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Exploring Barriers and Facilitators to Antiretroviral Therapy Adherence among HIV-Positive Adolescents and Young Adults: A Descriptive Study at Buea Regional Hospital

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Abstract

***Background*:** Despite all the strategies put in place by WHO and the International AIDS control program, such as free HIV screening and free distribution of ART's, large numbers of adolescents and young adults still find it difficult to comply with their treatment regimens. Hence, the purpose of this study to identify the barriers and factors facilitating compliance and non-compliance to ART among HIV positive adolescents and young adults and to evaluate the sense of well-being of the patients receiving treatment at the Buea Regional Hospital. ***Methodology*:** A cross-sectional study design was carried out at the Buea Regional Hospital from June 1st to August 31st, 2022. A convenient sampling technique was used to enroll consented participants, whereby a structured questionnaire was administered as they came to the treatment center for their appointments. Data was collected from respondents on demographic characteristics, compliance to ART was evaluated using a well-structured questionnaire. The data was analyzed using SPSS version 26 and Excel 2013 at 0.05 significance level. ***Results*:** Out of the 150 participants, an overall compliance rate of 68.7% was observed against a non-compliance rate of 31.3%. Taking medication when feeling depressed was significantly (p=0.016) associated to compliance with treatment than sometimes not taking medications when feeling depressed. Moreover, stopping to take medication when feeling depressed was significantly (p=0.010) associated with compliance compared to sometimes not taking medication when feeling depressed. The factors associated with non-compliance were; taking medication when feeling depressed significantly (p=0.016) associated with non-compliance than not taking medication when feeling depressed. Not taking medication sometimes when feeling depressed significantly (p=0.010) associated with non-compliance than not taking medication when feeling depressed. The highest percentage scored for being worried (over the last two weeks) resulted from the fact that most of the participants had little interest in carrying out daily tasks (16.4%). Nevertheless, majority of respondents (76.0%) had a very good sense of well-being characterised by minimal levels of being bothered over the last two weeks. ***Conclusion*:** The factors associated with compliance to ART have been categorised as religious, cultural, family and community factors; patient related factors; socio-economic factors; work place related factors; and health care team and system related factors. Some factors such as a female gender, age greater than 49 years, higher levels of education, positive perceptions of treatment, high motivation, satisfaction with information provided by physician and higher CD4 count at initiation of ART were also identified.

Keywords: Adolescents, Antiretroviral Therapy, Young Adults, Barriers/Facilitators.

INTRODUCTION

Acquired Immunodeficiency Syndrome (AIDS), caused by the Human Immunodeficiency Virus (HIV), remains a significant global health challenge. First identified in 1981 (Emedicine, 2009), HIV has infected an estimated 38.4 million people worldwide, with a global adult prevalence of 0.7% (WHO, 2022). The African Region is disproportionately affected, harboring over two-thirds of the global HIV-positive

population (WHO, 2022). Cameroon reflects this trend, with a national HIV prevalence of 3% among adults aged 15-49 (CDC, 2021). While a substantial proportion (79%) of diagnosed individuals in Cameroon receive antiretroviral therapy (ART) (Cameroon Country Operational Plan, 2022), adherence to this treatment is crucial for optimal outcomes and preventing drug resistance (Bauleth, 2013). Studies in Cameroon report varying compliance rates to ART (Bongfen *et al*., 2020), highlighting the ongoing challenges, particularly among adolescents, who exhibit lower adherence rates compared to adults (Eboua *et al*., 2018; Villiera *et al*., 2022). Despite progress in treatment accessibility, sustained compliance to ART remains a critical factor in managing HIV and improving the health outcomes of individuals living with the virus (Eboua *et al*., 2018).

Compliance to Antiretroviral Therapy (ART) is influenced by a complex array of factors, including socio-cultural, patient-related, socio-economic, and healthcare team and system-related factors (Bauleth, 2013). Research has identified specific factors associated with compliance, such as female gender, age greater than 49 years, higher levels of education, positive perceptions of treatment, high motivation, satisfaction with information provided by physicians, and higher CD4 count at initiation of ART (Mbuagbaw *et al*., 2012; Letta *et al*., 2015). Conversely, factors linked to non-compliance include male gender, age 20-29 years, parental divorce or widowhood, CD4 inclusion rate ≥ 500 cells/ml, and duration on ART ≥ 10 years (Okoronkwo *et al*., 2013; Hudelson and Cluver, 2015). Despite existing research, there is a need for further study on the factors associated with compliance and non-compliance to ART among adolescents and young adults in Cameroon, particularly in the Buea region.

Managing HIV/AIDS can be challenging for people living with HIV (PLHIV), affecting their daily lives, physical activities, and social relationships. The well-being of PLHIV has become a significant medical outcome measure, with improvement being an important goal (Basavaraj *et al*., 2010). Antiretroviral therapy (ART) has been shown to increase survival rates and improve overall well-being (Busi *et al*., 2021). However, adolescents living with HIV still face numerous health challenges that impact their well-being (Salako *et al*., 2022).

Despite efforts to promote adherence to treatment, many adolescents struggle to comply with their ART regimens. The World Health Organization (WHO) and international AIDS control programs have implemented various measures, including door-to-door sensitization, health campaigns, and awareness programs. However, large numbers of adolescents still find it difficult to comply with their treatment regimens, facing challenges such as lack of knowledge, pill burden, stigmatization, and loss of a parent or both.

The non-compliance to ART among adolescents is a concern, as it can lead to drug resistance and the spread of the virus. Adolescents are lagging behind in achieving the "third 95" objective of the joint United Nations Program on HIV/AIDS (Hudelson and Cluver, 2015). Therefore, identifying the factors associated with compliance and non-compliance with ART among HIV-positive adolescents and young adults is crucial. This study aimed to investigate the factors associated with compliance and non-compliance with ART among HIV-positive adolescents and young adults receiving treatment at the Buea Regional Hospital. By identifying these factors, healthcare providers can develop targeted interventions to improve adherence, increase compliance, and ultimately enhance the well-being of PLWHIV.

