Determinants of non-adherence to subsidized anti-retroviral treatment in southeast Nigeria

B S C Uzochukwu,[1]* O E Onwujekwe,[2] A C Onoka,[3] C Okoli,[4] N P Uguru[5] and O I Chukwuogo[3]

The anti-retroviral (ARV) treatment programme in Nigeria is delivered through selected teaching and mission hospitals at a free/subsidized rate. The government aims to scale up ARV treatment in the country. However, non-adherence to ARV medication can lead to viral resistance, treatment failure, toxicities and waste of financial resources. This study examined the factors responsible for non-adherence to free/subsidized ARV treatment in south-east Nigeria.

The study was cross-sectional and descriptive. Information was collected from 174 patients selected by simple random sampling from the register of all patients who had been on anti-retroviral therapy (ART) for at least 12 months at the beginning of the study period. Patients were identified during their clinic visits. Information on their socio-demographic profile, ARV treatment and determinants of non-adherence to ARV treatment was obtained from those who gave consent, using pre-tested interviewer-administered questionnaires.

All patients clearly understood the need to take ARV drugs throughout their lives, and what the costs entailed. They understood the need for periodic testing, the probability that complications would develop, cost of transportation to treatment site and the daily treatment regimen. Seventy-five per cent of respondents were not adhering fully to their drug regimen; the mean number of days that respondents had been off drugs was 3.57 days the preceding month. Reasons for non-adherence included: physical discomfort (side effects); non-availability of drugs at treatment site; forgetting to carry drugs during the day; fear of social rejection; treatment being a reminder of HIV status; and selling of own drugs to those unable to enrol in the projects. Being female, under 35 years, single, and having higher educational status were significantly associated with non-adherence.

It is important that policy makers and programme managers address the factors responsible for non-adherence when scaling up subsidized ARV treatment in Nigeria and other parts of sub-Saharan Africa.

Keywords Anti-retroviral therapy, adherence, determinants, compliance, treatment, HIV, AIDS

[1] Department of Community Medicine, College of Medicine, University of Nigeria, Enugu, Nigeria.
[2] Department of Health Administration and Management, College of Medicine University of Nigeria, Enugu, Nigeria.
[3] Department of Community Medicine, University of Nigeria Teaching Hospital, Enugu, Nigeria.
[4] Health Policy Research Group (HPRG), College of Medicine, University of Nigeria, Enugu, Nigeria.
[5] Department of Preventive Dentistry, College of Medicine, University of Nigeria, Enugu, Nigeria.
* Corresponding author. Department of Community Medicine, College of Medicine, University of Nigeria, Enugu, Nigeria, P.O. Box 3295 Enugu, Nigeria. Tel: +234-80-3313-0050. E-mail: bscuzochukwu@yahoo.com

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KEY MESSAGES

- Non-adherence to the strict anti-retroviral (ARV) regimen is common for many reasons related to drug side effects, economic and drug supply problems, and socio-demographic factors.

- Policy makers and programme managers need to address the barriers to adherence in scaling up subsidized ARV treatment in Nigeria and other parts of sub-Saharan Africa.

- Setting up an efficient mechanism for monitoring and documentation of patients on ARVs would be beneficial in Nigeria.

Introduction

The United Nations Agency for AIDS (UNAIDS) estimated that 22 million people were living with HIV in sub-Saharan Africa at the end of 2007, with a global total of 33 million (UNAIDS 2008). In 2007, AIDS killed an estimated 2 million people worldwide, and 170 000 in Nigeria (UNAIDS 2008). The final report on the '3 by 5' initiative revealed that around 1.3 million people in low- and middle-income countries were receiving ARV medication at the end of 2005 (WHO 2006). This was just 40% of the intended target of 3 million. In 2005 in sub-Saharan Africa, 810 000 were on treatment out of an estimated 4.7 million who needed it (WHO 2006). The failure to meet the target has led to the development of the 'universal access by 2010' programme, aimed at providing access to drugs for 10 million people in need by 2010.

The first reported case of HIV/AIDS in Nigeria was identified in 1986. Since then the number of people infected with the virus has increased tremendously, with the national sero-prevalence rate rising from 1.8% in 1991 to 5.5% in 2005 (Federal Ministry of Health 2006). In 2004, it was estimated that there were 300 000 deaths from AIDS and 2 million AIDS orphans in Nigeria.

