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HIV/AIDS and Adolescent Adherence to Antiretroviral Therapy: A Cross-Sectional Study of Adolescents in the Bamenda Health Districts, Cameroon

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Abstract

Background: Adolescents living with HIV (ALHIV) in conflict-affected regions face unique barriers to antiretroviral therapy (ART) adherence, undermining UNAIDS 95-95-95 targets. This study assessed ART adherence levels and associated factors among ALHIV in Bamenda, Cameroon, a region impacted by sociopolitical instability. **Methods:** A hospital-based, cross-sectional mixed-methods study was conducted from December 2023 to April 2024, involving 196 ALHIV aged 10 - 19 years at Bamenda Regional Hospital and Nkwen Baptist Hospital. Quantitative data were collected through a pretested, semi-structured questionnaire, analyzed using SPSS version 25.0, with binary logistic regression to identify adherence predictors. Qualitative data from in-depth interviews (N = 48) and focus group discussions (N = 12) were analyzed using MAXQDA 24 to explore barriers and facilitators. **Results:** ART adherence was 81.6%, below the 95% target. Key predictors of poor adherence included 5 - 10 years on ART (OR 3.4, 95% CI 1.08 - 10.80, p = 0.016) and absence of discrimination (OR 4.64, 95% CI 0.324 - 16.263, p = 0.016), while care satisfaction (OR 0.031, 95% CI 0.001 - 0.819, p = 0.038) and father caregivers (OR 0.34, 95% CI 0.11 - 1.01, p = 0.052) were protective. Qualitative findings highlighted that 40% reported stigma, 44% forgetfulness and logistical barriers, with family support, peer networks, and counselling as facilitators of adherence. **Conclusion:** Adherence among ALHIV in Bamenda is suboptimal, driven by structural barriers like conflict-related disruptions and transport

and psychosocial barriers like stigma and treatment fatigue barriers. A multi-stage model integrating differentiated service delivery, long-acting ART, and mHealth is proposed to enhance adherence and equity in conflict zones.

Keywords

ART Adherence, CALHIV, HIV/AIDS, Adolescents, Bamenda Health District, Cameroon

1. Introduction

The 2025 estimates show that of the estimated 40.8 million people living with HIV worldwide in 2024, 2.42 million were children aged 0 - 19. Each day in 2024, approximately 712 children became infected with HIV and approximately 250 children died from AIDS-related causes, mostly due to inadequate access to HIV prevention, care and treatment services.

The burden remains heaviest in sub-Saharan Africa, which accounted for 61 per cent of the 630,000 AIDS-related deaths globally in 2024. And adolescent girls and young women continue to be disproportionately affected. Over 210,000 adolescent girls and young women aged 15 - 24 acquired HIV last year, an average of 570 new infections every day [1] [2].

These figures help in the understanding of the HIV epidemic and the reflection on the urgent need for targeted investment and equity-focused strategies especially for those being left behind. This approach helps governments and communities to eliminate vertical transmission of HIV, and thrive for triple elimination of HIV, syphilis and hepatitis B, close the treatment gap for children and adolescents living with HIV by integrating early diagnosis and optimising new paediatric regimens which prevent new HIV infections among adolescent girls and improve access to quality sexual and reproductive health services [1]-[3]. UNAIDS and UNICEF are collaborating on a new analysis using the 2025 estimates and updated modelling to understand the future impacts of the current funding landscape. Preliminary scenarios show how increased child mortality and rising HIV infections among children and adolescents if the current trajectory continues [1] [3].

Antiretroviral therapy (ART) has transformed HIV from a fatal disease to a manageable chronic condition, but optimal adherence defined as taking ≥95% of prescribed doses is essential for viral suppression, prevention of transmission, and averting HIV drug resistance or (HIVDR) [2]. The standard definition of adherence is taking 95% - 100% of the right drug, in the right way, at the right time and in the right dose. Adherence requires an informed choice, a relationship of trust between patient/family/care provider and the implementation of evaluation procedures for better monitoring of patients on ART [4]. Despite progress, SSA lags behind the UNAIDS 95-95-95 targets which means 95% of people living with HIV (PLHIV) knowing their status, 95% of those who have a positive status should be

on their ART, and 95% those who are on ART should virally suppressed.

In Cameroon, national estimates indicate only 46.9% of PLHIV know their status, 91.3% of the 46.9% of the general population are on ART or are ART adherent, and 80% of those who are on ART are virally suppressed, with paediatric rates even lower at 35% coverage; meaning only 35% of estimated paediatric PLHIV in Cameroon are on ART—far below the adult rate (~42.8% of all PLHIV on ART) and the 95% UNAIDS target [5] [6].

