

FACTORS INFLUENCING ADHERENCE TO ANTI-RETROVIRAL THERAPY AMONG PERSONS LIVING WITH HIV/AIDS IN ENUGU STATE SOUTHEAST NIGERIA

Comment [BB1]:

Abstract

HIV/AIDS is a leading cause of death in sub-saharan Africa. Nigeria has the second largest HIV epidemic in the world and one of the highest rates of new infection in sub-Saharan Africa with 1.9 million people living HIV in 2018. Antiretroviral therapy (ART) has significantly reduced morbidity and mortality, prolonged life expectancy and improved quality of life among people living with HIV/AIDS infection (PLWHA).

Comment [BB2]:

This study assessed the effect of health education on factors influencing adherence to ART among PLWHAs in Enugu State.

Methodology: A health education intervention was carried out among 312 persons living with HIV/AIDS receiving ART in Enugu metropolis to improve their perception and adherence to antiretroviral therapy.

A structured questionnaire was used to collect data from 312 people living with HIV/AIDS (156 each in the study and control groups), who were selected by multistage sampling. Subsequently, health education was conducted among the study group. Three months after this intervention its effects were assessed through a survey using the same structured questionnaires employed in the baseline survey.

Results: Knowledge of supportive and limiting factors of adherence improved significantly among the study group than the controls post-intervention ($P < 0.001$). The factors that facilitated adherence included follow-up visits, adequate information education/counseling and supportive relationships. The limiting factors were drug side-effects, forgetfulness, finance and travel time to clinic.

Conclusions: Health education improved knowledge of supportive factors of ART adherence among PLWHAs in Enugu State, and this should be promoted.

Keywords: Health education, supportive factors, limiting factors, adherence.

Introduction

HIV/AIDS continues to be a major global public health issue. Despite the improved understanding of the epidemiology of HIV/AIDS worldwide, the epidemic has continued to grow in Africa with disastrous consequences [1]. HIV/AIDS has reduced life expectancy deepened poverty, lessened labour productivity and eroded the capacity of government to provide essential services [1,2].

Findings from the 2019 National HIV/AIDS Indicator and Impact Survey (NAIIS) shows that Nigeria, Africa's most populous nation has an HIV prevalence of 1.4%. Enugu State has HIV prevalence of 2.0% [3,4].

The treatment and care of HIV-infected people requires comprehensive integration of patient-centered medical and social services. Notable components of successful clinical care include early diagnosis, access to

Comment [BB3]: It will be more better if you will start your introduction by adding some line about the HIV/AIDS....

care, antiretroviral therapy, symptom control, treatment of opportunistic infections and end of life care [5]. The achievement of these objectives requires multisectoral and multidisciplinary teams that are cross-linked to provide a continuum of care that involves patients, their families, health-care providers, governmental and non-governmental organizations, and society at large [6].

Several patient related factors may influence the choice and outcome of ART in resource-limited countries. In Nigeria, many patients may delay visiting a clinic until they present with advanced HIV disease because of stigma and absence of counseling and testing. Success with any medication depends not only on the intrinsic properties of the drugs, but also on the ability of the patient to take the medication [7].

A number of factors affect adherence. These include the patients' belief systems regarding the etiology, as well as their knowledge of the management and treatment of HIV infection. Other factors include the social, emotional and financial status of the patient as well as the tolerability, dosing schedule and pill burden of the drug regimen. Active use of illicit drugs or alcohol, psychiatric disease and depression are also important factors promoting non-adherence. Young people and those with a disruptive social life are also likely to be non-adherent to ART. Several reports have observed a significant correlation between low pill burden and improved virological response [8,9].

Comment [BB4]: [8,9].

The potential for improved adherence is also maximized when clinicians develop long-term plans for treatment and are careful to select regimens that will avoid drug interactions and side effects. Prescribing regimens with

low pill burdens, infrequent dosing, minimal toxicities, and no food interactions are all associated with optimal adherence. [10]

Comment [BB5]: [10].

Adherence to ART is key and vital for the successful management of HIV/AIDS infection. Adherence is the act of following a course of medication in exactly the manner it is prescribed [11].

