Impact of HIV/AIDS knowledge on adherence to combined antiretroviral therapy in Niger Delta

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ABSTRACT

Background: The decision to change recommendations, medications, or communication style to promote adherence depend on valid and reliable measurement of adherence determinants which in turn ensures well focused interventions for improvement.

Objective: To determine the impact of knowledge and other determinants of adherence to combined antiretroviral therapy (cART) formerly referred to as highly active antiretroviral therapy (HAART) in Bayelsa State, Niger Delta.

Methods: The cross-sectional study involved the use of validated questionnaire to 601 consented patients attending the two human immunodeficiency virus (HIV) clinics in Bayesla State, Nigeria. Pieces of information collected include HIV knowledge, its prevention and transmission among others as well as patient's CD_4+ T cells count from case notes. Adherence was assessed by asking patients to recall their intake of prescribed doses in the last fourteen days and subjects who had 95-100% of the prescribed antiretroviral drugs were considered adherent. At 95% confidence interval, a 2-tailed p-value less than 0.05 was considered significant.

Results: Non adherence rate in 26.6% subjects is very high. Nine out of the twelve variables studied were significantly associated with adherence to cART among the respondents. These include sex ($p=0.0232$), age ($p< 0.0001$), marital status ($p=0.0007$), level of education ($p<0.0001$), occupation ($p=0.0470$), depression in the past four weeks ($p=0.0166$), knowledge of HIV and anti-retroviral therapy ($p<0.0001$), cART regimen ($p=0.0010$) as well as duration on cART ($p=0.0016$).

Conclusion: Respondents with good knowledge of HIV generally had better adherence to cART and improved immune status. This indicates the fact that improved outcomes are assured with optimum adherence to therapy. Other modifiable factors such as level of education, social support, employment status and type of regimen were major determinants of adherence as well.

Key words: HIV/AIDS, cART, HAART, Non-adherence

Impact des connaissances sur le VIH/SIDA sur l'observance du traitement combiné antirétroviral au Delta du Niger

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RESUME

Contexte: La décision de modifier les recommandations, les médications, ou le style de communication pour promouvoir l'adhésion dépend de la mesure valide et fiable de l'observance des déterminants qui, à son tour, assure les interventions bien ciblées pour l'amélioration.

Objectif: Déterminer l'impact des connaissances et d'autres déterminants de l'adhésion à la thérapie combinée antirétrovirale (TARV), anciennement appelée traitement antirétroviral hautement actif (HAART) dans l'État de Bayelsa, Delta du Niger.

Méthodes: L'étude transversale impliquait l'utilisation du questionnaire validé à 601 patients ayant consenti fréquentant les deux cliniques de virus de l'immunodéficience humaine (VIH) dans l'État de Bayesla, Nigeria. Des morceaux d'information recueillie comprennent la connaissance du VIH, sa prévention et transmission entre autres, ainsi que les comptes de cellules T CD4 + des patients à partir des dossiers. L'adhésion a été évaluée en demandant aux patients de se rappeler leur consommation de doses prescrites au cours des quatorze derniers jours et les sujets qui avaient 95-100% des médicaments antirétroviraux prescrits ont été considérés comme adhérents. A intervalle de confiance de 95%, une valeur p à 2 queues inférieure à 0,05 a été considérée comme significative.

Résultats: Le taux de non-observance chez 26,6% des sujets est très élevé. Neuf des douze variables étudiées ont été significativement associés à l'adhésion à cART parmi les répondants. Ceux-ci comprennent le sexe (p=0,0232), l'âge (p<0,0001), l'état matrimonial (p=0,0007), le niveau d'éducation (p<0,0001), la profession (p=0,0470), la dépression au cours des quatre dernières semaines (p= 0,0166), la connaissance du VIH et de la thérapie antirétrovirale (p<0,0001), régime cART (p=0,0010) ainsi que la durée sur cART (p=0,0016).

Conclusion: Les répondants ayant une bonne connaissance du VIH ont généralement une meilleure adhérence à cART et une amélioration de l'état immunitaire. Ceci indique le fait que l'amélioration des résultats est assurée avec une adhérence optimale à la thérapie. D'autres facteurs modifiables tels que le niveau d'éducation, le soutien social, le statut d'emploi et le type de régime ont été également les principaux déterminants de l'adhésion.