In 2002, the Nigerian government started an ambitious ARV treatment programme to get 10 000 adults and 5000 children onto ARVs within 1 year, and an initial US$3.5 million worth of ARVs were imported from India (Avert, undated). The cost of subsidized ARV drugs was about US$368 per person per year, and these were delivered at a subsidized monthly cost of US$7 per person per month. In 2004, the programme suffered a major setback when it was hit by a shortage of drugs. This meant that some people did not receive treatment for up to 3 months. Eventually, another US$3.8 million worth of drugs were ordered and the programme resumed.

In 2006, Nigeria began a programme that aimed to provide ARV drugs at no cost to about 250 000 HIV-positive residents. As of 2006, there were about 74 treatment sites for HIV/AIDS in Nigeria (Lambo 2006), and ARVs are currently delivered free of charge to HIV/AIDS patients at these centres. However, only about 15% of those with HIV/AIDS needing ARV drugs in Nigeria had access to them at the end of 2006 (WHO 2007).

Non-adherence to ART

As HIV/AIDS rates continue to rise in developing countries, it is becoming increasingly necessary to scale up access to highly active antiretroviral therapy (HAART), especially in Africa where 95% of all new HIV infections occur. However, in resource-constrained settings where health care services are not well developed, poor adherence to treatment and defaulting from treatment are the two major challenges faced by ART programmes (Kebede *et al.* 2008). Non-adherence, one of the foremost contributing factors in treatment failure, is associated with virological failure, immunological failure, clinical disease progression (Sethi 2004) and drug resistance (Poppa *et al.* 2004). Non-adherence to ART in the adult population has been shown to range from 33 to 88% depending on how adherence is defined and evaluated (Mills *et al.* 2006a). Research reveals that a minimum of 95% adherence is necessary to achieve (or predict) virological success in patients receiving HAART (Orell *et al.* 2003).

Several studies have been conducted to shed light on the factors affecting adherence by patients. Mills *et al.* (2006a) classified the factors into four key themes: patient related (e.g. fear of disclosure, forgetfulness, being depressed); beliefs about medication (e.g. faith in how well the drugs work); daily schedules (e.g. using reminder tools, disruptions to routine); and interpersonal relationships (e.g. trusting relationship with health care provider, social isolation). The nature of the treatment regimen has been identified as critical in understanding non-adherence. Also, health care system factors such as provider-patient relationship and specific characteristics of the health care setting have been associated with non-adherence (Van Servellen *et al.* 2002). Other factors contributing to non-adherence identified in the literature include side effects, high number of doses per day, number of different pills, food restrictions, lack of education, demanding job, indigent/poor, mental incompetence, substance abuse other than intravenous drugs, homelessness and the clinical state of HIV (Cheevers 2000; Harries *et al.* 2001). According to Ickovics and Meade (2002), the factors associated with medication adherence are commonly divided into five intersecting categories: patient variables (including socio-demographic characteristics of the patient); factors related to treatment regimen; disease characterization; patient-provider relationship; and aspects of the clinical setting that may influence adherence. In a study from Costa Rica, Stout *et al.* (2004) found the most common reasons for non-adherence were forgetfulness, being busy with other things, falling asleep through dose time, being far from home and a change of daily routine. It is generally believed that treatment burden of long duration, with serious side effects, and potential drug interactions, such as found with HAART, yields significant adherence problems (Van Servellen *et al.* 2002).

Many barriers to adherence are common to both developed and developing settings, such as fear of disclosure (Mills *et al.* 2006a). Some are unique to studies conducted in the developing world, such as financial constraints (cost of drugs and/or transport) and problems with travel to access treatment. Some barriers can be addressed relatively easily, for example by providing transport vouchers to ensure that patients can attend the clinic. Others, such as stigma, require more profound changes (Rosen *et al.* 2007). Adherence to therapy is an individual patient behaviour that is difficult to objectively measure, monitor and improve (Simpson 2006).

