear of being identified as a person living with HIV in their communities.

Access to medicines

In the treatment center, medicines for HIV/AIDS patients were received regularly from both the Federal Government and PEPFAR programmes. Other medicines were obtained through tendering, direct purchase and telephone orders, as appropriate. The average stock out duration (SOD) for each of the antiretroviral medicines, multivitamins/hematinics and antibiotics often prescribed for the patients during the 3 months period was zero. Similarly the mean number of days the medicines could not be dispensed in the center (SOD^{pt}) was zero. However, 7 of the patients (6.9%), ran out of stock of their medications in their homes (mean stock out duration, SOD^{ph}, is 10.3 ± 3.5 days). Lack of finance (6 patients) and being too busy (1 patient) were the reasons given by the patients why they ran out of medicines.

DISCUSSION

Remarkably, defaulting from treatment is one of the most important problems in the management of HIV/AIDS. Low adherence can result in cross-resistance to other antiretroviral drugs (Leake and Home, 1998) which can potentially interfere with future therapeutic option for those being treated and those who subsequently become infected with resistance virus (Nwauche et al., 2006). Ninety-five percent adherence to antiretroviral drugs regimen is often needed to achieve optimal rates of viral suppression in people living with HIV/AIDS. Even so, there is often undetectable viral load in approximately 80% of patients (Peterson et al., 2000). Adherence level of 95% implies that a patient taking a twice-daily regiment cannot miss or delay more than 3 doses per month. This can be more difficult than it might seem particularly if the need to refill prescriptions every month, to have medications available when working and traveling, and to avoid predictable side effects of medication, are considered (Hardy, 2003).

It is even more problematic in developing countries like Nigeria where illiteracy, poverty, long distance from HIV/AIDS care centers and poor health care facilities are common. Although there is no gold standard for evaluating adherence to medication (Osterberg and Blacschke, 2005), patient self-reporting and pill counts have frequently been used in evaluating adherence to ART in different parts of sub-Saharan Africa (Liu et al., 2001; Weiser et al., 2003; Idigbe et al., 2005; Mukhtar et al., 2006; Mill et al., 2006; Nwauche et al., 2006). We have adopted a combination of both patient self-reporting and

Table 3. Patients' and pharmacist's assessment of adherence

Finding	No of patients (mean ±sd)
Self assessment of adherence (n = 102)	
Adherent[a]	59.3±2.5 (58.1%±2.4%)*
Non-adherent	42.7±2.5 (41.9%±2.4%)
Gaps in treatment[b]	27.0±2.0 (26.5%±2.0%)
Pharmacist's assessment of adherence (n = 89)	
Adherent[a]	54.0±2.6 (60.7±2.9%)*
Non-adherent	35.0±2.6 (39.3±2.9%

*p=0.768
[a]Defined as completing 95% of prescribed doses each month
[b]Defined as stopping all medications for a period of at least 2 weeks

pill counts in our study because of the reliability of the measurements from previous studies.

Our data suggest that the adherence levels among the patients studied are comparable to the levels in North America (Kaiser, 2003; Mill et al., 2006) and the one earlier reported in Port-Harcourt, Nigeria (Nwauche et al., 2006) but lower than the levels earlier reported in different countries in sub- Saharan Africa (Kaiser, 2003; Mill et al., 2006) . Whereas an estimate of 55% (95% confidence interval, 49 - 62%) adherence has been reported in a meta analysis involving 31 studies carried out in North America, 29 studies in 12 sub-Saharan African countries (including Nigeria) indicated an estimate of 77% (95% confidence interval, 68 - 85%) (Mill et al., 2006).

Short-term and long-term adverse reactions (can be early and transient or evident with more prolonged use) have been identified with all of the available antiretroviral agents (Esch, 2001). Consistent with previous studies (Ekong et al., 2003; Nwauche et al., 2006), our data demonstrated association of side effects of medication and level of education with non-adherence to the ART used by the patients involved in this study. The low educated people, low income earners and the unemployed had lower adherence levels than the other patients. Although high level of education cannot be directly linked to higher knowledge of HIV/AIDS, better educated people generally have greater access to information and are more likely to make better-informed decisions. They generally have better jobs and greater access to money to regularly procure their medications and support healthier and productive lives. The non-association of sex and level of income with non-adherence was inconsistent with previous studies (Ekong et al., 2003; Nwauche et al., 2006) . Average monthly income of the patients in our study (21,917.17 ± 19,186.80 Naira or US$188.13 ± 164.69) is much higher than the 9,127 ± 11,376 Naira (about $65.00) in an earlier study (Nwauche et al., 2006) and this may explain while income was not associated with non-adherence. Majority of the patients in our study were Christians. Many of the patients were either living with relatives or caring for others who were not neces-

sarily their children or spouse. Furthermore, majority of the non-adherent patients defaulted in obtaining their CD4 count. These could explain why religion, family size and CD4 count were not associated with non-adherence in the regression models.