Mots clés: VIH / SIDA, cART, HAART, non-respect

INTRODUCTION

The Joints United Nations Programme on HIV/AIDS estimated 35.3 million people to be living with HIV in 2012, up from 29.4 million in 2001. About 1.6 million people died of AIDS in 2012, a 30% decrease since 2005. Deaths have declined partly due to anti-retroviral treatment (ART) scale-up. Intensification of efforts to combat the epidemic through new commitments and targets has been made with significant impact evident with the creation of Global Fund for HIV/AIDS.[1]

In Nigeria, by December 2011; 3,459,363 people were living with HIV and an estimated 1,449,166 required Anti-retroviral drugs (ARVs). Similarly, records from the Federal Ministry of Health indicated that the annual number of new infections in the country has been on a steady decline, decreasing from 340,015 in 2008 to 319,322 in 2010 and then slightly again to 310,620 in 2011.[2] Scale-up programmes which increase access to cART are predominantly responsible for recorded achievements. Combined ART decreases the patient's total burden of HIV, maintains function of immune system, and prevent opportunistic infections that often lead to death.

World Health Organisation recommends that accurate assessment of adherence is necessary for effective and efficient treatment planning.[3] It is well understood and documented that HIV/AIDS requires near perfect adherence to obtain successful treatment outcome. Studies have estimated the required level of adherence for sustained virological suppression to be about 95%.[4] The implication is that there is urgent need for systematic data collection and analysis to estimate the prevalence of non-adherence as well as its determinants to make strong evidence-based recommendation to improve adherence.[5]

The factors associated with medication adherence are commonly divided into five intersecting categories to include patient variables, treatment regimen, disease characteristics, patient-provider relationship and clinical setting.[6,7]

Decisions to change recommendations, medications, and/or communication style to promote adherence depend on valid and reliable measurement of adherence and its determinants.

Understanding the factors that influence adherence can increase a clinician's attention to adherence when working with susceptible patients and can inform the development of interventions to improve adherence. Several studies have been conducted to examine factors affecting adherence to cART.[8, 9, 10] The management of HIV/AIDS normally includes the use of multiple highly active antiretroviral therapy in an attempt to control the infection with very tasking adherence and in some cases drugs to treat or prevent opportunistic infections are added.

Systematic reviews have indicated that the most important and frequent factors that negatively impact adherence in developing countries are cost, stigma, alcohol abuse, lack of transportation and Pharmacy stock-outs[5]. Several studies in Nigeria have evaluated the factors associated with non-adherence to antiretroviral therapy among HIV-positive adults.[10, 11, 12, 13, 14]

In spite seeming wide publications on determinants of cART in Nigeria, there is paucity of detailed information that is specific to Bayelsa State, Niger Delta, south-south region of the country. It is thus essential to investigate the factors that determine cART adherence in the state in order to identify similarities and exceptions to the existing body of knowledge which in turn would facilitate implementing measures by healthcare professionals to improve adherence and to prevent worsening of existing adherence problems.

METHODS

The study was conducted at clinics of the two tertiary health institutions in Bayelsa State: Federal Medical Centre (FMC), Yenagoa and the Niger-Delta University Teaching Hospital (NDUTH), Okolobiri. They provide comprehensive antiretroviral services to almost 80% of all the Persons Living With HIV/AIDS (PLWHA) in the state.

The study population was 1,366 adult on cART in FMC and 987 adults in the NDUTH, who commenced antiretroviral therapy before March, 2014. Inclusion criteria were: Confirmed HIV/AIDS patients aged 15 years or older who had started antiretroviral therapy three (3) months prior to the study and are willing and able to participate. Exclusion Criteria were HIV/AIDS patients who had not started ART or had started less than three (3) months prior to the study, HIV/AIDS patients who were less than 15 years old as well as adult patients that were not willing and not able to participate. Appropriate sample size was determined based on the total number of enrolled patients and a precision level of 5%, which was a minimum of 310 patients from FMC and 285 patients from NDUTH.

Study design

The multi-site cross-sectional study involved interviewer administration of an adapted and pretested questionnaire in English language which was appropriately translated to illiterate patients in local

dialect by trained data collectors.