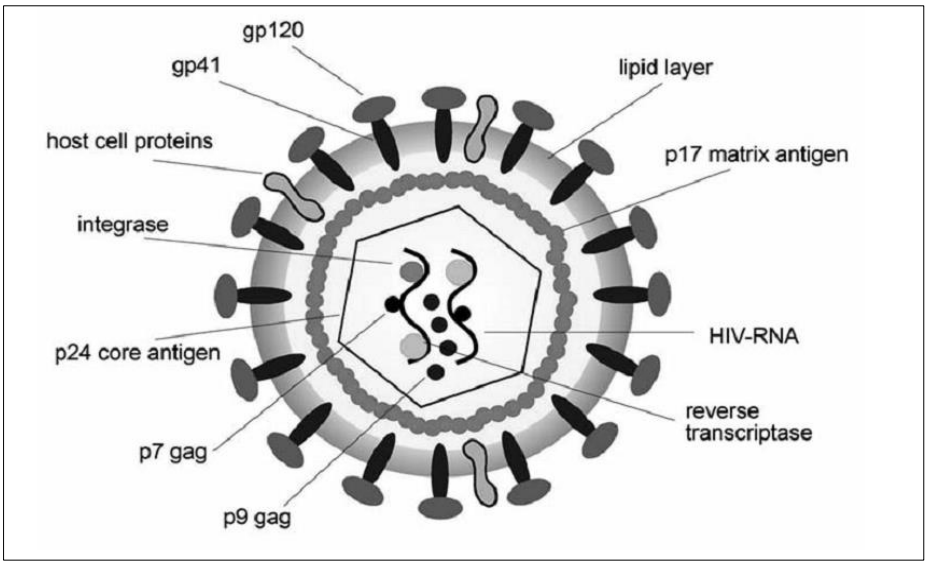

Figure 1: Structure of HIV (Linda *et al.*, 1989)

The Transmission and Cellular Mechanisms of HIV Infection

Human Immunodeficiency Virus (HIV) transmission occurs through specific routes, predominantly involving unprotected sexual intercourse (vaginal, anal, or oral) with an infected individual, particularly the former two. Transmission also occurs via the sharing of unsterilized sharp objects and through transfusion of infected blood. However, the oral route presents a comparatively lower transmission risk.

Once introduced into the body, HIV targets T cells displaying the CD4 antigen and specific host-cell surface receptors, including the CD4 receptor (Brik *et al*., 2003). The virus then binds to the chemokine co-receptors CXCR4 or CCR5, inducing conformational changes in the envelope proteins. This process culminates in the formation of a pore, facilitating the entry of the viral capsid into the cell (Warnke *et al*., 2007). Following entry, the viral RNA undergoes reverse transcription into DNA, a process mediated by the virally encoded enzyme, reverse transcriptase. The viral DNA subsequently integrates into the host cell's genome via the integrase enzyme. Upon activation, the host cell transcribes the viral DNA into mRNA, which is then translated into viral proteins. The HIV protease enzyme then cleaves a viral polyprotein precursor into mature proteins. Finally, viral RNA and proteins assemble into new virions at the cell surface, budding and releasing to infect further cells. The cycle of infection and replication ultimately leads to the death of infected cells, attributable to both the disruption of the host's genetic machinery and the processes of virion budding and release (Brik *et al*., 2003).

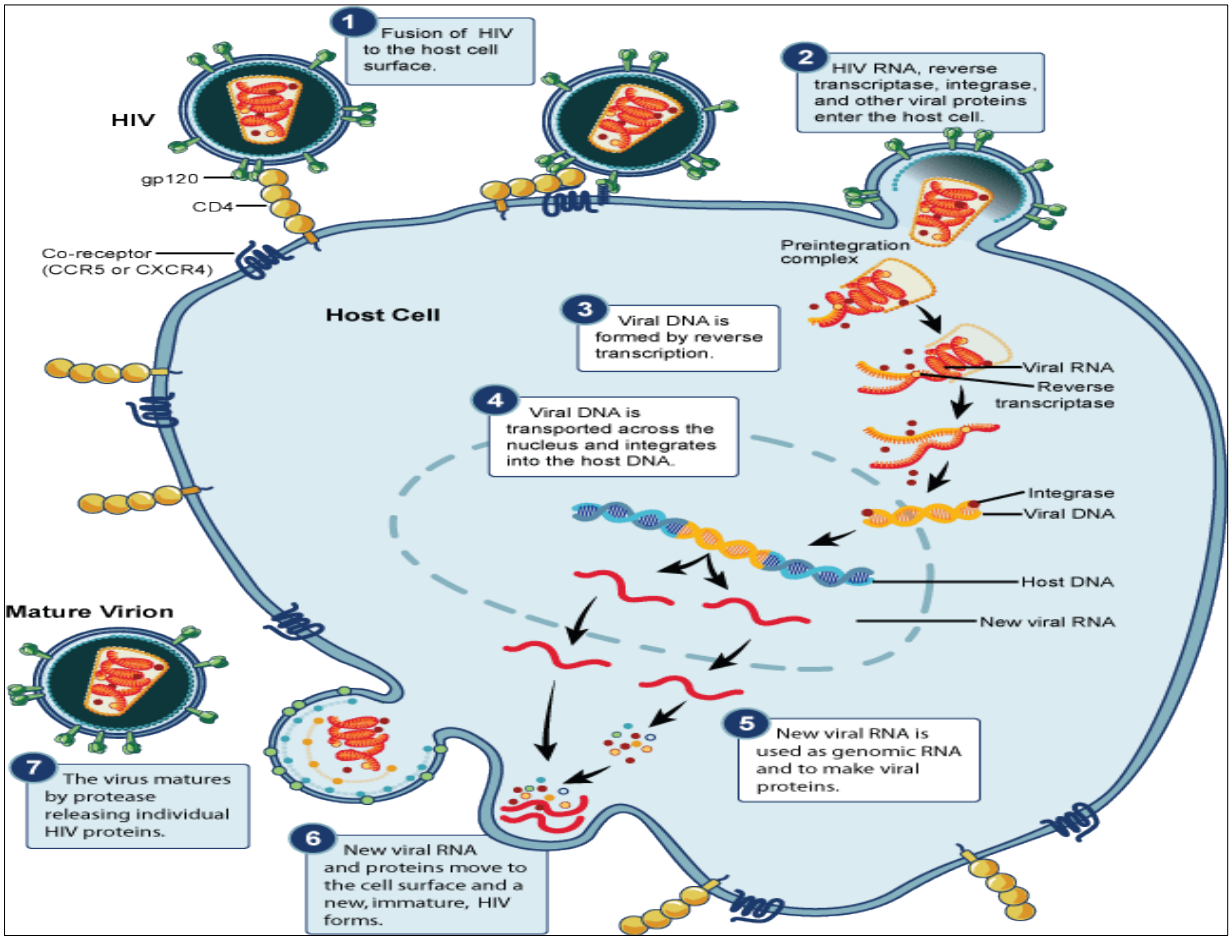

Figure 2: Life cycle of HIV (Brik *et al*., 2003)

The World Health Organization (WHO) clinical staging system for adults with HIV infection provides a hierarchical framework for categorizing disease progression. This system classifies patients into one of four stages, ranging from Stage 1 (asymptomatic or mild symptoms) to Stage 4 (AIDS), based on the presence of specific clinical conditions. Progression through these stages reflects the gradual immunodeficiency characteristic of HIV infection. While Stage 1 may persist for years with minimal clinical manifestations, later stages, particularly Stage 3 and Stage 4, involve increasingly severe opportunistic infections and systemic complications. The WHO staging system is valuable for clinical management, resource allocation, and epidemiological surveillance, particularly in resource-limited settings where laboratory diagnostics may be unavailable. The presence of any single criterion condition within a stage is sufficient for classification, highlighting the clinical significance of even seemingly minor manifestations in individuals with

HIV. However, due to the increased accessibility of virological assays and immune monitoring, the value of the WHO staging system may diminish over time.