Factors known to improve adherence include; provision of free medications, engagement of family members or treatment supporters in adherence education and provision of effective adherence counseling. Other factors known to improve adherence include patients' knowledge of the disease, low pill burden and less adverse effects, clinicians knowledge of the disease and continuous availability of drugs. Adherence has been shown to be the single most important factor in successful HIV therapy [12].

Factors associated with poor adherence include; poor patient-doctor relationship, high pill burden, forgetfulness and dementia. Other factors include depression, lack of patient education, drug toxicity, severity of illness, lack of social support, cost of treatment and distance from facility [13].

Other social influences on adherence are poverty, illiteracy, level of education and family support. It is imperative to provide the patient with basic knowledge about ARVs and HIV disease, and to stress the importance of adherence before initiating ART [14].

This study assessed the effect of health education on factors influencing adherence to anti-retroviral therapy among PLWHAs in Enugu State Southeast Nigeria.

MATERIALS AND METHODS

Enugu State is one of the five states in the Southeast geopolitical zone of Nigeria. The State has seventeen local government areas and is bounded on the east by Ebonyi State, in the West by Anambra State, the North by Kogi and Benue States and in the South by Abia State. The population of the State is about 3.32 million according to the 2006 national population census; with a growth rate of 2.83% [15]. The inhabitants are mainly of the Igbo tribe and are predominantly Christians. Most of the urban dwellers are civil servants, traders or artisans while rural dwellers are mainly farmers.

The study was an intervention study involving a before and after comparison of the knowledge and ART adherence pattern of PLWHAs subjected to a 3-day intensive health education training and adherence counseling on ART with those not trained. A total of 312 patients participated in the study; 156 in the study group and 156 in the control group. A total of 4 facilities, offering ART services were selected for this study; University of Nigeria Teaching Hospital, Enugu State University Teaching Hospital, Annunciation Specialist Hospital and Mother of Christ Specialist Hospital. Out of the 4 selected ART hospitals in Enugu metropolis, 2 served as the intervention centers while the other 2 served as the control centers. The study centers also were located on the out sketch of Enugu metropolis while the control centers were at the heart of the town again limiting the possibility of cross-interference.

A multistage sampling technique was applied. The sample size was proportionally allocated to the facilities based on the patient's load. A systematic sampling technique was then used to select participants as they presented for their clinic visits using the clinic, attendance register. The questionnaire was pretested in a health facility which was not selected for the main study. Ambiguities or deficiencies in the study instruments were then revised.

Quantitative data was collected using interviewer-administered semi-structured questionnaires. Responses were elicited on the socio-demographic characteristics, knowledge of HIV manifestations, benefits and side effects of ART, knowledge and practice of adherence to ART.

The research was conducted in 3 phases. The first phase was a baseline data collection. The second phase was a 3-day intensive health education intervention on ART and adherence counseling which involved only the study group. The third phase was the post health education intervention evaluation which took place after three months of the intervention. The effects were assessed using the same interviewer-administered questionnaires employed in the baseline study. However, at the end of the post-intervention assessment, health education on HIV/AIDS transmission and adherence was provided to the control group.

Data entry and analysis were done using statistical package for social sciences (SPSS) version 22. Frequency tables and cross-tabulations were also generated. Descriptive statistics, frequencies, and proportions were derived for categorical variables. Chi-square test of statistical significance

and student t-test were used in the analysis. The level of statistical significance was set at a predetermined P-value of < 0.05 .

The questionnaires and data are available at the Community Medicine Department, Enugu State University College of Medicine library and will be destroyed after 5 years.

Ethics Approval and Consent

Ethical approval for the study was obtained from the Health Research and Ethics Committee of Enugu State University Teaching Hospital and the management of selected health facilities. Written informed consent were obtained from the participants which gave a detailed account of the study objectives, procedures, risks, and benefits. Study participants will benefit from this study as data generated will be used to drive policies and plan interventions that will benefit PLWHA in the near future.

RESULTS

A total of 312 people living with HIV/AIDS (PLWHA) were studied, one hundred and fifty six (156) each in the study and control groups.