The ADULT AIDS Clinical Trial Group (AACTG) follow up Questionnaires for screening adherence and barriers to adherence was the adapted tool, with slight modifications.[15] The tool was divided into various sections such as socio-demographic data, socioeconomic data, educational status, psychosocial history, HIV knowledge, prevention and transmission of HIV and adherence to antiretroviral drug. In addition, the patient's medical records were reviewed to gather information about the CD4+ T cells count.

Data generated were sorted, coded and analyzed using Statistical Package for Social Sciences (SPSS) and Graph Pad Prism for Windows Instat Version 3 (GraphPad Software San Diego, CA, USA). At 95% confidence interval, a 2-tailed p-value less than 0.05 was considered significant using Chi Squared test or Fisher's exact test.

RESULTS

Nine out of the twelve variables studied were significantly associated with adherence to cART among the respondents. These include sex of respondents ($p=0.0232$), age of respondents ($p< 0.0001$), marital status ($p=0.0007$), level of education ($p<0.0001$), occupation ($p=0.0470$), depression in the past four weeks ($p=0.0166$), knowledge of HIV and anti-retroviral therapy ($p<0.0001$), cART Regimen ($p=0.0010$) as well as duration on cART ($p=0.0016$).

Seventy Seven percent of the female population was adherent to antiretroviral therapy as against 68.4% of their male counterparts. Highest degree of adherence (91.5%) was observed among the age group of 46-55 years followed by 81.5% for age group of 36-45. Younger age group of 15-25 years had the worst adherence rate of 83.3% followed by the elderly patients (>56 years) who were 61.5% non-adherent to their cART. As regard marital status, married respondents had the best adherence of 80.1% followed by 73.9% for co-habiting partners while the divorcees had the worst adherence rate of 58.8%.

More educated subjects were better adherent of cART where highest rate of 86.5% was recorded for respondents with tertiary education followed closely by those with secondary education with 73.0% rate of adherence. Retired and unemployed subjects were the least adherent with a value of 45.5% and 34.9% respectively. Psychological factors that significantly associated with adherence include depression ($p=0.0131$) while alcohol use as well as awareness of HIV status by friends and relatives had no significant association ($p>0.05$).

Table 1: Table 1: Demographic variables and adherence to cART

Variables	Adherence Category		Total	P value
	Adherent n (%)	Non Adherent n (%)		
Sex				
Male	173(28.8)	80(13.3)	253(42.0)	0.0196
Female	268(44.6)	80(13.3)	348(57.9)	
Age (year)				
15-25	24 (4.0)	20 (3.3)	44 (7.3)	< 0.0001
26-35	216 (35.9)	98 (16.3)	314 (52.3)	
36-45	123 (20.5)	28 (4.7)	151 (25.1)	
46-55	65 (10.8)	6 (1.0)	71 (11.8)	
≥ 56	13 (2.2)	8 (1.3)	21 (3.5)	
Marital Status				
Single	102 (17.0)	45 (7.5)	147 (24.5)	0.0007
Married	261 (43.4)	65 (10.8)	326 (54.2)	
Divorced	10 (1.7)	7 (1.2)	17 (2.8)	
Widowed	45 (7.5)	26 (4.3)	71 (11.8)	
Co-habiting	23 (3.8)	17(2.8)	40 (6.7)	
Level of education				
None	6 (1.0)	6 (1.0)	12 (2.0)	< 0.0001
Primary	94 (15.6)	55 (9.2)	149 (24.8)	
Junior Secondary	8 (1.3)	13 (1.2)	21 (3.5)	
Senior Secondary	154 (25.6)	57 (9.5)	211 (35.1)	
Tertiary	179 (29.8)	29 (4.8)	208 (34.6)	
Occupation				
Student	17 (2.8)	7 (1.2)	24 (4.0)	0.0470
Employed full-time	131 (21.8)	31 (5.2)	162 (27.0)	
Unemployed	41 (6.8)	22 (3.7)	63 (10.5)	
Self-employed	241 (40.1)	95 (15.8)	336 (55.9)	
Retired	6 (1.0)	5 (0.8)	11 (1.8)	
Employed part-time	5 (0.8)	0 (0.0)	5 (0.8)	