Adolescents pose unique challenges to ART adherence, including developmental transitions, stigma, mental health issues, and high-risk behaviours [7] [8]. In conflict-affected regions like Cameroon's Northwest, sociopolitical instability exacerbates barriers such as clinic access and supply chain disruptions [9]. Recent studies highlight multifaceted individual determinants of suboptimal ART adherence and retention in care such as forgetfulness, lack of family support, stigma, and food insecurity [10]-[12]. However, some studies combine insights from different groups, like patients, families, and healthcare workers, to create tailored solutions for HIV care in places with limited resources [13].

By integrating mixed-methods data, it proposes an adaptable multistage model to optimize adherence, aligning with WHO's 2025 [2]. guidelines on differentiated service delivery (DSD) and long-acting injectables (LAI-ART). This study proposing a tailored, multistage model to improve adherence, incorporating WHO's 2025 strategies like DSD a customized care delivery and LAI-ART; injectables to simplify treatment is highly relevant to ART adherence, aiming to close the gap between diagnosis and sustained viral suppression for adolescents, a population with long standing low adherence rates in Cameroon.

Non-adherence to ART among CALHIV in SSA contributes to high morbidity, mortality, and onward transmission of HIV [14]. In Cameroon, the Northwest Region's ongoing Anglophone crisis has displaced populations, disrupted healthcare, and increased loss-to-follow-up (LTFU) rates to 58% in the paediatric populations [15] [16]. HIV care system issues like suboptimal regimens for example use of non-nucleoside reverse-transcriptase inhibitors (NNRTIs) or NNRTI-based treatments, or HIV treatment plan which involves a combination of drugs which are not fully effective, possibly due to issues like drug resistance, inappropriate drug choices, side effects, or limited access to better medications, as seen in resource-limited settings like Cameroon may not work well for everyone especially in adolescents. Over time, the virus can become resistant to these drugs, meaning they stop working for many Cameroonian adolescents, leading to treatment failure in about 35% of cases. Also, if people do not get treatment or if they skip doses, this speeds up HIV drug resistance (HIVDR), when the virus learns to fight back against the medications, making them useless. This puts huge pressure on health systems, as switching to stronger "second-line" drugs can cost up to $10,000 (5,650,000 FCFA) per person [2] [17]. This issue also affects fairness in healthcare, as women and girls face unique challenges. About 85% of caregivers for HIV-positive kids are single women, who often bear heavy responsibilities alone. However,

studies show that teenage girls with HIV are better at sticking to their treatment, with 1.8 times higher success rates compared to boys in some cases. These differences highlight how gender and other social factors create unequal experiences in managing HIV [8] [18].

Current interventions, like Zimbabwe's Zvandiri peer model, show promise of 25% adherence boost, but lack adaptation to conflict zones [11]. Two-thirds (64.7%) of the global population of adolescents living with HIV, ages 10 - 19, reside in ESA2. Challenges related to pregnancy and parenthood can threaten ART adherence among adolescents living with HIV, whose ART adherence rates are already lower than those of all other age groups. These disadvantages are predicted to extend to the children of adolescent mothers, with the next generation showing lower educational achievement, higher poverty, and increased risk of becoming adolescent parents themselves [19].

In Cameroon, there is limited data on the adherence to ART by ALHIV and the factors associated with adherence to ART amongst these adolescents. Understanding the factors associated with adherence ALHIV population provides vital information to guide targeted interventions and thus better outcomes for the clients. This study therefore sets out to assess the adherence level of ALHIV and to evaluate the factors associated with ART adherence in the Bamenda Health Districts.

2. Materials and Methods

2.1. Study Site, Design and Study Participants

This study was a hospital-based cross-sectional mixed method study involving 196 ALHIV (10 - 19 years) attending either the Nkwen Baptist Hospital (NBH) or Bamenda Regional Hospital (BRH) PTCs in Bamenda III and Bamenda Health Districts respectively for HIV and had been on ART for at least three months and were already partially or fully be disclosed to selected through a multistage sampling technique. The study was conducted between December 2023 and April 2024 in two health facilities in Bamenda Regional Hospital and Nkwen Baptist Hospital Bamenda Health Districts in the Northwest Region of Cameroon. This region has a 3.7% HIV prevalence and faces sociopolitical instability [5].