Although demographic factors such as age and gender have not been found to be accurate predictors of adherence for other diseases (Friedland and Williams 1999), the impact of these factors on adherence to ART remains uncertain. While Montessori *et al.* (2000) found associations between adherence and older age, male gender and higher income, Eldred *et al.* (1998) found no association between socio-demographic characteristics and adherence. This led them to conclude that the use of such characteristics for purposes of non-adherence prediction may be influenced more by clinician bias than by patients' actual behaviour; clinicians often correlate patients' level of education, living standards and lifestyles, and sometimes also age and sex, with their adherence potential. However, Van Servellen *et al.* (2002) found that functional health literacy may be significantly related to medication adherence, and Maskew *et al.* (2007) found that higher educational level is associated with better adherence.

It is clear from existing literature that the area of adherence and ART in Nigeria and sub-Saharan Africa is still a relatively unexplored area. In order to dispel existing myths pertaining to the inability to successfully administer HIV/AIDS programmes in developing countries, more research is needed. Paradigms focused on preparation of patients prior to initiation of ART, as opposed to the use of non-clinical predictors of adherence or selection criteria, may be more appropriately suited to meet the aggressive targets set for the scaling up of ART in resource-poor settings (Coetzee *et al.* 2004a).

Although some evidence on the reasons why people do not adhere to ARV drugs already exists, only 12 out of 84 studies reported in a review by Mills *et al.* (2006a) were from the developing world, where the majority of HIV/AIDS patients live. There is also a dearth of such studies in Nigeria, thus the effect of socio-demographic factors on adherence is unclear in Nigeria. In view of the current national policy to scale up ARV treatment, there is a need to determine and understand the factors that favour non-adherence to treatment.

This study therefore set out to determine the predictors of non-adherence to ART. Key findings from this study will provide the Nigerian Federal Ministry of Health (FMOH), donors, policy makers and other stakeholders with valuable information to design ways of improving the uptake of drugs, and hence ensure effectiveness of drug treatment and prevent the development of drug resistance. This has become important in the wake of renewed efforts to combat HIV/AIDS in Nigeria and achieve Millennium Development Goal 6 (MDG 6)—to combat HIV/AIDS, malaria and other diseases—which involves halting the spread of HIV/AIDS by 2015.

Methods

Study area

The study was conducted at the University of Nigeria Teaching Hospital Enugu. Enugu State is located in the south eastern geographical zone of Nigeria. Health care delivery is through a network of private and public health facilities. The state has a high fertility rate, with equally high infant and maternal mortality rates. Current data indicating the general health status of the population are: infant mortality rate, 110/1000; under-five mortality rate, 170/1000; maternal mortality rate, 144/100 000; crude death rate, 18/1000; crude birth rate, 45/1000; life expectancy at birth, 51 years; total fertility rate, 5.6; and population growth rate, 2.83% (Enugu State Government 2003).

The University of Nigeria Teaching Hospital was founded in 1971 as a teaching hospital for the medical school of the University of Nigeria. It has 704 beds and offers specialist services in medicine, surgery, obstetrics, paediatrics and other medical specialties. It is the highest referral centre for the country's south eastern zone and parts of the north central zone. The HIV clinic was established in 2004 as an ARV treatment centre and is run jointly by the departments of Community of Medicine and Internal Medicine. The centre conducts a clinic session once a week and an average of 200 patients are seen by 5–8 clinicians during this session. It has a counselling unit, a laboratory unit as well as a treatment unit. Patients receive formal pre-treatment adherence education/counselling sessions. They are also expected to visit the centre once a month for drug pick-up. Three drugs— Lamivudine (3TC), Nevirapine (NVP) and Stavudine (d4T)—are provided as a combined treatment regimen.

Study design

The study was cross-sectional and descriptive. Information was collected from 174 patients, selected by simple random sampling from the register of all patients who had been on ART for at least 12 months at the beginning of the study period. Patients were identified during their clinic visits. During each clinic day, the eligible patients were approached by three resident doctors and asked to participate in the study. The patients who agreed were fully informed about the study and asked to sign an informed consent form. The ethics committee of the University of Nigeria Teaching Hospital Enugu reviewed and approved the study procedures and data collection instruments.