cART= Combined antiretroviral therapy

There was a significant association between knowledge of subjects about HIV and adherence to cART ($p<0.0001$). With respect to causes of AIDS, those who correctly associated HIV with the immune suppressing syndrome had the highest adherence rate of 83.8%. The subjects who claimed ignorance as to the causes of AIDS and those who thought it is caused by bacteria were the worst adherent with a respective non-adherence cART rate of 44.4% and 53.3%. Respondents who knew about mother to child transmission adhere much more to therapy (76.9%) as against 56.3% adherence rate for ignorant subjects. A good proportion of about 26.0% had poor adherence in spite their correct knowledge of transmission modes through blood transfusion, use of sharp objects, surgical tools as well as sexual intercourse in addition to realizing that touching of infected persons, mixing with them or sharing clothes or food cannot lead to transmission (Tables 2 & 3).

Table 2: Effect of HIV Knowledge and Transmission on adherence

Variables	Adherence Category		Total	P value
	Adherent n (%)	Non Adherent n (%)		
Cause of AIDS				
HIV	283 (41.7)	55 (9.2)	338 (56.2)	< 0.0001
Bacteria	14 (2.3)	16 (2.7)	30 (5.0)	
Spiritual Forces	45 (7.5)	13 (2.2)	58 (9.7)	
Malaria Parasite	4 (0.7)	0 (0.0)	4 (0.7)	
Don't Know	95 (15.8)	76 (12.6)	171 (28.5)	
Infected Mother to Child				
Yes	383 (63.7)	115 (19.1)	498 (82.9)	< 0.0001
No	42 (7.0)	37 (6.2)	79 (13.1)	
Don't Know	16 (2.7)	8 (1.3)	24 (4.0)	
Transfusion of Infected Blood				
Yes	440(73.2)	160 (26.6)	600 (99.8)	0.5466
Don't Know	1 (0.2)	0 (0.0)	1 (0.2)	
Use of Infected needles				
Yes	431 (71.7)	160 (26.6)	591 (98.3)	0.0548
Don't Know	10 (1.7)	0 (0.0)	10 (1.7)	
Touching/Playing with an Infected Person				
Yes	3 (0.5)	17 (2.8)	20 (3.3)	< 0.0001
No	435 (72.4)	141 (23.5)	576 (95.8)	
Don't Know	3 (0.5)	2 (0.3)	5 (0.8)	
Sharing of Clothes with an Infected Person				
Yes	1 (0.2)	6 (1.0)	7 (1.2)	0.0017
No	415 (69.1)	144 (24.0)	559 (93.0)	
Don't Know	25 (4.2)	10 (1.7)	35 (5.8)	
Interacting with Infected Persons at Work/School				
Yes	1 (0.2)	2 (0.3)	3 (0.5)	0.0055
No	436 (72.5)	151 (25.1)	587 (97.7)	
Don't Know	4 (0.7)	7 (1.2)	11 (1.8)	
Sharing of Food with Infected Persons				
Yes	2 (0.3)	2 (0.3)	4 (0.7)	0.4160.
No	430 (71.5)	153 (25.5)	583 (97.0)	
Don't Know	9 (1.5)	5 (0.8)	14 (2.3)	
Sharing of Toilet				
Yes	11 (1.8)	13 (2.2)	24 (4.0)	< 0.0001
No	405 (67.4)	93 (15.5)	498 (82.9)	
Don't Know	25 (4.2)	54 (9.0)	79 (13.1)	
Use of Infected Surgical Tools				
Yes	414 (68.9)	122 (20.3)	536 (89.2)	< 0.0001
No	19 (3.2)	33 (5.5)	52 (8.7)	
Don't Know	8 (1.3)	5 (0.8)	13 (2.2)	

HIV= Human immunodeficiency

A significantly high proportion (96.0%) know the importance of condom use during sexual intercourse as a means of preventing HIV infection but it is disheartening to still have as much as about 4.0% to be ignorant of this simple fact. More so, about one quarter was still poorly adherent to cART. There was significance association of knowledge of abstinence, being faithful sexual partner, avoidance of multiple sexual partners, and safe blood transfusion with transmission of HIV by majority of the subjects but with high rate of about 25.0% non-adherence. However, 70.0% knew having sexual intercourse with a virgin cannot prevent or cure HIV indicating high degree (30.0%) of exhibited ignorance (Table 3).