The age range of the respondents was 25-44years. Majority of them were married and had secondary school education. The mean age of the group was 34.1 ± 6.5 years while that of the control group was 36.8 ± 9.6 years. Both the study and control groups at baseline were statistically comparable ($P < 0.05$) in marital status, religion and occupational characteristics.

However the differences observed in the age structure, sex distribution and educational level between the study and control groups at baseline were statistically significant ($P < 0.05$); table 1.

Table 1. Socio-demographic Characteristics of the respondents at baseline.

| Characteristics | Study group n = 156 N (%) | Control group n = 156 N (%) | χ^2 | P-Value |
|--------------------------|---------------------------------|-----------------------------------|----------|---------|
| Age | | | | |
| Mean \pm SD | 34.1 \pm 6.5 | 36.8 \pm 9.6 | 0.063* | 0.950 |
| Age in groups | | | | |
| 15 – 19 | 0(0.0) | 3(1.9) | 6.542 | 0.001 |
| 20 – 24 | 1(0.6) | 7(4.5) | | |
| 25 – 29 | 33(21.2) | 24(15.4) | | |
| 30 – 34 | 51(32.7) | 40(25.6) | | |
| 35 – 39 | 40(25.6) | 29(18.6) | | |
| 40 – 44 | 22(14.1) | 17(10.9) | | |
| 45 – 49 | 7(4.5) | 9(5.8) | | |
| 50 – 54 | 0(0.0) | 16(10.3) | | |
| 55 – 60 | 0(0.0) | 11(7.0) | | |
| 60 & above | 2(1.3) | 0(0.0) | | |
| Sex | | | | |
| Male | 33(21.2) | 57(36.5) | 8.99 | 0.003 |
| Female | 123(78.9) | 99(63.5) | | |
| Marital Status | | | | |
| Single | 40(25.6) | 59(37.8) | 0.195 | 0.846 |
| Married | 88(56.4) | 71(45.5) | | |
| Widowed | 17(10.9) | 20(12.8) | | |
| Divorced | 11(7.1) | 6(3.8) | | |
| Educational Level | | | | |
| Primary | 19(12.2) | 24(15.4) | 4.942 | 0.001 |

| | | | | |
|---------------------|----------|-----------|-------|-------|
| Secondary | 68(43.6) | 69(44.2) | | |
| Post secondary | 67(42.9) | 56(35.9) | | |
| No formal education | 2(1.3) | 7(4.5) | | |
| Religion | | | | |
| Anglican | 51(32.7) | 14(9.0) | 1.298 | 0.206 |
| Catholic | 48(30.8) | 102(65.4) | | |
| Pentecostal | 43(27.6) | 34(21.8) | | |
| Others | 14(8.9) | 6(3.8) | | |
| Occupation | | | | |
| Civil servants | 49(31.4) | 56(35.9) | 1.268 | 0.206 |
| Trader/Business | 39(25.0) | 41(26.3) | | |
| Farmers | 14(9.0) | 8(5.1) | | |
| Artisan | 54(34.6) | 51(32.7) | | |

Table 2 shows the respondents knowledge of the nature of HIV/AIDS disease at baseline and post intervention. At baseline, over 80% of the study and control groups identified AIDS as a serious disease, that persons with HIV can still live active life and demonstrated the need for routine HIV screening during pregnancy. This was not statistically significant. However, knowledge of availability of drugs for HIV treatment was statistically significant among PLHWA in study group than those in the control group at baseline (P=0.042).

Post-intervention, there was increased knowledge of the nature of HIV/AIDS disease among the study when compared with the control group. The difference in knowledge among all variables was statistically significant.