The global impact of HIV/AIDS remains a significant public health challenge. While the global prevalence of HIV-1 has stabilized, millions continue to be affected. Data from the World Health Organization (WHO, 2007, 2010) and UNAIDS (2011, 2013) reveal disparities in regional burden. Sub-Saharan Africa bears the brunt, accounting for a disproportionate share of infections and deaths, particularly affecting women. South and Southeast Asia, including India, also face substantial numbers of cases, although prevalence rates vary. Developed nations, such as the United States, United Kingdom, Australia, and Canada, also experience the ongoing impact of HIV, with varying prevalence and mortality rates (CDC, 2011; Health Protection Agency, 2010; HIV and AIDS in Canada; Surveillance report to December 31, 2009). Since its discovery, AIDS has claimed approximately 30 million lives (UNAIDS, 2010). Factors potentially influencing prevalence, such as religious tenets, are also being explored (Gray and peter B, 2004). These statistics highlight the continued need for targeted prevention and treatment strategies to address the HIV/AIDS pandemic effectively.

HIV is diagnosed using blood product, saliva, and other body fluids i.e. vaginal secretions, semen. Early diagnosis is important in better management of persons with HIV. Diagnosis can be done either by antibody testing, HIV RNA test, Polymerase chain reaction (PCR) and western Blot test (confirmatory test). Due to the cost of the confirmatory test kit, the rapid test is performed prior to the secondary or confirmatory test (De Cock *et al*., 1991; Tedder *et al.,* 1998). The HIV antibody test is a rapid test and is the most common HIV test. The test checks for HIV antibodies in blood, urine, or fluids from the mouth. HIV antibodies are a type of protein the body produces in response to HIV infection. However, a confirmatory test is usually required if this rapid test is positive (For example Western blot test). These tests can detect HIV up to 20 days earlier than standard tests. They check for HIV antigen, a part of the virus that shows up 2-4 weeks after infection (webmd, 2014).

This is an antibody detection test and serves as a confirmatory test. This test is very sensitive. In this test, viral proteins are first separated and then immobilized. In subsequent steps, the binding of serum antibodies to specific HIV proteins is visualized as viral bands (positive test) but if no viral bands are detected, the result is negative. Results from a Western blot test are usually available within a few days to a few weeks. A positive Western blot test result confirms that a person is infected with HIV (De Cock *et al*., 1991; Tedder *et al*., 1998).

It is a molecular technique used to diagnose HIV in children less than 18months and also in adults but it is mainly for children. It is difficult to determine if a baby born to a mother infected with HIV is actually infected because babies carry their mothers' HIV antibodies for several months making the diagnoses of HIV with other tests (for example ELISA) in children difficult. The results are usually available after a week. It is also recommended for HIV testing adults, adolescents and pregnant women who present indeterminate rates (Revised recommendation for HIV testing in adults, adolescents and pregnant women in Health care settings, September, 2006).

Currently there is no cure for HIV/AIDS, but a variety of drugs can be used in combination to control the virus. These drugs are known as; 'The Cocktail' or Antiretroviral (ARVs), or Highly Active Antiretroviral Therapy (HAART or ART). Currently, there are five different classes of these drugs and each drug attacks the virus at different points in the life cycle. AZT was the first drug approved for the treatment of HIV disease and since then 30 drugs have been approved to treat people living with HIV/AIDS, and more are under development. These five classes are;

Entry Inhibitors interfere with the virus ability to bind to receptors on the outer surface of the cell it tries to enter. When receptor binding fails, HIV cannot infect the cell e.g. Maraviroc.

Fusion Inhibitors in Entry Inhibitors interfere with the virus ability to bind to receptors on the outer surface and inhibits the virus's ability to fuse with a cellular membrane, preventing HIV from entering into a cell e.g. Enfuvirtide.

Reverse Transcriptase Inhibitors prevent the HIV enzyme reverse transcriptase (RT) from converting single-stranded HIV RNA into double-stranded HIV DNA, a process called reverse transcription. There are two types of RT inhibitors: Nucleoside/nucleotide RT inhibitors (NRTIs) that are faulty DNA building blocks that halts HIV DNA synthesis eg Zidovudine. Non-nucleoside RT inhibitors (NNRTIs) bind to RT, interfering with its ability to convert HIV RNA into HIV DNA.eg Nevirapine.

Integrase Inhibitors block the HIV enzyme integrase, which the virus uses to integrate its genetic material into the DNA of the cell it has infected e.g, Raltegravir.

Protease Inhibitors interfere with the HIV enzyme called protease, which normally cuts long chains of HIV proteins into smaller individual proteins. When the viral protease does not work properly, new virus particles cannot be assembled e.g. Lamivudine. Multi-class Combination Products combine HIV drugs from two or more classes, or types, into a single product (FDA, 2014)

HIV can be prevented by; Abstinence: Not having sex of any kind is a sure way to avoid HIV infection through sexual contact. Be faithful to your partner: If you and your partner are both HIV negative and have sex only with each other, you are not at risk of HIV infection through sexual contact. Use of condoms: Use good quality condom every time you have vaginal, anal, or oral sex. Limit the number of sexual partners: If you have more than one sexual partner, get tested for HIV regularly. Get tested and treated for sexually transmitted infections (STIs), and insist that your partners do, too. Having an STI can increase your risk of becoming infected with HIV. Use sterilized sharp objects. Increase in sensitizations, workshops and seminars to educate people about HIV/AIDS would go a long way in preventing HIV transmission.

MATERIALS AND METHOD

Study Area:

This study was carried out at the Buea Regional Hospital (BRH) (Figure 3). The BRH, is located in the Buea Sub-Division, Fako Division, South - West Region of Cameroon. It is located on latitude 4° 8' 53.5" North and longitude 9° 14' 11.5" East. The mean annual rainfall is 2625mm with a constant humidity of 75 – 80 % (Wanji *et al*., 2003). The district has approximately 184,602 inhabitants (Buea District Health Service records, 2022). Buea consists mainly of the Bakweri people who happen to be the indigenes of the area. Immigrants from other parts of the country can also be found in the area (Wanji *et al*., 2003). It has an altitude of 4100m (Delancey, 2000)