Trained interviewers used pre-tested, semi-structured interviewer-administered questionnaires to obtain information on a patient's socio-demographic profile, ARV treatment and determinants of non-adherence to ART from those who consented. Adequate sample size was determined using a power of 80%, 95% confidence level and adherence level of 77% (Mills *et al.* 2006b). EPI-info software version 6.04 (Centers for Disease Control and Prevention, Atlanta, USA, http://www.cdc.gov) was used to calculate the sample size.

Data collection

Data were collected on the socio-demographic profile of HIV-positive patients and their experiences of ARV treatment.

They were asked to state if they had ever missed taking their ARV medications in the preceding one month. Those who said they had were further asked an open-ended question: 'Why did you stop taking your ARV medication?' In addition, they were asked to state for how long this lasted. The following variables were examined as determinants of non-adherence: sex, age, marital status, education, employment status, household income and distance from residence to the treatment centre. These variables were chosen because most of the data on their effect on adherence have come from developed countries and are conflicting. Knowledge of their effect in developing countries, especially Nigeria, is limited and unclear.

Data analysis

Data were entered and analysed using SPSS for windows version 11. Tabulations were used to analyse the data. The effect of the socio-demographic variables on non-adherence was assessed using multiple logistic regression analysis. The dependent variable was coded as $1 =$ adhere and $0 =$ not adhere. A P-value of 0.05 was considered to be statistically significant.

Results

Of the 197 patients approached, 182 agreed to participate in the study and 174 completed the questionnaire, giving a response rate of 95.6%. The mean age of the respondents was 34.6 years, 62.5% were female and 52.9% married (Table 1). A majority of them were business men and women. The mean years of formal education and of being on ARV drugs were 4.9 and 2.4 years, respectively. Nearly half (48.3%) of household heads had a monthly income of less than 5000 naira (US$38.5). Most respondents (91.4%) lived more than 20 km from the treatment centres. All the patients understood the need to take the ARVs for the rest of their lives, and what the costs entailed. They also understood the need for periodic testing, the probability that complications would develop, cost of transportation to the treatment site and the daily treatment regimen.

The results also showed that 75% of the respondents were not fully adhering to their drug regimen; the mean number of days respondents had been off drugs was 3.57 days in the preceding 1 month (Table 2). The reasons given for non-compliance included physical discomfort following each dose (side effects); non-availability of the drugs at the treatment site; forgetting to carry the drugs during the day; fear of social rejection; treatment being a reminder of HIV status; and selling of own drugs to those unable to enrol in the subsidized treatment programme.

Table 3 shows that age less than 35 years, being single, female and having formal education were negatively and statistically significantly associated with adherence to ART. Conversely, being male and living more than 20 km from the treatment centre were positively and statistically significantly associated with adherence to ART. The regression was statistically significant and correctly predicted more than 88% of the observation.

Table 1 Socio-demographic characteristics of respondents ($N = 174$)

Variables	n (%)	Mean/median (SD)
Age		34.6/37.4 (7.2)
Sex		
Female	108 (62.5)	
Male	66 (37.5)	
Marital status		
Married	92 (52.9)	
Single	24 (13.8)	
Separated	12 (6.9)	
Widowed	46 (26.4)	
Occupation		
Civil servant	32 (18.4)	
Farmer	7 (4.0)	
Business/trading	69 (39.6)	
Artisan	25 (14.4)	
Professional	12 (6.9)	
Student	9 (5.2)	
Unemployed	20 (11.5)	
Head of household's income/month		
<5000	84 (48.3)	
5000–10 000	61 (35.0)	
>10 000	29 (16.7)	
Years of formal education		4.9/5.2 (3.62)
Years on anti-retroviral drugs		2.4/2.9 (1.3)
Distance from residence to treatment centre		
≤20 km	15 (8.6)	
>20 km	159 (91.4)	

Discussion

While all patients clearly understood the need to take the ARVs throughout their lives, 75% of respondents were not fully adhering to their drug regimen. The main two reasons given for non-adherence were side effects and non-availability of drugs at the treatment centre. Being female, aged less than 35 years, being single, and having higher educational status (formal education) were significantly associated with non-adherence.