UNDER PEER REVIEW

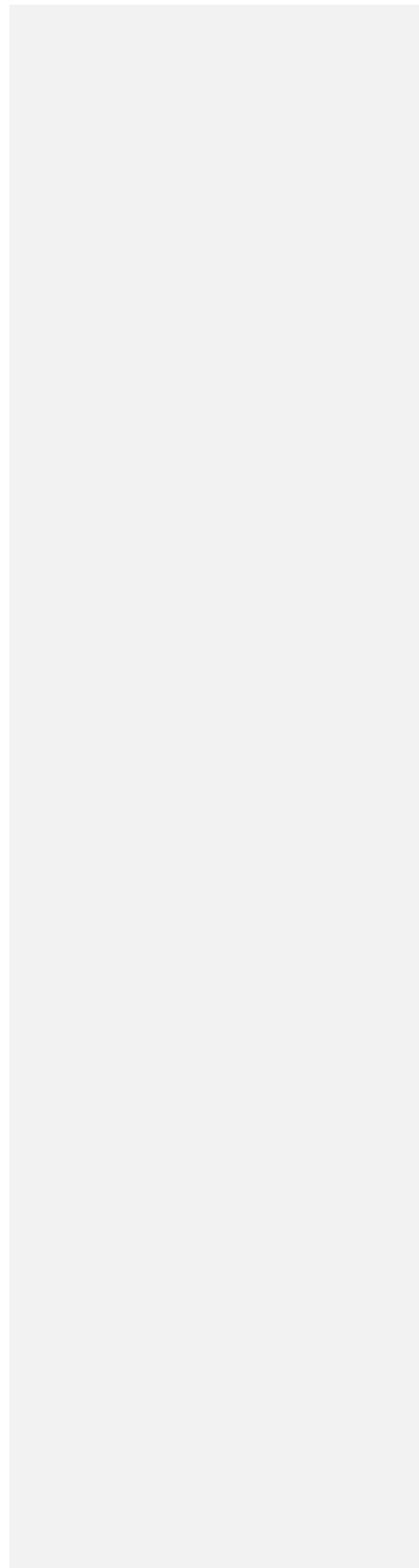


Table 2: Respondents' knowledge of the nature of HIV/AIDS disease at baseline and post intervention.

| Knowledge | Baseline | | | | Post Intervention | | | |
|---|---------------|-----------------|-------|-------|-------------------|-----------------------|--------|--------|
| | N = 156 | | X2 | P | N = 156 | | X2 | P |
| | Study b/f (%) | Control b/f (%) | | | Study after (%) | Control after b/f (%) | | |
| AID is a serious disease | 136(87.2) | 139(89.1) | 0.28 | 0.599 | 156(100.0) | 140(89.7) | 16.86 | <0.001 |
| Drugs available for treatment of people with HIV | 88(56.4) | 70(44.9) | 4.15 | 0.042 | 154(98.7) | 65(41.7) | 121.34 | <0.001 |
| If a person is HIV positive, he has AIDS | 46(29.5) | 43(27.6) | 0.14 | 0.707 | 24(15.4) | 46(29.5) | 8.91 | 0.003 |
| All antenatal patients should be routinely tested for HIV | 125(80.1) | 131(84.0) | 0.78 | 0.376 | 152(97.4) | 120(76.9) | 29.36 | <0.001 |
| HIV person can still live active/fulfilling life | 147(94.7) | 150(96.2) | 0.427 | 0.427 | 156(100.0) | 144(92.3) | 12.48 | <0.001 |

Table 3 displays the factors influencing adherence to ART among the respondents.

At baseline, most of the respondents in both study and control groups identified counseling, effectiveness of ART and positive attitude to ART as factors supporting adherence to ART. Post-intervention, knowledge of the supportive factors of adherence improved significantly in the study group ($P < 0.001$) unlike the control group.