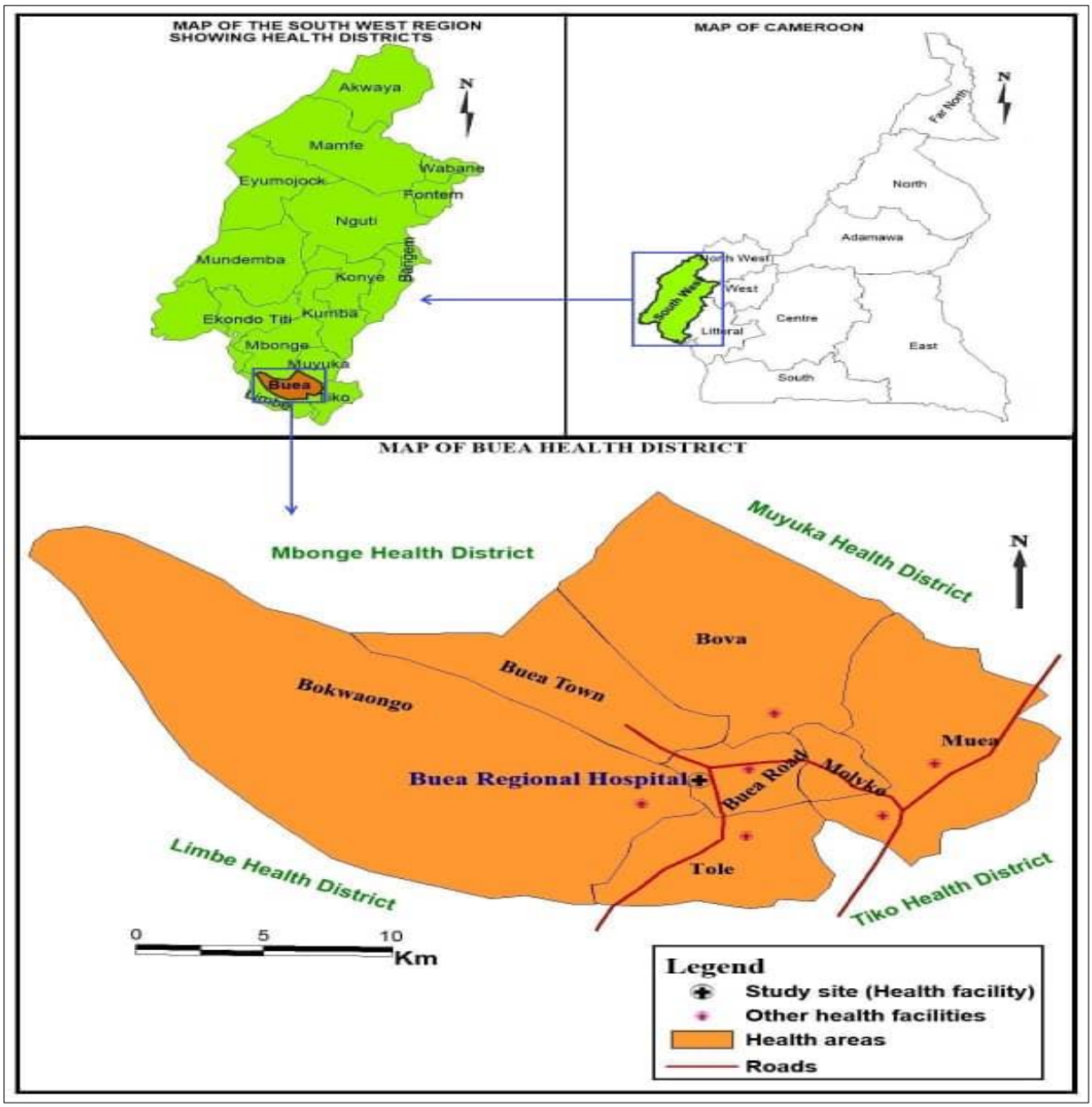

Figure 3: Map of the Buea Health District showing the Buea Regional Hospital
Source: Map derived using MapInfo Pro software version 11.

Study Design:

The study was carried out from June 1st to August 31st, 2022. A cross-sectional study design was used to carry out this study at the Buea Regional Hospital.

Study Population:

Male or female adolescents and young adults receiving treatment for at least 6 months.

Inclusion Criteria:

Participants who are male or female adolescents and young adults, and who are 10-19 years and 20-30years of age respectively. They should have been receiving treatment at the treatment center for at least 6 months.

Exclusion Criteria:

Severely ill clients to participate, Participants who were less than 10 years of age

Sample Size Determination:

Minimum sample size (n) = Z^2pq / e^2

Where the proportion of population with the characteristic p=0.62, 1-p= 1-0.62. At 95% confidence interval, the critical value $Z_{\alpha/2}$=1.96. An error margin (e) of 5%

Thus

$1.96^2 (0.62) (1 - 0.62) / 0.05^2$ = 362 participants

However, according to Sekran (2003) rule of Thumb for sample size determination, a sample size greater than 30 and less than 500 is suitable for most qualitative research. Hence, a convenient sample size of 150 participants was used for the study that is, n=150 participants.

Sampling Technique:

Participants were selected by convenient sampling technique. Participants were enrolled for the study as they came for their regular meetings for follow up. Upon their arrival, the rationale of the study was explained to them.

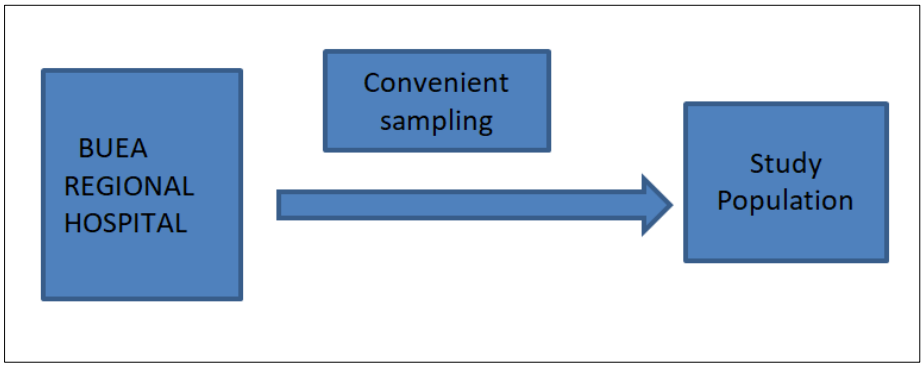

Figure 4: Sampling Technique flow chart

Pre-Test of Questionnaires

For verification of reliability and validity, 10 questionnaires were pre-tested at the Limbe Regional Hospital on the 24th of May 2022. Limbe Regional Hospital was chosen because it has similar characteristics as the Buea Regional Hospital. Some minor adjustments were made to the questionnaire prior to the eventual take off of data collection at the Buea Regional Hospital.

Administration of Questionnaires

Data was collected using a well-structured questionnaire designed following a previous format (Carter *et al*., 2017). The questionnaire was structured into 4 parts comprising of Section A (demographic data), Section B (duration on ART and perceived lifestyle characteristics of respondents), Section C (compliance and non-compliance to ART) and Section D (evaluation of the sense of well-being). Section A was made up of demographic characteristics involving age, gender, level of education, marital status, religion, occupation (whether schooling or learning a trade), address and the duration from the house to the clinic by vehicle. Section B comprised of the time of initiation on ART in years so as to capture the duration on ART. Also, this section comprised of respondent intake of alcohol, whether they had sexual partners or not. Other aspects were opinion of sharing items with family members, opinion of what can be their Life expectancy, to enquire if it was appropriate for them to donate blood and to state if they have any lifestyle restrictions.