For the qualitative data we did an in-depth interview with all 48 peer educators age (15 - 19 years) who had been trained to teach their peers. Two focus group discussions were done with 12 ALHIV, (6 per group) to provide comprehensive insights into ART adherence [20]. The researcher was assisted by the ward charge who played the role of the moderator in the FGD and the time or Saturdays allocated for support group meetings were used for the FGD.

Prior to data collection the research assistants who were health care providers of the two centres were trained and briefed on data collection with emphasis on the ethical issues. The general information, consent forms or assent forms as the case might be were attached to the data collection instrument said concerned. The activities of the centre are carried out every work day per scheduled from Monday to Saturday.

During a regularly scheduled clinic visit, the research staff (assisted by a nurse in each clinic) met with each adolescent and parent or caregiver and jointly completed a semi-structured questionnaire (which was already piloted before the study) to gather information on socio-demographic and ART adherence practices. The questionnaire was straightforward and we needed the dyad in the completion of the questionnaire to ensure the information provided was correct. However, the participants information sheet gave a leeway to participants not to answer question they do not feel to answer (prefer not to say) was considered for questions that had no responses provided.

For adolescents who could not read or write, the questionnaire was completed for them after interviewing them and the responses were confirmed from parents/caregivers who accompanied these children. However, adolescents who were literate and were not accompanied by any parent or caregiver were asked to administer the questionnaire in the presence of the research staff assisted by a staff nurse who had already trained as a research assistant. A written consent that explained the purpose of the study was distributed to parents/guardians of the study participants and the heads of the clinics. Also, the research principal investigator (PI) and research assistants (RAs) had to explain the purpose of the study to the participants before data collection. Those who consented to the study were asked to sign the consent form and assent was obtained from children above 10 years of age.

2.2. Ethical Considerations

Approval to carry out this study was obtained from the Institutional Review Board (IRB) of The University of Bamenda (Ref: 2022/0704H/UBa/IRB) and the Cameroon Baptist Convention Institutional Review Board (Ref: IRB 202387). Administrative clearance was gotten from the Regional Delegate of Public Health for the North West Region (Ref No 292/ATT/NWR/RDPH/BRIGAD). Administrative authorisation was obtained from the Director of Bamenda Regional Hospital (REF No R005/MPH/RDPH/RHB/369) and the Nkwen Baptist Hospital (Ref. CBC/NBH/Admin-L/24/05). Before being allowed to accessed the HIV treatment Centre of the Nkwen District Hospital to pilot the data collection instruments, an administrative had to be gotten from the director of the (REF.NO.I 1/MPH/RDPH/NDH/195) as well as from the individual adolescents or caregivers and staff that HIV treatment Centre. Assent was obtained from adolescents aged 10 - 15 and consent for those 18 - 19 years before any data collection procedure started. All necessary efforts were done to guarantee patients' confidentiality throughout the study. The study sample was calculated according to Krejecie & Morgans [21]. the required sample size for adolescents was calculated using the formula for estimating a single population proportion for a cross-sectional survey.

Where, N is the total number of children and adolescents attending (target population) the two paediatric HIV treatment centres, n_0 is the required minimum sample size, Z is a standard score corresponding to 95% Confidence level,

and is thus equal to 1.96, p is the proportion of awareness, but the information is not available, and so 50% (0.5) is assumed to get the possible maximum sample size, e is the margin of error and is taken to be 5% (0.05). Due to multistage nature of the study a design effect of 2.76 is considered and non-response rate is taken at ten percent (10%).

$$n_0 = \frac{Z^2 pq}{e^2}$$

Therefore, $n_0 = \frac{(1.96)^2 (0.5)(0.5)}{(0.05)^2} = 385$

Finite population $n_0 = \frac{n_0}{1+\frac{n_0}{N}} = \frac{385}{1+\frac{385}{720}} = \frac{385}{1.53} = \frac{385}{1.5} = 256$

256 − 60 (children aged 0 - 9 years)

=196. ALHIV aged 10 - 19 years.

Therefore, the total number of respondents (CALHIV) is 256, CLHIV is 60 and ALHIV is 196. Since the ratio of respondents in BRH to the respondents in NBHC is 2:1, the same ratio is used to calculate the number adolescents from each paediatric Treatment Centre for HIV which was 116 respondents from BRH and 80 respondents from NBHC respectively.