UNDER PEER REVIEW

Table 3: Factors Influencing Adherence to ART among the respondents

| Factors Identified | Pre-intervention (N=156) | | | | Post-intervention (N = 156) | | | |
|--------------------------------|--------------------------|-------------|----------------|---------|-----------------------------|-------------|----------------|---------|
| | Study (%) | Control (%) | X ² | P-value | Study (%) | Control (%) | X ² | P-value |
| Supportive factors: | | | | | | | | |
| Adherence Counseling | 20(12.8) | 23(14.7) | 13.56 | 0.001 | 9(5.8) | 20(12.8) | 4.60 | 0.032 |
| Effectiveness of ART | 34(21.8) | 30(19.2) | 0.315 | 0.576 | 8(5.2) | 33(21.2) | 17.50 | 0.001 |
| Persons willingness | 23(14.8) | 6(3.8) | 10.99 | 0.001 | 6(3.8) | 30(19.2) | 18.09 | 0.001 |
| membership of support group | 13(8.3) | 19(12.2) | 1.25 | 0.263 | 6(3.8) | 23(14.7) | 10.99 | 0.001 |
| Limiting Factors: | | | | | | | | |
| Long waiting period | 33(21.2) | 29(18.6) | 0.322 | 0.570 | 6(3.8) | 31(19.9) | 19.165 | 0.001 |
| Dislike taken drugs | 59(37.8) | 57(36.5) | 0.055 | 0.815 | 5(3.2) | 59(37.8) | 57.321 | 0.001 |
| Quantity/Number of ART regimen | 36(23.1) | 43(21.8) | 0.831 | 0.362 | 12(7.7) | 29(18.6) | 8.115 | 0.004 |
| Fear of drug side effects | 17(10.9) | 18(11.5) | 0.032 | 0.858 | 8(5.1) | 16(10.3) | 2.889 | 0.089 |
| Forgetfulness | 28(17.9) | 26(26.5) | 0.090 | 0.765 | 5(3.2) | 27(25.6) | 16.854 | 0.001 |
| Finance | 10(6.4) | 9(5.8) | 0.056 | 0.813 | 9(5.8) | 10(9.4) | 0.056 | 0.813 |
| Travel time/distance to Clinic | 8(5.8) | 11(7.1) | 0.504 | 0.478 | 1(0.6) | 12(7.7) | 9.712 | 0.002 |

Table 4 displays the intra group comparison of the factors influencing adherence to ART among the respondents before and after intervention.

The study group demonstrated a statistically significant difference ($P < 0.05$) in the knowledge of supportive and limiting factors influencing adherence after the intervention; unlike the control group with no difference in knowledge.

UNDER PEER REVIEW

Table 4: Intra group comparison of the factors Influencing Adherence to ART among the respondents before and after intervention

| Factors Identified | Study group (N=156) | | | | Control group (N = 156) | | | |
|--------------------------------|---------------------|-----------------|----------------|---------|-------------------------|-------------------|----------------|---------|
| | Study b/f (%) | Study after (%) | X ² | P-value | Control b/f (%) | Control after (%) | X ² | P-value |
| Supportive factors: | | | | | | | | |
| Adherence Counseling | 20(12.8) | 9(5.8) | 4.06 | 0.032 | 23(14.7) | 20(12.8) | 0.24 | 0.622 |
| Effectiveness of ART | 34(21.8) | 8(5.2) | 18.60 | 0.001 | 30(19.2) | 33(21.2) | 0.18 | 0.672 |
| Willingness to take ARV drug | 23(14.8) | 6(3.8) | 10.99 | 0.001 | 6(3.8) | 30(19.2) | 18.09 | 0.001 |
| membership of support group | 13(8.3) | 6(3.8) | 2.75 | 0.09 | 19(12.2) | 19(12.2) | 0.44 | 0.507 |
| Limiting Factors: | | | | | | | | |
| Long waiting period | 33(21.2) | 6(3.8) | 21.363 | 0.001 | 29(18.6) | 31(19.9) | 0.083 | 0.774 |
| Dislike taken drugs | 59(37.8) | 5(3.2) | 57.321 | 0.001 | 57(36.5) | 59(37.8) | 0.055 | 0.815 |
| Quantity/Number of ART regimen | 36(23.1) | 12(7.7) | 14.184 | 0.001 | 43(21.8) | 29(18.6) | 3.539 | 0.060 |
| Fear of drug side effects | 17(10.9) | 8(5.12) | 3.522 | 0.061 | 18(11.5) | 16(10.3) | 0.132 | 0.716 |
| Forgetfulness | 28(17.9) | 5(3.2) | 17.926 | 0.001 | 25(265) | 27(25.6) | 0.023 | 0.880 |
| Finance | 10(6.4) | 9(5.8) | 0.056 | 0.813 | 9(5.8) | 10(9.4) | 0.056 | 0.813 |
| Travel time/distance to Clinic | 8(5.8) | 1(0.6) | 5.606 | 0.018 | 11(7.1) | 12(7.7) | 0.047 | 0.828 |

Discussion

At baseline the study and control groups differed in their mean age, educational level and sex distribution. The most frequent age range in the study group was 25 years - 44years corresponding to the sexually active age groups mostly affected by HIV/AIDS.