Section C of the questionnaire consisted an important aspect to know if they missed any dose of medication for the past two weeks. This was to enable determination of compliance (did not miss any dose) and non-compliance (missed doses sometimes). Also, whether they had difficulties taking medications, if they would not take medication when they feel better and also whether they do not take medication when they feel depressed. These habits were used to assess if they are associated with compliance and non-compliance. Lastly, Section D had different components as follows; if they were lethargic towards their daily activity, felt depressed, had trouble staying asleep, felt tired, had poor appetite, felt bad about themselves, had trouble

concentrating, spoke slowly and if they preferred to be dead. Each component was arranged on a scale with scores ranging from 0 to 3. This section was used to capture the sense of well-being of participants over the last two weeks.

Data Collection Tools:

The data was collected using self-administered semi-structured questionnaires consisting of closed and open-ended questions with information on their socio-demographic data of adolescent and young adults. Data obtained from the collection procedure were checked daily and the filled forms were put in a large envelope and stored in a cupboard to prevent it from destruction by insects. The questions were coded in SPSS (Statistical Package for Social Sciences) version 26 and the data collected were eventually entered in the data editor of SPSS. The data was checked for completeness by ensuring that all data were properly entered from the questionnaires. The data was also stored in Excel format and several copies kept save in a phone, computer and email account.

Statistical Analysis:

Data was analysed using SPSS version 26 for windows (SPSS Inc, Chicago USA) and also Excel 2013. Descriptive summary of the data was presented on frequency tables using percentages and also on graphs using Excel. Descriptive statistics was mostly used to describe outcome variables by frequencies and percentages. Chi-square test (χ^2) was used to compare the perceived life style characteristics within each component such as intake of alcohol, having a sexual partner. The major indicators estimated were compliance (did not miss any dose for the past two weeks). Binary logistic regression was used to identify the variables which were candidates for the multivariate analysis by considering $p<0.2$ as a cut-off point. The multivariate analysis was used to identify factors associated with compliance. The scores of component of wellbeing (being bothered over the last two weeks) for each participant was presented as percentage scored by each component. Chi-square test was used to compare the relationship between variables (socio-demographic characteristics, respondents' perceptions and habit) and the well-being of HIV positive adolescents and young adults.

Ethical Considerations:

An ethical approval was obtained from the Faculty of Health Sciences Institutional Review Board of the University of Buea. Also, an administrative authorization was obtained from the Regional Delegation of Public Health for the South West Region. Other administrative authorisation was obtained from the Buea Regional Hospital. All participants were informed of the study goals, procedure, potential harm and benefits of the study.

A signed assent form was obtained from adolescents and their parents/guardians. An informed consent was obtained from young adults before the administration of the questionnaire. All consented participants were immediately enrolled in the study. Also, confidentiality of respondent's information was fully assured.

RESULTS

Table 1: Socio-demographic characteristics of respondents

Variables	Categories	Frequency	Percentage
Age	10-19	72	48.0
	20-30	78	52.0
	Total	**150**	**100.0**
Gender	Male	42	28.0
	Female	108	72.0
	Total	**150**	**100.0**
Level of education	Primary education	21	14.0
	Secondary education	67	44.7
	University/Professional education	62	41.3
	Total	**150**	**100.0**
Marital status	Single	146	97.3
	Married	4	2.7
	Total	**150**	**100.0**
Religion	Christian	142	94.7
	Muslim	8	5.3
	Total	**150**	**100.0**
Schooling or learning a trade	Schooling	118	78.7
	Learning a trade	32	21.3
	Total	**150**	**100.0**
Address	Buea	108	72.0
	Tiko	16	10.7

	Limbe	12	8.0
	Others	14	9.3
	Total	**150**	**100.0**
Duration from house to clinic by vehicle	10 minutes	4	2.7
	20 minutes	35	23.3
	30 minutes	53	35.3
	>30 minutes	58	38.7
	Total	**150**	**100.0**

The majority of participants (52.0%) were between the ages of 20-30 years. With respect to gender, most of the respondents were female (72.0%) as compared to males (28.0%) (Table 1). Also, most of participants were at the secondary level of education (44.7%) as compared to the primary (14.0%) and university (41.3%) levels of education. For marital status, 97.3% and 2.7% of the respondents were single and married respectively. About 94.7% of the participants were christians while 5.3% of the participants were muslims. Majority of participants were schooling (78.7%) while a minority of them were learning a trade (21.3%). The greater proportion of the respondents were from Buea (72.0%), while the rest were from Tiko (10.7%), Limbe (8.0%) and other areas (9.3%). The highest duration required by participants to travel from their homes to the hospital by vehicle was reported to be greater than 30 minutes (38.7%).

Table 2: Lifestyle perception of respondents

Variables	**Category**	**Frequency**	**Percentage**	**P-value**
Intake of alcohol	Yes	44	29.3	<0.001
	No	106	70.7	
	Total	**150**	**100.0**	
Having a sexual partner	Yes	49	32.7	<0.001
	No	101	67.3	
	Total	**150**	**100.0**	
Partner's awareness of their HIV status	Yes	14	28.6	0.003
	No	35	71.4	
	Total	**49**	**100.0**	
Have as opinion sharing personal belongings with family members	Yes	7	4.7	<0.001
	No	143	95.3	
	Total	**150**	**100.0**	
Envisaged what their life expectancy can be (Years)	>25 years	2	2.7	<0.001
	>30 but <50	8	5.3	
	>50 but <60	16	10.7	
	>60 but <70	48	32.0	
	>70 but <80	41	27.3	
	>80	33	22.0	
	Total	**150**	**100.0**	
Assumed it is appropriate to donate blood	Yes	5	3.4	<0.001
	No	137	91.3	
	I don't know	8	5.3	
	Total	**150**	**100.0**	
Life style restrictions	Yes	25	16.7	<0.001
	No	125	83.3	
	Total	**150**	**100.0**	
Lifestyle restrictions; no unprotected sex (9), no sharing of blades, needles and other personal belongings (7), avoid blood donation (4), no alcohol (3), avoid bad friends (2)				

*P-value computed from chi square test.