Table 3: Impact of HIV transmission knowledge and prevention on adherence

	Adherence Category		Total	P value
	Adherent n (%)	Non Adherent n (%)		
Bite of Mosquitoes				
Yes	95 (15.8)	23 (3.8)	118 (19.6)	< 0.0001
No	302 (50.2)	94 (15.6)	396 (65.9)	
Don't Know	44 (7.3)	43 (7.2)	87 (14.5)	
Use of blade of an Infected Person				
Yes	421 (70.0)	130 (21.6)	551 (91.7)	< 0.0001
No	13 (2.2)	30 (5.0)	43 (7.2)	
Don't Know	7 (1.2)	0 (0.0)	7 (1.2)	
Sex with HIV infected person without condom				
Yes	433 (72.0)	146 (24.3)	579 (96.3)	< 0.0001
No	0 (0.0)	5 (0.8)	5 (0.8)	
Don't Know	8 (1.3)	9 (1.5)	17 (2.8)	
Use of condom during sex				
Yes	418 (69.6)	159 (26.5)	577 (96.0)	0.0386
No	5 (0.8)	0 (0.0)	5 (0.8)	
Don't Know	18 (3.0)	1 (0.2)	19 (3.2)	
Avoid sex with Multiple Partners				
Yes	414 (68.9)	149 (24.8)	563 (93.7)	0.9438
No	15 (2.5)	6 (1.0)	21 (3.5)	
Don't Know	12 (2.0)	5 (0.8)	17 (2.8)	
Sex with a Virgin				
Yes	37 (6.2)	22 (3.7)	59 (9.8)	< 0.0001
No	341 (56.7)	83 (13.8)	424 (70.5)	
Don't Know	63 (10.5)	55 (9.2)	118 (19.6)	
Abstinence				
Yes	386 (64.2)	126 (21.0)	512 (85.2)	0.0139
No	38 (6.3)	27 (4.5)	65 (10.8)	
Don't Know	17 (2.8)	7 (1.2)	24 (4.0)	
Be faithful to your Partner				
Yes	427 (71.0)	131 (21.8)	558 (92.8)	< 0.0001
No	5 (0.8)	27 (4.5)	32 (5.3)	
Don't Know	9 (1.5)	2 (0.3)	11 (1.8)	
Use of Safe Blood for Transfusion				
Yes	421 (70.0)	153 (25.5)	574 (95.5)	0.9798
No	15 (2.5)	5 (0.8)	20 (3.3)	
Don't Know	5 (0.8)	2 (0.3)	7 (12)	

HIV= Human Immunodeficiency virus

A significantly (p=0.0165) very high proportion of the subjects (98.8%) demonstrated their strong believe in the positive effects of cART on health status out of which 73.0% were adherent to cART HAART. The 25.0% non-adherent fraction of this group is however very high and a cause for concern. Out of 76.9% who believed in the administration of antiretroviral drugs, 17.6% were poor adherent to cART. Twenty Six percent of the 79.0% subjects who appreciated the importance of CD_4 cell count in antiretroviral therapy were non-adherent while 21.0% who failed to understand this fact is on high side. Of the 82.5% who acknowledged the need to take cART for life, 25.0% adhere poorly to therapy. The subjects who do not know are too many as well (17.5%) for epidemiological reasons (Table 4).

Table 4: Knowledge of HIV and cART on adherence status

	Adherence Category		Total	P value
	Adherent n (%)	Non Adherent n (%)		
Believe in positive effect of cART on health				
Yes	439 (73.0)	155 (25.8)	594 (98.8)	0.0165
Don't know	2 (0.3)	5 (0.8)	7 (1.2)	
Use of ARV drugs by infected pregnant women				
Yes	356 (59.2)	106 (17.6)	462 (76.9)	0.0005
No	61 (10.1)	43 (7.2)	104 (17.3)	
Don't Know	24 (4.0)	11 (1.8)	35 (5.8)	
Knowledge of Importance of CD_4 CELL count				
Yes	351 (58.4)	124 (20.6)	475 (79.0)	0.0006
No	87 (14.5)	27 (4.5)	114 (19.0)	
Don't Know	3 (0.5)	9 (1.5)	12 (2.0)	
ARV drugs are taking for life				
Yes	372 (61.9)	124 (20.6)	496 (82.5)	< 0.0001
No	45 (7.5)	8 (1.3)	53 (8.8)	
Don't Know	24 (4.0)	28 (4.7)	52 (8.7)	
Overall knowledge				
Good knowledge (>70.0% score)	425 (70.7)	132 (22.0)	557 (92.7)	< 0.0001
Poor knowledge (<70.0% score)	16 (2.7)	28 (4.7)	44 (7.3)	