The female respondents largely out-numbered the male respondents. This finding is in line with the WHO survey study which showed that HIV/AIDS infection among females in sub-sahara Africa out-numbered that of males, where the national prevalence values are estimated using women on antenatal clinic [15,16]. The finding may also be an indication that women are assessing ART services more than men and are becoming more open about the disease than men [17]. The study group improved significantly in their knowledge and awareness of nature of HIV/AIDS post-intervention unlike the control group. This could be because the study group received intensive health education intervention on the nature of HIV/AIDS disease, ART and adherence counseling unlike the control group. This is similar to previous findings where there was higher knowledge in the group that received health education before commencement of treatment [18,19].

The factors identified by both the study and control groups that supported their adherence to ARV drugs pre-intervention were attendance at counseling sessions, effectiveness of ART, willingness to take ART drug and membership of HIV/AIDS support group. The group also identified long hospital waiting period, unwillingness to take ARV drug, multiple ARV drugs, side effects, forgetfulness, finance and travel time to clinic as the limiting factors to their adherence to therapy [20]. There was no

statistically significant difference ($P > 0.05$) in the identified factors between the study and the control groups pre-intervention. The finding of this study supports previous study where adherence health education, membership of a support group, fixed drug combinations and less adverse effects were found to improve adherence [21,22,23]. The factors found to limit adherence to ARV drug pre-intervention were less contributory in the study group post-intervention as fewer than 5% of the respondents presented them as reasons for non-adherence. Health education on the importance of adherence to ART drugs may have made most of the study group respondents to adhere to their drugs. There was statistically significant difference ($P < 0.05$) on the influence of the factors to adherence among the study group post-intervention. The limiting factors had a greater effect on the control group than the study group. This difference again may be due to the health education intervention received by the study group. Other research studies have similarly reported these factors as among those limiting adherence to ART [24,25,26].

The major source of adherence support identified by the respondents in this study is the doctor or primary physician. Studies have shown that involvement of relatives, friends, pastors, peer groups, the family and community members in educating and supporting the patients are beneficial in improving and maintaining adherence [27].

Conclusions and Recommendations

This study has demonstrated that health education on HIV/AIDS disease and its management improved knowledge of supportive factors of ART adherence among PLWHAs in Enugu state, Nigeria.

It is therefore recommended that all persons living with HIV/AIDS receive regular health education, and that relatives and friends are involved in patient's treatment.

UNDER PEER REVIEW

REFERENCES

1. World Health Organization (WHO) HIV/AIDS Data and Statistics – WHO/ World Health Organization. 2019. Available at: www.who.int/hiv/data. Accessed 13/10/19
2. UNAIDS: Report on the Global AIDS epidemic 2013. Joint United Nations Programme on HIV/AIDS (UNAIDS). Available at: http://www.unaids.org/sites/default/files/media_asset/UNAIDS_Global_report_2013_en_1.pdf. Accessed on 2/2/2016.
3. Federal Ministry of Health (FMOH) 2019. National HIV/AIDS indicator and impact survey (NAIIS) fact sheet. Abuja, Nigeria. 2019: 2
4. Averting HIV and AIDS (AVERT). HIV and AIDS in Nigeria. Accessed on 15/11/2019. Available at: <https://www.avert.org/professionals/hiv-around-world/sub-saharan-africa/nigeria>
5. UNAIDS 'AIDSinfo'. People living with HIV. Accessed on 15/11/2019. Available at: <http://aidsinfo.unaids.org/>
6. Nigeria National Agency for the control of AIDS (NACA) (2017) National Strategic Framework on HIV and AIDS 2017-2021
7. Nigeria Federal Ministry of Health (2013) National HIV/AIDS and Reproductive Health Survey 2012. (NARHS).
8. Nigeria Federal Ministry of Health (2013) National HIV/AIDS and Reproductive Health Survey 2012. (NARHS).