Self report (asking the patients how they take the drugs) is a frequently used method of adherence assessment and was used in this study. This method, like many other subjective methods of measurement, is associated with many limitations. It has been demonstrated in many studies concerning therapy for other diseases that patients often say what they think the doctor would like to hear (Bond and Hussar 1991). Similar observations have also been made with respect to HIV-infected subjects. However, a few studies of anti-retroviral treatment have demonstrated a correlation between the patients' self-reported adherence level and virological efficacy of the therapy (Miller 2000).

A further limitation of this study is that we were unable to corroborate patient self-report with viral load and CD4

Table 2 Respondents' experiences with taking anti-retroviral drugs and reasons for failing to take their drugs (N = 174)

Variables	n (%)	Mean/median (SD)
Experience with taking ARV drugs		
Aware that ARV drugs will be taken for the rest of their lives	174 (100)	
Aware that costs of treatment include periodic testing; of probability that complications will develop; of cost of transportation to the treatment site; and of daily treatment regimen	174 (100)	
Ever failed to take ones ARV drugs	131 (75.3)	
No. of days patients did not take drugs		3.57/4.00 (2.16)
Reasons for not taking ARV drugs		
Physical discomfort (fatigue, dizziness, nausea and vomiting)	100 (76.3)	
Non-availability of drugs at the treatment centre	86 (65.6)	
Taking the drugs is a reminder of HIV status	42 (32.1)	
Did not have money to pay for the drugs and transport	40 (30.1)	
Sold own drugs because needed money for something else	37 (28.2)	
Fear of someone knowing that taking ARV drugs	29 (22.1)	
Too many tablets	28 (21.4)	
Tablets too large	15 (11.4)	
Forgot to carry drugs while going out on daily business	13 (9.9)	

Table 3 Logistic regression analysis to determine some explanatory socio-economic and demographic factors for non-adherence

Variables	Coefficient (SE)	P-value
Sex (male)	0.267 (0.071)	0.000
Age (less than 35 years)	−0.1455 (0.0529)	0.0267
Marital status (single)	−0.2542 (0.0482)	0.0442
Education (formal)	−0.2615 (0.0394)	0.007
Employment status	0.2631 (0.0344)	0.613
Household income	0.45 (0.120)	0.691
Distance from residence to treatment centre (>20 km)	0.6849 (0.0866)	0.038
χ^2	81.54	<0.001
Corrected R-square	0.16	
Correct predictions	88.75%	

responses because of financial barriers to frequent laboratory monitoring in this setting. We also did not assess the impact of other medications, such as ART combined with medication for tuberculosis.

The self-reported adherence level in this study was 75%. A pooled analysis of African studies by Mills *et al*. (2006b), 66% of which were based on patient self-reported adherence, similarly indicated an adherence level of 77%. Mills *et al*. also showed that a significantly higher proportion of patients in Africa were adherent compared with patients in America. Reasons for this finding may be that ART programmes are still at an early stage in African countries such as Nigeria. The findings from our study indicate, however, that adherence levels could fall, since the drugs are currently being provided free of charge or are heavily subsidized. The introduction of charges may limit access to ARVs.

Reasons for non-adherence to ART

Access to drugs

Some of the most common reasons for non-adherence in this study were running out of medicines, and the inability to purchase more due to non-availability and inaccessibility to medications and financial constraints. Some of these findings are consistent with those found in Kano, Nigeria (Iliyasu *et al*. 2005; Mukhtar-Yola 2006).

Access to medication at the treatment centres is of great concern and one of the predictors of non-adherence. The frequent ARV drug stock-outs at several facilities in Nigeria have raised serious concerns about the sustainability of the national ARV programme and issues of non-adherence. For some time in 2004 and 2005, the ARV treatment programme suffered a major setback when it was hit by a shortage of drugs. This meant that some people did not receive treatment for a long time. This would no doubt have demoralized patients and most likely shaken their faith in the government and the treatment programme. This is apart from the fact that these drugs are taken under a strict time-based regimen where 95% adherence or more is needed to effectively control viral load.