HIV= Human Immunodeficiency virus, cART= combined antiretroviral therapy

Majority of the patients (354; 58.9%) were on zidovudine/lamivudine/nevirapine regimen (first line one tablet twice daily fixed dose combination) of which 269 (76.0%) were adherent. The second most frequently utilized combination was tenofovir/lamivudine/efavirenz (alternative first line one tablet once daily fixed dose combination (149; 24.8%) with adherence proportion of 115 (77.2%). The highest adherence rate of 78.2% was achieved with tenofovir/lamivudine/lopinavir/ritonavir regimen (second line two tablets twice daily fixed dose combination). The other three combinations were associated with high degree of non-adherence rate ranging from 46.0% for zidovudine/lamivudine/efavirenz to 53.0% for tenofovir/lamivudine/ nevirapine.

Adherence rates generally decreases as the therapy duration become prolonged with 88.1%, 75.3% and 67.6% for those on cART for 6-11 months, 12-17 months and >24 months respectively. However, the result also revealed that awareness of status by the respondents' family (p=0.8596) as well as awareness of status by the respondents' friends (p=0.2442) and frequency of alcohol use by the respondents (p=0.7449) were

not associated with adherence.

Impact of adherence pattern on immune status indicated a statistically significant association between cART and CD_4 cells count ($p<0.0001$). A CD_4 cells count of <200 in majority of the subjects (332; 55.2%) at therapy initiation was reduced to fewer numbers (84; 14.0%) at study period. A very low proportion (33; 5.5%) of the respondents with CD4 cells count of >350 at therapy initiation increased to almost two-third (238; 56.3%) during the study (Table 5).

Table 5: HIV and ART-related factors associated with adherence

Variables	Adherence Category		Total	p- value
	Adherent n (%)	Non Adherent n (%)		
cART regimen				
AZT/3TC/NEV	269 (44.8)	85 (14.1)	354 (58.9)	0.0010
AZT/3TC+EFZ	28 (4.7)	24 (4.0)	52 (8.7)	
TDF/3TC/NEV	7 (1.2)	8 (1.3)	15 (2.5)	
TDF/3TC/EFZ	115 (19.1)	34 (5.7)	149 (24.8)	
AZT/3TC+LPV/r	4 (0.7)	4 (0.7)	8 (1.3)	
TDF/3TC+LPV/r	18 (3.0)	5 (0.8)	23 (3.8)	
Duration on cART (months)				
3-5	44 (7.3)	11 (1.8)	55 (9.2)	0.0016
6-11	59 (9.8)	8(1.3)	67 (11.1)	
12-17	61 (10.1)	20 (3.3)	81 (13.5)	
18-23	41 (6.8)	8 (1.3)	49 (8.2)	
≥24	236 (39.3)	113 (18.8)	349 (58.1)	
Impact of Adherence pattern on Immune Status				
CD_4 cells count at ART initiation				
< 200	242 (40.3)	90 (15.0)	332 (55.2)	0.0721
> 200 but < 349	179 (29.8)	57 (9.5)	236 (39.3)	
> 350 but < 499	15 (2.5)	6 (1.0)	21 (3.5)	
> 500	5 (0.8)	7 (1.2)	12 (2.0)	
CD_4 cells count at study period				
< 200	53 (8.8)	31(5.2)	84 (14.0)	< 0.0001
> 200 but < 349	149 (24.8)	30 (5.0)	179 (29.8)	
> 350 but < 499	96 (16.0)	63 (10.5)	159 (26.5)	
> 500	143 (23.8)	36 (6.0)	179 (29.8)	

HIV= Human Immunodeficiency virus, cART= combined antiretroviral therapy
AZT= Zidovudine, 3TC= Lamivudine, NEV= Nevirapine, EFZ= Efavirenz
TDF= Tenofovir, LPV/r =Lopinavir/ritonavir

DISCUSSION

The significant association of nine variables with adherence to cART therapy among the respondents which include sex, age, marital status, level of education , occupation, depression in the past four weeks, cART regimen, therapy duration and knowledge of HIV and anti-retroviral therapy can assist health care professionals in stratifying patients who need to be more supported as regard therapy adherence.