9. National Bureaus of Statistics (NBS) and United Nations Children's Fund (UNICEF) (2017) multiple indicator cluster survey 2016-17, survey Findings Report.
10. Chem. ED. Treatment outcomes and antiretroviral uptake in multidrug-resistant tuberculosis and HIV co-infected patients in sub-saharan Africa: a systematic review and meta-analysis. *BMC Infect. Dis.* 2019
11. Chirambo Lusungu, Martha Valeta, Tifiness Mary Banda, Alinane Linda Nyondo-Mipando. Factors influencing adherence to antiretroviral treatment among adults accessing care from private facilities in Malawi. *BMC Public Health* 2019; 19: 1382
12. Musinguzi N. Antiretroviral Therapy Adherence Interruptions Are Associated with Systematic Inflammation Among Ugandans who Achieved Viral Suppression. *Acquired Immune Deficiency Syndr.* 2019.
13. Endebu Tamrat, Alem Deksisa, Warku Dugasa, Ermiyas Mulu. Accessibility and feasibility of short message service to improve ART medication adherence among people living with HIV/AIDS receiving treatment at Adama hospital medical college, central Ethiopia. *BMC Public Health*, 2019; 19: 1315.
14. Chadambuka A. Acceptability of lifelong treatment among HIV-positive pregnant and breastfeeding women in selected health facilities in Zimbabwe: a qualitative study. *BMC Public Health.* 2017.
15. National Population Commission (NPC). 2006 Population and Housing Census of Federal Republic of Nigeria: National and State Population Tables (Priority Tables) Vol. 1 Abuja Nigeria; 2009.
16. Tabatabai J. Understanding reasons for treatment interruption among patients on antiretroviral therapy – a qualitative study at

- the Lighthouse Clinic, Lilongwe, Malawi. *Global Health Action*. 2014.
17. Larson BA. A tool for estimating antiretroviral medication coverage for HIV-infected women during pregnancy (PMTCT-ACT). *Global Health Res Policy*. 2019.
 18. Haberer JE, Lora Sabin, Rivet Amico, Catherine Orrell, Omar Gallarraga, Alexander C. Improving antiretroviral therapy adherence in resource-limited setting at scale: a discussion of interventions and recommendations. *Int AIDS Soc*. 2017; 20(1): 21371
 19. Hudelson C, Cluver L. Factors associated with adherence to antiretroviral therapy among adolescents living with HIV/AIDS in low and middle-income countries: a systematic review. *AIDS Care* 2015; 27(7): 805-16.
 20. Bijker R, Jiamsakul A, Kityo C, Kiertiburanakul S, Siwale M Akanmu S. Adherence to antiretroviral therapy for HIV in sub-saharan Africa and Asia: a comparative analysis of two regional cohorts. *J Int AIDS Soc*. 2017; 20(1) 21218.
 21. Olowookere SA, Fatiregun AA, Adewole I.F. Knowledge and attitudes regarding HIV/AIDS and antiretroviral therapy among patients at a Nigerian treatment clinic. *J Infect Der C tries*. 2012 Nov. 26, 6 (11).
 22. Heestermans T, Browne JL. Determinants of adherence to antiretroviral therapy among HIV-positive adults in sub-saharan Africa: a systematic review. *BMJ Global Health*. 2016; 1(4).
 23. Kabore L, Muntner P. Self-report measures in the assessment of antiretroviral medication adherence: comparison with medication

possession ratio and HIV viral load. *J Int Assoc Provid AIDS care.* 2015; 14 (2) 156-162.

24. Mghamba FW, Minzi OM. Adherence to antiretroviral therapy among HIV infected children measured by caretaker report, medication return, and drug level in Dar Es Salaam, Tanzania. *BMC Pediatr.* 2013; 13;95.
25. Arage G, Tessema GA. Adherence to antiretroviral therapy and associated factors among children at south Wollo Zone Hospital, Northeast Ethiopia: A cross-sectional study. *BMC Public Health.* 2014; 14(91); 365.
26. Wadunde I, Tuhebwe D. Factors associated with adherence to antiretroviral therapy among HIV infected children in kabala district, Uganda: A cross-sectional study. *BMC Res Notes:* 201; 11(1); 466.
27. Ugwu R, Eneh A. Factors influencing adherence to paediatric antiretroviral therapy in portharcourt, south-south Nigeria. *Pan Afr Med J.* 2013; 16; 30.