Doubts have been expressed about the ability of health systems to maintain ART adherence in the African setting (Stevens 2004). Stock outs and the attendant consequences of system-induced non-adherence will promote development of resistance to drugs, worsening of the health status of patients, and also increases the risk of transmission of resistant strains. It is imperative that sustainable ways of providing ART are developed. Therefore, maximum possible support should be given to ongoing efforts to develop efficient procurement mechanisms and supply management programmes. In addition, ART programmes should be planned and implemented based on evidence on consumption of ART across different parts of the country. Reduction in the cost of drugs at local pharmacies will also ensure that should stock-outs occur, a reasonable number of patients will be able to purchase needed drugs.

Side effects

The finding that experience of side effects was the commonest reason for non-adherence in our study is plausible because, in the early period of treatment in particular, side effects occur relatively frequently and they have the potential to substantially reduce quality of life (Max and Sherer 2000). Significant mortality of up to 10% was found in the early months of treatment in one South African setting (Coetzee *et al*. 2004b).

However, it is possible that in our study, patients may have had episodes of side effects, *or* they may have been aware that side effects usually occur and thus stated so. Chesney *et al.* (2000) found that 24% of patients cited the wish to avoid side effects as a reason for failing to take their medication as prescribed. The World Health Organization has also noted that the effectiveness of treatment programmes, particularly in low- and middle-income countries, can be compromised by problems related to side effects such as toxicity, intolerance and drug-drug interactions (WHO *et al.* 2008).

Although patients may be willing to tolerate side effects when they perceive their illness as life threatening, it is still important that health care personnel help patients to adhere to the therapy through appropriate support and routine management of side effects, including counselling on possible side effects, and how and where to seek care when they occur. The fact that the benefits of taking the drugs regularly outweigh the side effects should be stressed by health workers.

Financial constraints

Even in the context of free drugs, the cost of transportation to obtain ARVs was a reason given for non-adherence. This finding has also been reported in another study (Yu *et al.* 2007). Not having money to pay for drugs and the tendency to sell own drugs because the money is needed for something else also contributed to non-adherence. It has been noted elsewhere that making patients in poor countries contribute towards the cost of their anti-retroviral treatment is one of the major causes of non-adherence to treatment (Keith 2004). Charges for treatment are widespread in resource-limited settings and some degree of user fee funding of health care has been advocated by the World Bank as orthodoxy over the past 15 years. A study in Nigeria which followed adherence in 53 patients (40 of whom received free medication and 13 paid for treatment) found a trend towards better adherence in those who received free treatment, although this was not statistically significant. Inability to afford medication has been one of the most frequently reported reasons for non-adherence (Daniel *et al.* 2004). It has been suggested that to increase rates of adherence, HIV therapy in developing countries should be made available free of charge (Lange 2004).

Stigma

Fear of someone knowing ones HIV status is another contributor to non-adherence. In such cases, patients are likely to have frequent treatment interruptions since their tablets must be hidden and therefore not taken in the presence of others for fear of being stigmatized. Encouraging voluntary HIV status disclosure in a community with access to ART may help decrease stigma, and improve adherence.

Treatment regimen

Patients also complained of too many and too large tablets as contributors to non-adherence. Studies have verified that the best improvement in adherence comes with the reduction of dosing frequency from three to two times per day (Cheevers 2000; Saag 2000). Patients are often concerned that taking medication may accidentally reveal their HIV status to, for example, work colleagues. Therefore, once-daily dosing is an important advance in improving adherence (Moyle 2005). Another way suggested for delivering ART and dealing with the non-adherence issue is the directly observed treatment short course (DOTS) strategy, developed to monitor treatment for tuberculosis, although this has had limited success for tuberculosis in much of Africa. However, the use of directly observed therapy of ART (DOT-ART), supervised by a family member or other social support, has been reported to be successful in some settings (Farmer *et al.* 2001; Nachega *et al.* 2005; Severe *et al.* 2005). Through observation of a patient actually taking a dose, by a close family member or friend to whom the patient has voluntarily disclosed their HIV status, DOT-ART helps to improve or maintain high levels of ART adherence. Thus this might be worth trying in Nigeria. Long-term, clinic-based ART has inherent problems, including distances to clinics and the associated problems and costs of transport.