2.3. Data Collection

2.3.1. Data Collection Tools

Quantitative data was collected using a researcher-developed, self-administered, semi -structured questionnaire adapted from WHO adherence guidelines and based on Eswatini [22]. Ghanian [23], and Zimbabwean [24] studies that revealed successful services and policies towards UNAIDS 2021 strategy [25] [26]. The pretested semi-structured questionnaire was used to collect data from the 196 ALHIV. This questionnaire comprised the following sections; 1) sociodemographic information of the adolescents, 2) Factors associated with ART adherence level among adolescents living with HIV, 3) Factors associated with ART adherence and the Adolescents Living with HIV; 4) Assessment of adherence and non-adherence among adolescents living with HIV and 5) the predictors of ART adherence among adolescents living with HIV.

A researcher-developed, structured questionnaire was used for quantitative data collection after it was pretested to ascertain its validity and reliability and the procedures of data collection before the study.

In-depth interview (IDI) and Focus group discussion (FGD) guides were used to collect qualitative data from adolescents. An IDI guide was used by exploring four themes namely barriers' theme which captures the challenges patients face in maintaining consistent ART use, regimens, related factors such as quality of care in the current treatment clinic; cost considerations, family/social network supports; history of HIV diagnosis and treatment and to end up proposing possible solutions that would improve/optimise ART adherence from ARV users' point of

view.

A focus group discussion guide was used on adolescents to gather data on their knowledge about ART, the challenges the adolescents faced with adhering and retention in HIV management, the factors that cause adolescents to remain in HIV management, the kind of information adolescents think they should have to enable them to adhere to HIV management and the way they think they are being treated or handled by the health care workers. Assessing whether the treatment affects their decision regarding adherence to HIV care and if support is available for them in the community to adhere to HIV management

Qualitative data were collected by use of in-depth interview and focus group discussion guides. The researchers conveniently used all the 48 adolescent peer educators that were in the program and who have been trained to take care of their peers. We collected data by use of a semi-structured in-depth interview guide. A focus group discussion guide that included probing questions was used to collect data during two FGD from a total of 12 randomly selected peer educators who came for their monthly support group meetings. Each FGD took 45 - 60 minutes and focus group (ALHIV; 60 - 90 min, 6 participants). Guides explored perceptions, barriers, solutions. Audio-recorded with consent; The questionnaire and in-depth interview and FGD guides were piloted at the Nkwen District Hospital among 10 conveniently selected ALHIV two weeks prior to data collection to test their effectiveness. and were then interpreted to Pidgin or French applicable for those having issues with English.

2.3.2. Data Collection Techniques

During each visit, consent was sought from each respondent that met the criteria and if the client consented, the adolescent was attended or allow to finish with the reason for the visit or what brought him/her to the centre. Then the adolescent was served with a questionnaire by the researcher or research assistant who were all health care providers working at the Centre. The questionnaire constituted six sections namely adolescent's sociodemographic information, associated factors with ART adherence level, assessment of adherence and non-adherence by assessing the approximate time spent at clinic, if respondents take their medications as prescribed or not, and the reason for not taking as prescribed, if adolescent (peer educator) missed clinic appointment or not, reason for missing appointment, and if they were implementing home lifestyle changes which at improving healthy living.

The qualitative data

An in-depth interview (IDI) guide was used to collect qualitative data from adolescents exploring four themes; barriers' theme which captures the challenges patients face in maintaining consistent ART use; facilitators of ART Adherence, a theme which focuses on factors that support consistent ART use, including tools, social support, and personal strategies, suggestions for improvement, the theme that reflects on respondents' recommendations for enhancing ART adherence and

overall HIV management.

A focus group discussion (FGD) guide used to assess socioeconomic challenges for adolescents; theme which is unique to the FGDs and highlights the socioeconomic burdens faced by adolescent mothers living with HIV, particularly in the absence of partner or family support

2.4. Statistical Analysis

Data was analysed using SPSS for windows version 25. Frequency distribution tables were used to present sociodemographic characteristics of study participants. The overall response was 98%, with a total of 196 valid entries. Association between categorical variables was assessed using Chi square and logistic regression was used to assess predictors of adherence in the children and presented using Odds Ratio with their corresponding Confidence intervals.

All measures of associations were presented as odds ratios with their 95% confidence interval. Qualitative data were entered in Kobo and downloaded in Excel, cleaned and analysed in MAXQDA 24 software and was systematically organised, coded, and interpreted transcripts from in-depth interviews (IDIs) and focus group discussions (FGDs). Another statistician for qualitative data assisted in the process of analyzing data. MAXQDA was used because it is particularly effective for IDIs (one-on-one semi-structured conversations) and FGDs (group discussions yielding interactive data). Statistical significance was set at $P < 0.05$.

