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Original Research

Novel structured teaching of human immunodeficiency virus patients in resource-limiting settings: Effects of learning outcomes on adherence to highly active antiretroviral therapy, hospitalization, immunologic recovery and mortality

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ABSTRACT

Background: Patient education is an important part of antiretroviral (ARV) treatment (ART) and plays a cardinal role in adherence to highly active ARV therapy. **Aims:** The objective was to compare a structured teaching method (STM) with traditional casual patient education method (TM) and evaluate its effectiveness on adherence to high activity ART (HAART), immunologic recovery, development of opportunistic infections (OI), hospitalization and mortality. **Materials and Methods:** This study was a hospital-based, prospective cohort study of 620 (296 subjects and 324 controls) consecutive human immunodeficiency virus patients admitted into the medical in-patient wards of the Federal Medical Centre, Ido-Ekiti, Nigeria, for various clinical conditions, between January 2006 and December 2012. A pre-test and post-test time series design were used for data collection using a 30-item knowledge and skills assessment schedule with items rated on a five-point Linkert-type scale. The schedule was pre-tested on 20 patients with Cronbach's score of 0.92 and a test-retest co-efficient of 0.89 at a 2 weeks interval. $P < 0.05$ was considered significant. **Results:** Mean age was 28.7 ± 6.9 years. Mean adherence rate for the subjects was 98.9% ± 1.0% and for controls, 87.6% ± 2.4% ($P < 0.001$). CD4+ T-cell count increase was significantly more in subjects (238 vs. 141, $P < 0.001$). Frequency of OI per patient per month was lower in subjects than in controls (0.51 vs. 1.31, $P = 0.002$). Mean number of readmissions per patient was 0.18 ± 0.01 for subjects and 0.89 ± 0.02 for controls ($P = 0.0012$). Subject group had shorter hospital stay ($P = 0.002$) and lower mortality ($P = 0.008$) for the controls. **Conclusion:** STM has a significant effect on adherence to HAART, immunologic recovery, development of OI, re-admission rate, hospital stay and mortality. This teaching method is novel and should be recommended as a core aspect of patient adherence counseling and education in ART program in resource-poor settings and globally.

KEY WORDS: Adherence, antiretroviral therapy, human immunodeficiency virus/AIDS, human immunodeficiency virus education/counseling, immunologic recovery, resource-limited setting, structured teaching method

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INTRODUCTION

In 2010, the World Health Organization estimated that there were 34 million people living with human immunodeficiency virus (HIV), with the majority of them in sub-Sahara Africa [1]. That antiretroviral (ARV) treatment (ART) can substantially reduce morbidity and mortality in people with HIV has been well established [2-4]. However, the success of ART depends crucially on adherence [5-7]. Although many studies have reported that the greatest effectiveness could only be achieved if patients took at least 95% of prescribed ARV doses [8-10], recent findings suggested that treatment with some potent ART regimens, such as those based on ritonavir-boosted protease inhibitors and non-nucleoside reverse transcriptase inhibitors, can achieve viral suppression at lower adherence [11,12]. Studies have shown that generally there is poor adherence to ART in sub-Sahara Africa with proportion of non-adherent patients ranging from 2% to 70% [13]. Thus, there is need to develop effective

interventions to improve adherence particularly in resource-poor settings prevalent in sub-Sahara Africa. Patient education is a crucial aspect of ART, and it plays a significant role in adherence, immunologic recovery, and development of opportunistic infections (OI), hospitalization and mortality [14-17].

Structured teaching has been known to produce a range of patient outcomes, motivates the patients, enhance compliance with treatment and result in fewer unnecessary visits to the hospital [18,19]. It also reduces the duration of hospitalization and the rate of readmission with the resultant reduction in health costs [20,21]. Structure teaching method of HIV patient education is a type of teaching and/or instruction targeted at the cognition and emotion of the patients to affect adherence to high activity ART (HAART). Thus, structured teaching method (STM) belongs to the cognitive and affective categories of interventions to improve ART adherence

Unfortunately, this is not often done, or done casually, in most resource-poor HIV burdened settings. The objective was to compare an STM with traditional casual patient education method (TM) and evaluate its effectiveness on adherence to ART, immunologic recovery, development of OI, hospitalization and mortality.

MATERIALS AND METHODS

Study Design and Study Centre

This study was a hospital-based, prospective cohort study of consecutive HIV patients admitted into the medical in-patient wards of the Federal Medical Center (FMC) (recently upgraded to Federal Teaching Hospital), Ido-Ekiti, Nigeria, between January 2006 and December 2012. The FMC, Ido-Ekiti, is a tertiary hospital with 16 medical and surgical departments and accredited residency training programs in internal medicine, family medicine, pediatrics, obstetrics and gynecology, general surgery, mental health and community medicine. It is the only Federal Ministry of Health designated ART center, which started in 2005. The hospital serves the population of Ekiti state and four other adjoining states of Kogi, Kwara, Osun and Ondo.