For many patients, optimal adherence to antiretroviral therapy is often difficult to achieve for reasons ranging from patient factors to patient-health professionals relationship and clinical factors (Tseng, 1998; Esch, 2001; Weiser et al., 2003). Most of the factors identified in our study for non-adherence (financial constraints, medication adverse effects occupational factor, and stigmatization) have been reported in previous studies carried out in other parts of Nigeria (Ekong et al., 2003; Nwauche et al., 2006; Mukhtar et al., 2006). None of the patients identified sharing drugs with other patients, educational status and high pill burden as factors affecting their adherence to their ART as observed in the studies in Lagos, Kano and Port-Harcourt (Ekong, 2003; Nwauche et al., 2006; Mukhtar et al., 2006) even though educational status correlated with adherence in our regression model. The issue of the location of where medications were dispensed to HIV/AIDS patients that was reported by the patients in our study has also not been identified in previous studies. Presumably, the dispensing of antiretroviral drugs to HIV/AIDS patients using a room separated from the general dispensing area was seen as a reliable means of providing confidentiality and protection of the patients from discrimination. The pharmacists attending to the patients in the treatment center did not anticipate that some patients would see such approach as exposing them to easy identification as persons living with HIV. While acknowledging that confidentiality is a key factor in ensuring adherence to ART, a lesson learned from this study is that confidentiality must not necessarily be created by dispensing medications to patients in a place separate from other patients since this makes it easier for HIV positive patient to be easily identified.

It is known that adherence decreases as the number of medications, doses and side effects increase and as competing priorities prevail in a patient's life. When ART

is placed into the context of patients who have little financial support and other barriers, fragmented use of medication by many patients seen in our study is anticipated. Physical and psychological distress amidst financial constraints and stigmatization experienced by patients can decrease their interest in taking medications. Although the patients studied received free antiretroviral medications, the positive effect of free treatment is often offset by indirect transportation costs in areas in which patients live far away from health facilities (Mill et al., 2005).

Access to medicines is the cornerstone in the effective treatment of HIV/AIDS patients. With the huge financial support from many non-governmental and international organizations including PEPFAR, the Global Fund and the World Bank (Pennington, 2007), access to ART in Nigeria has greatly improved in the last 4 years. Under the emergency plan, Nigeria received more than US$ 70.9 million in 2004, more than US$110.2 million in 2005 and approximately US$163.6 million in 2006 while US$ 304.9 million was approved in 2007 (Global AIDS, 2007) . From our data, availability of medicines for the patients in the treatment center was not a problem. But it suffices to mention that the number of HIV positive patients turning up for treatment at the treatment center is quite small compared to the expected number from the relatively large number of HIV positive persons in the entire State and neighboring States. With a population of over 1 million people and HIV prevalence rate of 4% (2005 sentinel survey), thousands more patients ought to have been registered in the treatment center studied compared to the 3,500 patients that were registered for treatment at the time of the study. Perhaps, the problem of availability of medicines at the treatment center may have been apparent. There are indications that some patients often prefer to give up treatment because of costs they cannot afford (Hill et al., 2005). With an average monthly expenses on treatment per patient amounting to ₦3,014.47 ± ₦3,484.12 (US $25.87 ± $29.91) due to the 1,000.00 Naira (US$8.58) patients needed to pay for multivitamins, and the additional cost of medicines and transportation to the treatment center, it was not surprising that the 6 patients living over 30 kilometers away from the center had problem with availability of medicines due to their poor financial status.

As seen in our study and reported elsewhere, many of the people living with HIV/AIDS in Nigeria and other developing countries have incomes that fall below the poverty line. Ordinarily, most of such patients will not be able to meet the cost of their treatment. While the problem of access to ART for HIV positive persons in Benin City and other parts of Nigeria is mostly addressed by the various financial support programmes, a programme that will take medicines near the door step of poor patients can significantly resolve the problem of adherence to ART. Community-based directly observed therapy of ART (DOTART) has been has been reported to improve or maintain high levels of ART adherence in Africa (Farmer

et al., 2001; Severe et al., 2005; Nachega et al., 2005). However, the effectiveness of community-based DOTART is still to be confirmed in well conducted randomized trials. The priority now should to improve these ART adherence rates by maintaining access to ART in all treatment centers in the country, increase access to affordable medicines, other than ART and establishing reliable drug supply and distribution networks from the pharmacy to the individual patient.

Conclusions

The level of adherence to ART in a designated HIV/AIDS Treatment Center in Benin City, a resource poor area in Nigeria, is comparable to the levels previously reported from Niger Delta, other African countries and North America. Adherence is dependent on medication adverse effects and level of education of patients. Financial constraints, medication side effects, confidentiality, occupational factors and stigmatization were the major reasons accounting for non-adherence.

A programme that will take medicines near the door step of poor patients, and implementing policies and programmes that will involve the contribution of local government councils are recommended.

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