3. The Results

3.1. Descriptive Characteristics of Adolescents

Our study participants included 196 adolescents living with HIV and AIDS (ALHIV) we identified that 116 (59.2%) of them were from the Bamenda Regional Hospital (BRH), 145 (74.0%) were 10 - 14 years, 105 (53.6%) had secondary education. It was also found that 68 (34.7%) had a mother as the primary caregiver and 172 (87.8%) respondents were Christians. Twenty-eight (14%) of participants used more than one hour to reach the health facility for their ART care while 42(21%) had been on treatment for 11 - 15 years. Table 1 shows Characteristics of the Adolescents.

Table 1. Descriptive characteristics of the adolescents (N = 196).

Variable /Category	Frequency (N)	Percent (%)
Health Facility:		
BRH	116	59.2
NBH	80	40.8
Category (years) Age		
10 - 14	145	74.0
15 - 19	51	26.0

Continued

Gender:		
Male	82	41.8
Female	114	58.2
Level of Education:		
No Formal Education/Primary	65	33.2
Secondary	105	53.6
Tertiary	26	13.3
Primary Caregiver:		
Mother	68	34.7
Father	22	11.2
Both	61	31.1
Others	45	23.0
Religion:		
Christian	172	87.8
Muslim	09	04.6
Others	15	07.6
Length of Time to Get to Health Facility		
0 - 30 mins	94	48
30 mins - 1 hour	74	38
>1 Hour	28	14
Duration on ART		
0 - 5 years	48	24
6 - 10 years	85	43
11 - 15 years	42	21

3.2. Assessment of Adherence and Non-Adherence (N = 196)

Table shows that minutes at clinic. Inquiring about how medications are taken it was observed that 160 (81.6%) of the participants take their medications as prescribed and upon finding out why the 36 (18.4%) respondents do not take medications as prescribed, 6 (16.7%) said it was due to inconvenient/bad timing of taking the drugs, 4 (11.1%) were ashamed, 3 (8.3%) felt they were not sick, 16 (44.4%) forget to take medications, 2 (5.6%) of adolescents said they do not have to take them, 3 (8.3%) complained that they were not sick and hence do not have to take medications. Asking the participants whether there are times they missed clinic appointment 121 (61.7%) answered affirmatively. Asking the CALHIV further reasons for missed (N = 121), 40 (33.1%) of 121 respondents who missed appointment justified that was due to lack of transport and 36 (29.8%) they forgot. In-

quiring on implementation of home lifestyle changes, 71 (36.2%) of CALHIV implement balanced diet (1.5%) implement exercise, 39 (19.9%) avoid smoking, alcohol, and other drugs while 12 (6.1%) choose to implement others things for example drinking at least two and half hours daily. Table 2 shows assessment of adherence and non-Adherence by ALHIV.

Table 2. Assessment of adherence and non-adherence (N = 196).

Variable	Frequency (N)	Percentage (%)
Approximate Time Spent at Clinic: (N = 196)		
0 - 30 Mins	160	81.6
>30 Mins	36	18.4
Taking of Medications: (N = 196)		
As Prescribed	160	81.6
Not as Prescribed	36	18.4
Reasons not Taking Medications as Prescribed: (N = 36)		
It is inconvenient/bad timing	06	16.7
I'm ashamed	04	11.1
I am not sick	03	08.3
I forget	16	44.4
I don't have to take them	02	05.6
I am not sick and I don't have to take them	03	08.3
It is inconvenient/bad timing and I forget	02	05.6
Missed Clinic Appointment: (N = 196)		
Missed	121	61.7
Not Missed	75	38.3
Reasons for Missed Clinic appointment: (N = 121)		
Lack of transport	40	33.1
Stigma	08	6.6
Forget	36	29.8
Lack of family support	05	04.1
Peer pressure	05	04.1
All of the Above	05	04.1
Lack of transport & family Programs	07	05.8
Schooling	07	05.8
Others	08	06.6

Continued

Implementation of Home lifestyle changes: (N = 196)		
Balanced diet	71	36.2
Exercise	03	01.5
Safe sex	39	19.9
Avoid smoking, alcohol, & other drugs	33	16.8
All of the Above	38	19.4
Others	12	06.1

3.3. Factors of Associated with Adherence ART by Adolescents (N = 196)

Table 3 showed that 74% of the adolescents that participated were aged 10 - 14 years, 58.2 % were female while 43.4 % had been on Antiretroviral therapy for between 5 - 10 years. Sixty-eight (34.7%) of the adolescents that were studied had their biological mother as the caregiver, 172 (87.8) were Christians, primary, 151 (77%) of the adolescents have been disclosed to, while 174 (89%) received family support. Also,187 (96%) adolescents studied were satisfied with the ART adherence care they received at the PTCs, 63 (32%) of the were not attending support group meetings, 28 (14%) did not know the importance of the support group meetings, 39(20%) of the respondents were not living with someone or were living alone and 79 (40%) had experienced discrimination. Table 3 shows factors associated with ART adherence by ALHIV.