Of the variables, knowledge of HIV and anti-retroviral therapy as well as its prevention and transmission are the most important modifiable factors and interventions to improve them would impact positively on adherence rates. These could be through enlightenment programmes among the patients, strengthened pharmaceutical care and relevant curricula inclusion at the various levels of education. Higher literacy level would also encourage patient to be more knowledgeable and be well informed both in interaction with health care providers and in sourcing for information. Higher level of education also improves financial status and is known to be a positive predictor of adherence.[9,16,17]

The higher adherence rates among female subjects particularly those with 100.0% adherence shows the probability of greater commitment to their medication. This contradicts some earlier reports where male gender was associated with better adherence.[10, 11, 15] Higher level of education and better knowledge of HIV were actually observed among these females' subjects both of which are positive predictors of adherence. The prevalence of non-adherence among the youngest age group may be an indication of a combination of frustration, stigma, denial and financial burden while that of the elderly might be resulted from inadequate support from care givers and difficulties in understanding and following ART instructions as well low socio economic profile. This underscores the need for special interventions among these categories.

Higher adherence among subjects with supportive partners and means of livelihood calls for improved social support from stakeholders among lonely and subjects whose socioeconomic status are very poor. [18] There are conflicting evidence about association of patient variables including socio-demographic factors and adherence to cART but when an association is found, the direction is consistent, with male sex, white ethnicity, older age, higher income, higher education and literacy correlate with better adherence.[15, 19, 20] Accurate diagnosis and appropriate management including psychotherapy is highly needed for depressed patients. Depression and other psycho-social factors such as psychiatric illness, active drug or alcohol use, stressful life events, lack of social support are negative predictors of adherence.[19] Enduring therapeutic relationships between health-care providers and patients would promote achievement of desired outcomes. Patient-provider relationship that may influence adherence include patient's perceptions of the providers competence, affective tone of the relationship, warmth, trust, open communication, cooperation, willingness to include the patient in treatment decisions, adequacy of referrals, concordance of race/ethnicity between patient and provider and the patients overall satisfaction and trust in the provider and clinic staff.[21]

It is worrisome that some of the participants are ignorant of HIV causative agents which actually reflected in their worst case scenarios of non-adherence to cART. Better degree of adherence among respondents with good knowledge of mother to child transmission also indicates the need for the subjects especially the females of reproductive age group to be well enlightened of this important fact. Available evidence suggests that a good level of understanding about HIV/AIDS and awareness of the consequences of non-adherence are associated with good adherence.[16, 17, 21]

A record of poor adherence among one-quarter of respondents with correct knowledge of transmission modes such as sexual intercourse, in addition to realizing that touching of infected persons or interacting with them or sharing clothes or food cannot lead to transmission is of grave concern. This implied that great commitment, social and financial support as well as good attitude towards optimal adherence are essential in addition to appreciable relevant knowledge. Dedicated adherence programme, and satisfaction with past experiences in the healthcare system have been shown to promote adherence.[15]

Awareness of importance of condom use to prevent transmission is promising. The correct association of abstinence, being faithful sexual partner, avoidance of multiple sexual partners with transmission of HIV by majority of the subjects is encouraging. However, the ignorant proportions and high rate of about 25.0% to 30.0% non-adherence is disturbing due to its public health implication. Continuous enlightenments campaign is mandatory especially among the poorly adherent populations.[16,17,21]

The demonstrated strong believe in the positive effects of cART on health status by a significant proportion of participants is a source of encouragement to healthcare providers but non-adherent fraction of about one-

quarter of this group is however very high and a cause for concern. Failure of about one-fifth of the subjects to appreciate the importance of CD_4 cells count and the need to take cART for life also call for serious educational interventions. The fact that a good proportion of those who realized these facts were still poorly adherent to therapy indicate interplay of many variables in adherence to these medications and its adequate understanding.