A greater percentage (70.7%) of the participants reported that they take alcohol which was significantly higher (p<0.001) than those that reported not taking alcohol (29.3%) Most participants (67.3) did not have sexual partners and they were significantly (p<0.001) greater in number than those who had sexual partners (32.7). Out of those having sexual partners (n=49), only 28.6% reported that their partners were aware of their HIV status. Also, majority (95.3%) would not share personal body items with family members. A smaller proportion of respondents (27.3%) envisaged a life expectancy of >70 but <80 years. Those who did not have any lifestyle restriction (83.3%) were significantly more than (p<0.001) those with lifestyle

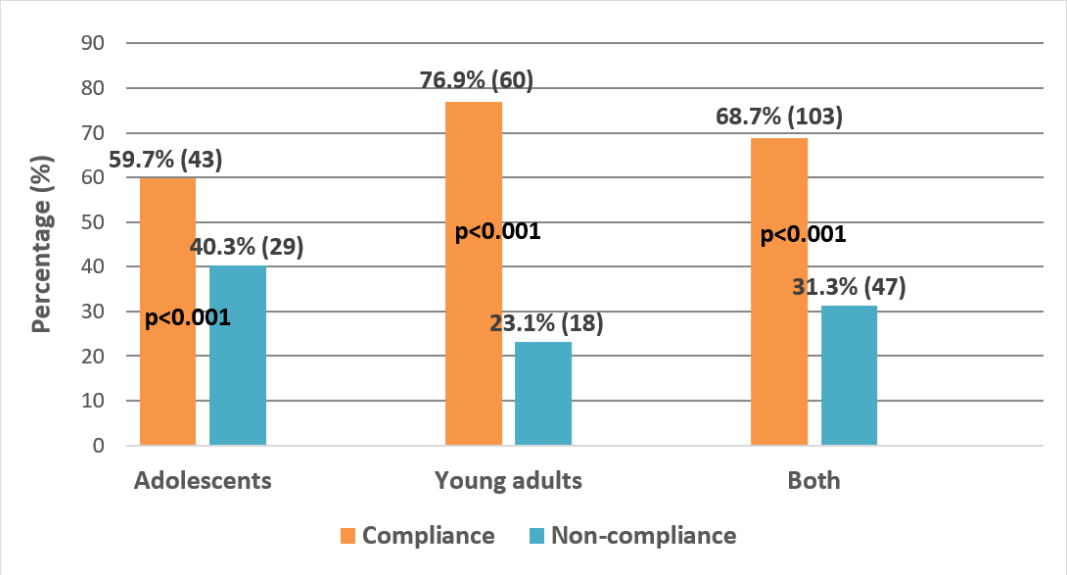

Figure 5: Compliance and non-compliance to HIV treatment regimen among adolescents and young adults

Out of the 150 participants, 103 (68.7%) were observed to comply to ART treatment as compared to a non-compliance rate of 31.3% with a significant difference (p<0.001) between the two Also, compliance in young adults (76.9%) was significantly greater (p<0.001) than that in adolescents (59.7%).

Table 3: Perceived lifestyle of respondents

Variables	Category	Frequency	Percentage	P-value
Intake of alcohol	Yes	44	29.3	<0.001
	No	106	70.7	
	Total	**150**	**100.0**	
Having a sexual partner	Yes	49	32.7	<0.001
	No	101	67.3	
	Total	**150**	**100.0**	
Partner's awareness of their HIV status	Yes	14	28.6	0.003
	No	35	71.4	
	Total	**49**	**100.0**	
Have as opinion sharing personal belongings with family members	Yes	7	4.7	<0.001
	No	143	95.3	
	Total	**150**	**100.0**	
Envisaged what their life expectancy can be (Years)	>25 years	2	2.7	<0.001
	>30 but <50	8	5.3	
	>50 but <60	16	10.7	
	>60 but <70	48	32.0	
	>70 but <80	41	27.3	
	>80	33	22.0	
	Total	**150**	**100.0**	
Assumed it is appropriate to donate blood	Yes	5	3.4	<0.001
	No	137	91.3	
	I don't know	8	5.3	
	Total	**150**	**100.0**	
Life style restrictions	Yes	25	16.7	<0.001
	No	125	83.3	
	Total	**150**	**100.0**	
Lifestyle restrictions; no unprotected sex (9), no sharing of blades, needles and other personal belongings (7), avoid blood donation (4), no alcohol (3), avoid bad friends (2)				

*P-value computed from chi square test.

In bivariate analysis, the age group 20-30 years was significantly (p=0.025) associated with compliance to ART compared to the age group 10-19 years (Table 3). Taking medication when feeling depressed was

significantly (p=0.005) associated with compliance compared to sometimes not taking medications when feeling depressed. Moreover, stopping to take medication when feeling depressed was still significantly (p=0.022) associated with compliance compared to sometimes not taking medications when feeling depressed.

Table 4: Bivariate analysis of socio-demographic characteristics with the state of compliance to ART

		Compliance			
Variables	**Category**	**Yes N (%)**	**No N (%)**	**OR (95% CI)**	**P-value**
Age	10-19	43 (41.7)	29 (61.7)	2.25 (1.11-4.56)	0.025*
	20-30	60 (58.3)	18 (38.3)	-	-
Gender	Male	31 (30.1)	11 (23.4)	0.71 (0.32-1.57)	0.398
	Female	72 (69.9)	36 (76.6)	-	-
Level of education	Primary	14 (13.6)	7 (14.9)	1.32 (0.45-3.84)	0.606
	Secondary	44 (42.7)	23 (48.9)	1.38 (0.65-2.94)	0.397
	University	45 (43.7)	17 (36.2)	-	-
Marital status	Single	99 (96.1)	47 (100.0)	-	-
	Married	4 (3.9)	0 (0.0)	-	-
Religion	Christian	95 (92.2)	47(100.0)	-	-
	Muslim	8 (7.8)	0 (0.0)	-	-
Schooling or learning trade	Schooling	82 (79.6)	36 (76.6)	0.84 (0.37-1.92)	0.676
	Learning trade	21 (20.4)	11 (23.4)	-	-
Address	Buea	75 (72.8)	33 (70.2)	1.10 (0.32-3.76)	0.879
	Tiko	11 (10.7)	5 (10.6)	1.14 (0.24-5.46)	0.873
	Limbe	7 (6.8)	5 (10.6)	1.79 (0.35-9.13)	0.486
	Others	10 (9.7)	4 (8.5)	-	-
Duration from house to clinic by vehicle	10 minutes	2 (1.9)	2 (4.3)	1.76 (0.23-13.44)	0.585
	20 minutes	27 (26.2)	8 (17.0)	0.52 (0.20-1.36)	0.182*
	30 minutes	37 (35.9)	16 (34.0)	0.76 (0.34-1.69)	0.502
	>30 minutes	37 (35.9)	21 (44.7)	-	-
Duration on ART (years)	14-20	10 (9.7)	8 (17.0)	2.53 (0.82-7.87)	0.108*
	7-13	55 (53.4)	27 (57.4)	1.56 (0.70-3.45)	0.277
	≤6	38 (36.9)	12 (25.5)	-	-

*Cut-off points (p<0.25) to be used for multivariate analysis

Table 5: Bivariate analysis of respondents perceived lifestyle characteristics with the state of compliance to ART