Ethical Considerations

The study protocol was reviewed and approved by the Institutional Review Board of the Hospital. Both oral and written consent of the patients was sought and obtained.

Enrollment and Randomization

The study was on HIV patients admitted into medical wards. The patients were admitted for various clinical conditions such as OIs, co-infections, complications of HIV infections and adverse reactions to ARV therapy. The inclusion criteria were consent to the study and age ≥16 years. The exclusion criteria were non-consent to the study, unconsciousness and neuropsychiatry illness. 620 patients who met the study criteria were enrolled into the study. Simple randomization was employed to select patients into subject and control groups. There were 296 and 324 patients in subject and control groups, respectively. An improvised method used to ensure allocation concealment was a sequentially written "yes/no" pieces of paper that were well sealed and each patient or the relative was to pick one from a pool.

Data Collection and Intervention

A pre-test and post-test time series design were used for data collection using a 30-item knowledge and skills assessment schedule with items rated on a five-point Likert-type scale. The schedule was pre-tested on 20 patients with Cronbach's score of 0.92 and a test-retest co-efficient of 0.89 at a 2 weeks interval. STM consist 10 modules which addressed issues on adherence such as benefits of treatment, family and social support, adverse drug effects, psychological factors, substance abuse, patient-provider relationship, patient's self-efficacy, effect of alternative medical practices, and traditional and cultural values. STM was used to teach the subject group while the TM was used for the control group. STM was delivered by the first author assisted by trained research assistants while TM was part of the standard of care generally done by doctors and/or nurses during ward round and infrequently assisted by HIV counselors. Teaching was done throughout the period of hospitalization, and it was individually and separately. Each patient had at least five sessions with each session lasting at least 20 min. All the patients that did not die were followed-up for 12 months at 4 weeks intervals through the out-patient clinics.

Adherence Definition and Measurement

Adherence to ARV drugs is defined as taking pills in all the prescribed doses at the right time, in the right doses and in the right way [22]. In this study, adherence was assessed by a combination of subjective and objective measurement instruments. The subjective instruments used were self-report and patient's recall of the number of missed doses in the past 30 days, and the objective instrument was the pill counts. Adherence was calculated as the percentage of the ARV drug adhered to correctly according to the standard instructions over the total number of ARV drug prescribed. In this study, adherence refers only to ARV adherence and does not include adherence to co-trimoxazole prophylaxis, other drugs for OI or dietary instructions that often accompany ART.

Data Analysis

The data collected from the patients were coded, double entered and analyzed using SPSS 12.0.1. Chi-square and *t*-test were used to compare the two groups for categorical and continuous variables, respectively, and $P < 0.05$ was considered significant.

RESULTS

Of the 620 patients enrolled into the study, 482 (77.7%) were females and 138 (22.3%) were males with a male/female ratio of 1:3. The mean age of the patients was 28.7 ± 6.9 years. The

socio-demographic distribution of the patients is shown in Table 1. 56 (8.4%) of the patients were lost to follow-up during the 12 months period: 24 (7.7%) in the subjects and 32 (9.0%) in the controls [Table 2]. 39 (6.3%) of the patients died during admission and in the 12 months follow-up period with group mortality of 4.5% and 8.1% in the subjects and controls, respectively [Table 2]. Other clinical and immunological characteristics of the subjects and controls are shown in Table 2.

DISCUSSION

In this study, the adherence rate for subjects taught with STM and controls taught with TM were 98.9% and 87.6%, respectively. Clearly, adherence was significantly higher with STM than TM. The adherence of 87.6% with TM is consistent with findings documented in comparable studies in resource limited settings in the sub-Saharan Africa [22-25]. Resource-rich settings are not really better as some studies have documented <50% of patients taking all the ARV drugs prescribed for them [26,27]. The adherence of 98.9% obtained with STM is well above the findings documented in many studies in both developing and developed settings [22-27]. Structure teaching method of HIV patient education is a type of teaching and/or instruction targeted at the cognition and emotion of the patients to affect adherence to HAART. Thus, STM belongs to the cognitive and affective categories of interventions to improve ART adherence. Other categories of interventions that can be used to improve adherence are listed in Table 3 [12]. Although, TM is also cognitive and affective, it is an informal method of patient education usually done mostly by the nursing staff in the in-patient wards while other duties are going on. However, STM is modular and different in terms of delivery of education and/or instructions to the patients. It is a purpose-structured educational package that is targeted to improve the adherence to HAART.