Adherence rates were somewhat similar for the two most commonly utilized regimens among the respondents. These include zidovudine/lamivudine/nevirapine regimen and tenofovir/lamivudine/ efavirenz. The combination with the highest rate of adherence (tenofovir/lamivudine/lopinavir/ritonavir) should be considered in poorly adherent subjects. The other three combinations which were associated with high degree of non-adherence should be avoided as much as possible particularly in poorly adherent subjects. These include zidovudine/lamivudine/efavirenz, tenofovir/lamivudine/ nevirapine and zidovudine/ lamivudine/lopinavir/ritonavir) combinations. Different side effects profile, adverse events might be responsible and had long been documented to affect adherence.[22, 23] Number and type of different medications prescribed [20, 24] and regimen that "fit" into the patient's daily routine were strongly associated with adherence among HIV patients.[15, 19] Higher pill burden have also being documented to lower the adherence.[3]

With respect to duration of therapy, adherence is mostly suspected among subjects who are on cART for less than six months and those who have taken it for more than 24 months which call for special counseling for them.

Details of reasons giving by subjects themselves for non-adherence has been published somewhere[25] alongside comparative degree of adherence between study centers some of which include simply forgot, too busy with other things, felt better, and wanted to avoid the side-effects. However, systematic reviews have indicated that the most important and frequent factors that negatively impact adherence in developing countries are cost, stigma, alcohol abuse, lack of transportation and pharmacy stock-outs.[21,26] In spite heavily subsidized cART in the Nigerian programme, patients have to bear the cost of transportation to and from the health facility as well as the cost of laboratory testing, which can be a huge burden on very poor patients.

Aspects of the clinical setting that may be associated with improved adherence include reliable primary care, involvement in a dedicated adherence programme, availability of transportation and childcare, pleasantness of the clinical environment, convenience in scheduling appointments, perceived confidentiality and satisfaction with past experiences in the healthcare system.[15,27]

The AIDS Clinical Trials Group protocol 370 found that adverse events were the strongest predictor of non-adherence and patients who experienced adverse events were 16 times less likely to be 95-100% adherent to medications.[23]

The extremely significant difference between the immune status of adherence and non-adherence categories at therapy initiation and during the study period further authenticate the effectiveness of the utilized cART in the state. This is also consistent with a very low proportion of about five percent of the respondents with CD4 cells count of >350 at therapy initiation which increased to almost two-third during the study. This observation is a reassurance to the fact that with optimum therapy adherence patient can enjoy good quality of life and prevention of opportunistic infections. Non-adherence to therapy would lead to more compromised immune status, development and progression of opportunistic infections, worsen quality of life resulting in depression and poorer adherence. The result obtained in this study was similar to a study in Ghana with an adherence proportion of 85.5% in which the baseline CD_4 count of mean of 77.4cells/°l increased to 229.2, 270.0, and 297.6 cells/°l at 6, 12, and 18 months of treatment respectively ($P < 0.0001$ at each time point).[28]

The major strength is that such study is rare in the state and the patients interviewed covers the two tertiary hospitals in the state, and all consented eligible adults were interviewed which ensure fair representation of HIV/AIDS patients in Bayelsa State. It is also very detail concerning relevant knowledge expected of PLWHA. In addition well validated study instrument was adapted. Study limitations include possible recall bias leading to possibility of somewhat subjective information, relatively small sample size though fairly representative, cross sectional nature with one point contact with the respondents.

CONCLUSION

Respondents with good knowledge of HIV generally had better adherence to cART and improved immune status. This indicates the fact that quality of life

improvement is assured with optimum adherence to therapy. Other modifiable factors such as level of education, social support, employment status and type of regimen are major determinants. Policy need promulgated and implemented to improve all these determinants appropriately. The cART regimens mostly implicated for non- adherence should be thoroughly investigated and avoided in patients with poor history of adherence. Patients should be stratified and specifically applicable modalities to handle their respective weaknesses should be put in place and supported with updated policy. These include who are new on cART and those who have being on it for more than 24months, the seemingly lonely, the socially deprived, and the poorly knowledgeable, less educated, the youngest categories and elderly.

ACKNOWLEDGMENT

The managements of Federal Medical Centre (FMC), Yenagoa and the Niger-Delta University Teaching Hospital (NDUTH), Okolobiri are appreciated for ethical approval to conduct the study. We acknowledge also the consented patients. There was no conflict of interest associated with the work.

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