		Compliance			
Variables	**Category**	**Yes N (%)**	**No N (%)**	**OR (95% CI)**	**P-value**
Intake of alcohol	Yes	30 (29.1	14 (29.8)	1.03 (0.49-2.20)	0.934
	No	73 (70.9)	33 (70.2)	-	-
Having a sexual partner	Yes	34 (33.0)	15 (31.9)	0.95 (0.46-1.99)	0.895
	No	69 (67.0)	32 (68.1)	-	-
Sharing body items	Yes	3 (2.9)	4 (8.5)	3.10 (0.67-14.45)	0.150*
	No	10 (97.1)	43 (91.5)	-	-
Envisaged life expectancy	>25 years	2 (1.9)	2 (4.3)	1.75 (0.22-14.07)	0.599
	>30 but <50	5 (4.9)	3 (6.4)	1.05 (0.21-5.19)	0.952
	>50 but <60	10 (9.7)	6 (12.8)	1.05 (0.31-3.61)	0.938
	>60 but <70	34 (33.0)	14 (29.8)	0.72 (0.28-1.85)	0.496
	>70 but <80	31 (30.1)	10 (21.3)	0.57 (0.21-1.54)	0.265
	>80	21 (20.4)	12 (25.5)	-	-
Assumed it is appropriate to donate blood	Yes	4 (3.9)	1 (2.1)	0.75 (0.05-11.31)	0.835
	No	93 (90.3)	44 (93.6)	1.42 (0.28-7.32)	0.676
	I don't know	6 (5.8)	2 (4.3)	-	-
Life style restriction	Yes	16 (15.5)	9 (19.1)	1.29 (0.52-3.17)	0.582
	No	87 (84.5)	38 (80.9)	-	-
Difficulty in taking medication	Yes	4 (3.9)	4 (8.5)	1.60 (0.37-6.98)	0.532
	No	59 (57.3)	18 (38.3)	0.49 (0.24-1.01)	0.053*

	Sometimes	40 (38.8)	25 (53.2)	-	-
Not taking medication when feeling better	Yes	2 (1.9)	2 (4.3)	1.00 (0.12-98.73)	0.998
	No	92 (89.3)	36 (76.6)	0.39 (0.14-1.07)	0.066*
	Sometimes	9 (8.7)	9 (19.1)	-	-
Not taking medication when you feel depressed	Yes	8 (7.8)	1 (2.1)	0.07 (0.01-0.68)	0.022*
	No	89 (86.4)	35 (74.5)	0.22 (0.07-0.63)	0.005*
	Sometimes	6 (5.8)	11 (23.4)	-	-
Experiencing stigmatization and discrimination	Yes	10 (9.7)	4 (8.5)	2.40 (0.22-26.82)	0.477
	No	87 (84.5)	42 (89.4)	2.90 (0.34-24.84)	0.332
	Sometimes	6 (5.8)	1 (2.1)	-	-
Eating well	Yes	79 (76.7)	38 (80.9)	1.92 (0.67-5.52)	0.223*
	No	4 (3.9)	4 (8.5)	4.00 (0.73-21.84)	0.109*
	Sometimes	20 (19.4)	5 (10.6)	-	-
Frequently sick	Yes	6 (5.8)	2 (4.3)	0.37 (0.06-2.32)	0.289
	No	87 (84.5)	36 (76.6)	0.46 (0.17-1.23)	0.120
	Sometimes	10 (9.7)	9 (19.1)	-	-
State of life after diagnosis	Good	70 (68.0)	31 (66.0)	1.55 (0.30-7.89)	0.598
	Bad	26 (25.2)	14 (29.8)	1.89 (0.34-10.32)	0.465
	Frustrated	7 (6.8)	2 (4.3)	-	-

*Cut-off points (p<0.25) to be used for multivariate analysis

In multivariate analysis, taking medication when feeling depressed was significantly (OR 0.20, 95% CI: 0.05-0.74, p=0.016) associated to compliance with treatment than sometimes not taking medications when feeling depressed (Table 5). Moreover, stopping to take medication when feeling depressed was significantly (OR 0.02, 95% CI: 0.001-0.39, p=0.010) associated with compliance compared to sometimes not taking medication when feeling depressed.

Table 6: Multivariate analysis of factors associated with compliance to ART

Variables	**Category**	**Compliance**			
		Yes N (%)	**No N (%)**	**OR (95% CI)**	**P-value**
Age	10-19	43 (41.7)	29 (61.7)	2.20 (0.89-5.41)	0.086
	20-30	60 (58.3)	18 (38.3)	-	-
Duration from house to clinic by vehicle	10 minutes	2 (1.9)	2 (4.3)	0.33 (0.02-4.96)	0.426
	20 minutes	27 (26.2)	8 (17.0)	0.68 (0.23-2.04)	0.489
	30 minutes	37 (35.9)	16 (34.0)	0.68 (0.27—1.68)	0.400
	>30 minutes	37 (35.9)	21 (44.7)	-	-
Duration on ART (years)	14-20	10 (9.7)	8 (17.0)	2.48 (0.66-9.24)	0.178
	7-13	55 (53.4)	27 (57.4)	1.20 (0.45-3.22)	0.713
	≤6	38 (36.9)	12 (25.5)	-	-
Envisaged sharing items with family members	Yes	3 (2.9)	4 (8.5)	7.38 (0.68-80.17)	0.101
	No	10 (97.1)	43 (91.5)	-	-
Difficulty in taking medication	Yes	4 (3.9)	4 (8.5)	1.38 (0.16-11.70)	0.769
	No	59 (57.3)	18 (38.3)	0.65 (0.28-1.51)	0.314
	Sometimes	40 (38.8)	25 (53.2)	-	-
Not taking medication when feeling better	Yes	2 (1.9)	2 (4.3)	10.22 (0.52-200.23)	0.126
	No	92 (89.3)	36 (76.6)	1.28 (0.32-5.12)	0.729
	Sometimes	9 (8.7)	9 (19.1)	-	-
Not taking medication when you feel depressed	Yes	8 (7.8)	1 (2.1)	0.02 (0.001-0.39)	0.010
	No	89 (86.4)	35 (74.5)	0.20 (0.05-0.74)	0.016
	Sometimes	6 (5.8)	11 (23.4)	-	-
Eating well	Yes	79 (76.7)	38 (80.9)	2.05 (0.61-6.92)	0.248
	No	4 (3.9)	4 (8.5)	5.50 (0.83-36.38)	0.077
	Sometimes	20 (19.4)	5 (10.6)	-	-

Taking medication when feeling depressed was significantly (OR 5.04, 95% CI: 1.35-18.83, p=0.016) associated with non-compliance than not taking medication when feeling depressed. Not taking medication sometimes when feeling depressed was significantly (OR 51.23, 95% CI: 2.55-1027.9, p=0.010)

associated with non-compliance than not taking medication when feeling depressed.