ART adherence is now widely recognized as critical health promotion behavior for HIV patients on ART [28], and it is the "Achilles heel" of a successful outcome [22,29]. Adherence is the second strongest predictor of progression to AIDS and death, after CD4+ T-cell count [30]. This study also showed that patients who were exposed to STM had higher CD4+ T-cell count increase and less duration of hospitalization than those exposed to TM. This reveals that the same patients with higher adherence rate also had more rapid immunologic recovery, less duration of hospitalization, less frequency of OI and fewer readmissions. Studies have shown that consistently high levels of adherence are important determinants of virologic

Table 1: Socio-demographic distribution of the patients

Characteristics	Frequency	Percentage
Age (years)		
Mean	28.7	
SD	6.9	
Range	16-58	
Minimum	16	
Maximum	58	
Gender		
Male	138	22.3
Female	482	77.7
Level of education		
No	61	9.8
Primary	121	19.5
Secondary	256	41.3
Postsecondary	182	29.4
Occupation		
Artisans/drivers	237	38.2
Civil servants	79	12.7
Students	61	9.8
Farmers	42	6.8
Retirees	4	0.6
Traders/self-employed	122	19.7
Unemployed/dependents	75	12.1
Monthly income		
<NGN 10,000	297	47.9
NGN 10,000 to <NGN 50,000	256	41.3
NGN 50,000 to <NGN 100,000	65	10.5
≥NGN 100,000	2	0.3

Table 2: Clinical and immunologic characteristic of subject and control groups

Characteristics	Subjects	Controls	*P* value
Mean adherence rate (%±SD)	98.9±1.0	87.6±2.4	0.0001
Mean CD4+T-cell count increase (cells/μl)	238±24	141±18	0.0001
Frequency of OI per patient per month	0.51	1.31	0.002
Mean number of re-admission per patient per month	0.18±0.01	0.89±0.02	0.0012
Duration of hospitalization (days±SD)	6.2±2.6	15.7±4.8	0.002
Number of patients lost to follow-up (%)	7.7	9.0	0.5
Mortality (%)	4.5	8.1	0.008

OI: Opportunistic infections, SD: Standard deviation

Table 3: Categories of interventions to improve ART adherence [12]

Category	Definition	Example
Behavioral	Affect ART adherence through direct behavioral modification	Reminder devices (e.g., 7-day pill boxes, alarms, mobile-phone text messages or pager messages) Cues for remembering dose times Cash incentives Directly observed therapy
Cognitive	Affect ART adherence through teaching, clarification or instruction	Media education materials (e.g., audio, video, or reading materials) Group education Education of individual patients
Affective	Affect ART adherence through emotional support	Peer support Treatment with antidepressants Counseling
Biological	Affect ART adherence through improved physical ability to take ART	Food rations Vitamin or micronutrient supplements
Structural	Affect ART adherence through changes in the delivery structure or through additional service structures	Delivering ART in community centers Income-generating activities for ART patients Community mobilization
Combination	Use of a combination of one or more of the above intervention categories	Patient information, behavioral adherence strategies, and peer support

ART: Antiretroviral therapy

and immunologic outcome, AIDS-related morbidity, mortality, and hospitalizations [31-34] and that low adherence is a risk factor for the development of drug resistance and failure of therapy [35,36].

In this study, the loss to follow-up in patients taught with STM was 7.7% as against 9.0% in the TM group without statistical significance. STM is not different from many other interventions to improve adherence, such as food rations, directly observed therapy, treatment supporters, non-physician providers, different models of ART delivery and mobile-phone text messages, that have been documented in previous studies where loss to follow-up was <10% [37-42]. From this study, some important insights have emerged on the effectiveness of STM in improving ART adherence. First, the patients were follow-up for a relatively long time of 12 months compared with shorter times in many studies [13], thus, the finding of improved adherence may be generalizable to the long-term because ART is lifelong. Second, STM produced a higher adherence rate based on subjective and objective adherence measures and also had a demonstrable effect on biologic correlates in terms of higher increase in CD4+ T cell counts. Because adherence affects CD4+ T-cell count and viral load, which consequently affect morbidity and mortality, the robustness and relevance of a result will increase with the number of distinct outcome measures that show the same result [13]. Finally, studies have shown that high ART adherence is associated with substantially lower monthly direct health-care costs including the cost of ART per patient [43-45]. Thus, STM may be an important adherence-enhancing intervention in sub-Sahara Africa where HIV is mostly hit, where there is growing number of patients requiring ART and where there is little hope of sustainable funding for HIV prevention, treatment and care.

CONCLUSION

STM of in-patients with HIV has a significant effect on adherence to HAART, immunologic recovery, development of OI, re-admission rate, hospital stay and mortality. This teaching method is novel as should be recommended as a core aspect of patient counseling particularly adherence counseling in the ART program in resource-poor settings.

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