Socio-demographic factors

In this study, males were more likely to say they were adherent to ARV medications, while females, those less than 35 years, unmarried respondents and those with formal education were less likely to report adherence to ARVs. It is not clear why those aged over 35 would adhere more to ARV drugs. It is possible that because they may be married, there will be pressure from their spouse to adhere to the drugs. Also they may have children and therefore have greater reason to stay alive. For those under 35 years, non-adherence could be a result of low economic power as they may be unemployed and also unmarried.

Some studies have found associations between adherence and older age, male gender and higher income (Gallant and Block 1998; Wenger *et al.* 1999; Montessori *et al.* 2000; Patterson *et al.* 2000). By contrast, others have found no such associations. It is not clear why those with formal education do not adhere to ARV treatment, a finding which is at variance with other findings in Nigeria (Iliyasu *et al.* 2005) and elsewhere (Reynolds 2004), where those with higher education were more likely to adhere to ARV medication. It is possible that in our environment, because those with formal education are more aware of the side effects and the fact that there is no cure for HIV/AIDS, they may decide to rationalize this and therefore are less likely to adhere to ARV medications. On the other hand, those without formal education would tend to respect the advice of the doctor and therefore be more likely to adhere to ARV medication. Furthermore, the setting of our study and that of Iliyasu *et al.* (2005) are different. The latter was conducted in northern Nigeria with less educated people, while our study was conducted in southern Nigeria with more educated people.

Also, it has been demonstrated in many studies concerning therapy for other diseases that patients often say what they think the doctor would like to hear (Bond and Hussar 1991). Such a situation may be playing out here where the reported lower level of adherence among females and the older ages may relate to truthfulness or frankness rather than adherence. In other words, women may be more honest than men, younger people may be more frank than those older, and better educated people may be more frank than those less educated.

However, increasing age in years and female gender have been reported elsewhere as factors associated with at least marginally significant increases in non-adherence to ARV drugs (Mellins *et al.* 2004; Williams *et al.* 2006). Corroborating findings such as this from self report with other methods of assessing adherence may be necessary before deductions can be made about the actual pattern of adherence in terms of socio-demographic characteristics. To date, there is no gold standard for evaluating adherence to medication (Osterberg and Blaschke 2005).

Finally, respondents who lived more than 20 km from the treatment centre were more likely to say they adhered to treatment. This is quite odd and the reason for this is not clear. The fact that they have to pay more for transportation to get to the centre may have motivated them to take their drugs.

Conclusion

In conclusion, patients stated a range of reasons for failing to adhere to their anti-retroviral regimens. These reasons should be targeted and assessed for each patient so that an appropriate adherence-enhancing intervention can be undertaken. If drugs are frequently out of stock, which is a major issue, efforts should be made by the government and donor agencies to ensure a steady supply at the treatment centres. If the regimen is too complex, steps can be taken to simplify it. For patients forgetting to carry their drugs when going out, reminders and memory aids are likely to be helpful. Patients should also be supported to put in place an effective family and social support system that will assist in ensuring that they carry their drugs along always. Our findings also suggest that government initiatives will be needed to address the problem of financial and geographical access to treatment. No form of user fees should be charged so as to improve adherence. Barriers to adherence can be addressed with patients through discussion and education regarding treatment benefits, both before initiation of treatment as well as during treatment.

Issuing 2 months' supply of medication could also aid adherence. The cost of transportation as a result of the long distance to clinics affected adherence for some clients. Giving 2 months supply of drugs reduces the number of times a patient has to attend a clinic, thereby improving adherence. Such an arrangement may be necessary in areas where there are few clinics and thus where access for the population is problematic due to the distances involved. Programmes may be developed in such a way that such patients have health workers living close to them and supervising them to ensure they are taking their drugs. However, this is notwithstanding the finding that those who lived more than 20 km from a treatment centre were more likely to say that they adhered to treatment.

The efficacy of the formal, institution-based adherence education and counselling programmes needs evaluating. Adherence monitoring plans should also be developed by health facilities involved in the ART programme. The factors considered important by patients, caregivers and health care providers in contributing to ARV medication adherence must be explored further.

An efficient mechanism for monitoring and documentation of patients on ARVs needs to be set up. At the moment, no such systems are in place in Nigeria. This study provides researchers and health policy makers with a starting point for changes that might help to ensure greater adherence to anti-retroviral treatment.

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