Table 7: Multivariate analysis of factors associated with non-compliance to ART

Variables	Category	Non-compliance			
		Yes N (%)	No N (%)	OR (95% CI)	P-value
Age	10-19	29 (61.7)	43 (41.7)	0.46 (0.19-1.12)	0.086
	20-30	18 (38.3)	60 (58.3)	-	-
Duration from house to clinic by vehicle	10 minutes	2 (4.3)	2 (1.9)	2.99 (0.20-44.38)	0.426
	20 minutes	8 (17.0)	27 (26.2)	1.47 (0.49-4.42)	0.489
	30 minutes	16 (34.0)	37 (35.9)	1.48 (0.60-3.66)	0.400
	>30 minutes	21 (44.7)	37 (35.9)	-	-
Duration on ART (years)	14-20	8 (17.0)	10 (9.7)	0.40 (0.11-1.51)	0.178
	7-13	27 (57.4)	55 (53.4)	0.83 (0.31-2.23)	0.713
	≤6	12 (25.5)	38 (36.9)	-	-
Envisaged sharing items with family members	Yes	4 (8.5)	3 (2.9)	0.14 (0.01-1.47)	0.101
	No	43 (91.5)	10 (97.1)	-	-
Difficulty in taking medication	Yes	4 (8.5)	4 (3.9)	0.73 (0.09-6.16)	0.769
	No	18 (38.3)	59 (57.3)	1.54 (0.66-3.59)	0.314
	Sometimes	25 (53.2)	40 (38.8)	-	-
Not taking medication when feeling better	Yes	2 (4.3)	2 (1.9)	0.10 (0.01-1.92)	0.126
	No	36 (76.6)	92 (89.3)	0.78 (0.20-3.14)	0.729
	Sometimes	9 (19.1)	9 (8.7)	-	-
Not taking medication when you feel depressed	Yes	1 (2.1)	8 (7.8)	51.23 (2.55-1027.9)	0.010
	No	35 (74.5)	89 (86.4)	5.04 (1.35-18.83)	0.016
	Sometimes	11 (23.4)	6 (5.8)	-	-
Eating well	Yes	38 (80.9)	79 (76.7)	0.49 (0.15-1.65)	0.248
	No	4 (8.5)	4 (3.9)	0.18 (0.03-1.20)	0.077
	Sometimes	5 (10.6)	20 (19.4)	-	-

Over the last two weeks, the highest percentage scored for being bothered was attributed to that fact that most of the participants had little interest in carrying out daily tasks (16.4%) (Table 7). It was closely followed by 14.8% who were depressed, 13.3% who felt tired and 12.9% by trouble concentrating on daily tasks.

DISCUSSION

Out of the 150 participants, 103 (68.7%) were observed to comply with ART treatment as compared to a non-compliance rate of 31.3% (47 participants). The rate of compliance in young adults was 76.9% while that in adolescents was 59.7%. The compliance in adolescents (59.7%) is in line with that obtained (59.6%) among HIV-Infected adolescents at the Paediatric Department of Yopougon University Hospital in Ivory Coast (Eboua *et al*., 2018). It is however below that obtained (83%) among HIV-positive adolescents on ART in the North West and South West regions of Cameroon (Bongfen *et al*., 2020). Compliance in young adults (76.9%) corroborates with a compliance rate of 79.2% reported in a previous study carried at the University of Nigeria Teaching Hospital Enugu (Onyekwere, 2013). Also, the overall compliance (68.7%) in the current study is similar to that of 67% reported among youths (15-24 years) in selected health facilities in Nyeri country, Kenya (Irakoze, 2021) but is below that of a previous study (82%) in Haiti by Dorcelus *et al*., (2021). It is also far below the average compliance rate (94.84%) observed in among adults (≥18 years) at a Tertiary Care Hospital in North Karnataka (Hasabi *et al*., 2016). The low level in the current study could be attributed to limited sample size (n=150) of recruited study participants. The level of non-compliance observed in the present study in adolescents (40.3%) and in young adults (23.1%) are respectively are similar to results obtained in Ivory Coast (40.4%) by Eboua *et al*., (2018) and in Cameroon (22.5%) by Perfua-Yone *et al*., (2013). They are however above the rate (5.16%) reported by a previous study (Hasabi *et al*., 2016).

This study showed that taking medication when feeling depressed was significantly associated to compliance with treatment than sometimes not taking medications when feeling depressed. Also, stopping to take medication when feeling depressed was significantly associated with compliance compared to sometimes not taking medication when feeling depressed. No previous study has demonstrated such outcomes. However, previous studies demonstrated other factors to be associated with compliance. These factors were female gender, age greater than 49 years, higher levels of education, positive perceptions of treatment, high motivation, using reminder methods, satisfaction with information provided by physician,

higher CD4 count at initiation of ART, and being transferred-in from another clinic, from a systematic review in Cameroon (Mbuagbaw *et al*., 2012). In addition, other factors associated with compliance were experiencing health improvement and receiving social support from a study in Nigeria (Onyekwere, 2013). Moreover, other factors were ages 35–44 years, having moderate monthly income, no history of opportunistic infection and having good family support in Eastern Ethiopia (Letta *et al*., 2015) and experiencing side effects and internalized stigma in the North West and South West regions of Cameroon (Bongfen *et al*., 2020). The high rate of overall non-compliance (31.3%) in the current study could be attributed to the limited sample size of 150 participants on site relative to the expected 362 participants from the sample size calculation study participants because of the short period of data collection. Non-compliance in adolescents (40.3%) was found to be significantly higher than the rate in young adults (23.1%), which could be due to lack of commitment by adolescents in adhering to ART treatment regimen.

However, a previous study conducted at the Nnamdi Azikiwe University Teaching Hospital, Nnewi, Nigeria, revealed the age group 20-29 years to be associated with non-compliance (Okoronkwo *et al*., 2013). Moreover, another outcome obtained in a study among hospitalized patients in North West Ethiopia identified the age group 31-45 years as a factor associated with non-compliance (Tsega *et al*., 2015). However, those do not stop taking their medication when they feel depressed will not full comply as they may fluctuate in taking their doses in trying to cope in the depression phase and as such may not fully adhere to ART treatment.

CONCLUSIONS

An overall compliance (68.7%) was observed against a non-compliance rate of 31.3%. The factors associated with compliance to ART treatment were; taking medication when feeling depressed significantly (p=0.016) associated to compliance with treatment than sometimes not taking medications when feeling depressed. Moreover, stopping to take medication when feeling depressed significantly (p=0.010) associated with compliance compared to sometimes not taking medication when feeling depressed.

Not taking medication sometimes when feeling depressed significantly (p=0.010) associated with non-compliance than not taking medication when feeling depressed.

RECOMMENDATIONS

The community should provide the necessary support to young people living with HIV by reducing stigmatization and discrimination.

Counsellors should educate HIV positive adolescents and young adults how to handle depression phase in their life in order not to interfere in their compliance with ART.

The government should provide enabling environment to adolescents and young adults ART and Health providers should educate parents as well as adolescents on the need to eat well in order to increase compliance.

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