Table 3. Factors associated with ART adherence by adolescent living with HIV/AIDS (N = 196).

Variables	Frequency (N)	Percent (%)
Age Category		
10 - 14	145	74
15 - 19	51	26
Gender		
Male	82	41.8
Female	114	58.2
Duration on ART		
<5 years	48	24.5
5 - 10 years	85	43.4
>10 years	63	32.1
Primary Caregiver		
Others	45	23.0

Continued

Both	61	31.2
Father	22	11.2
Mother	68	34.7
Religion		
Other	15	07.7
Christian	172	87.8
Moslem	09	04.6
Disclosure of HIV Status		
Disclosed	151	77
Not Disclosed	46	23
Family Support		
Received Family Support	174	89
Not Received Family Support	22	11
Satisfaction from Received Care		
Satisfied with Care Received	187	96
Not Satisfied with Care Received	08	04
Attendance of Support Meeting		
Attend Meeting	133	78
Not Attend Meeting	63	32
Knowledge of Importance of Support Meeting		
Know the importance	168	86
Not Know the importance	28	14
Living with someone in past 3 Months		
Living with Someone	157	80
Not Living with Someone/Living Alone	39	20
Experience of any Discrimination		
Not Experienced Discrimination	117	60
Experienced Discrimination	79	40

3.4. Factors Associated with ART Adherence Level

We found a significant association between appointment in the Paediatric Treatment Centre and adherence to antiretroviral therapy with 80.3% of the adolescents who respected their appointment had good adherence compared to 6.3% of adolescents who missed their appointment and therefore had poor adherence (X^2 = 6.842, P = 0.009). However, we did not find any significant association between

gender, duration on treatment, level of education, caregiver and adherence level. Table 4 shows factors associated with adherence level to ART by ALHIV.

Table 4. Factors associated with adherence level to ART (N = 196).

	Adherence to ART			
Factors	**Good adherence**	**Poor adherence**	**X^2**	**P-value**
Gender	N (%)	N (%)		
Male	67 (81.7)	15 (18.3)	1.849	0.174
Female	101 (88.6)	13 (11.4)		
Duration of Treatment				
10 - 14 years	40 (83.3)	8 (16.7)	4.892	0.087
5 - 10 years	69 (81.2)	16 (18.8)		
>10years	59 (93.7%)	4 (6.3)		
Level of Education				
No/primary	50 (76.9)	15 (23.1)	8.747	0.13
Secondary	92 (87.6)	13 (12.4)		
Tertiary	26 (100)	0 (0.0)		
Caregiver				
Mother	62 (91.2)	6 (8.8)		
Father	18 (81.2)	4 (18.2)	4.313	0.230
Both	53 (86.9)	8 (13.1)		
Others	35 (77.8)	10 (22.2)		
Appointment in the clinic				
Respected Appointment	94 (80.3)	5 (6.3)	6.842	0.009
Missed Appointment	74 (93.7)	23 (19.7)		

3.5. Predictors of Adherence to ART among Adolescents Living with HIV/AIDS

Table 5 indicated that being on ART for 5 - 10 years (OR 3.4, 95% CI, 1.08 - 10.80), being a father (OR 0.34 95% CI, 0.11 - 1.01), being satisfied care received (OR 0.031, 95% CI, 0.001 - 0.19) and not having experienced discrimination (OR 4.640, 95% CI, 0.324 - 16.263) were respectively significantly ($P < 0.05$) associated with poor adherence to ART. While being of age 10 - 14 years (OR 2.3, 95% CI, 0.77 - 7.1), being male (OR 1.7, 95% CI, 0.78-3.89) being a Christian (OR 0.309, 95% CI, 0.006 - 1.241), having been disclosed to (OR 0.581 95% CI, 0.163 - 2.071), having received family support (OR 0.561, 95% CI, 0.113 - 2.789) were not significantly ($P > 0.05$) associated with poor adherence to ART. Also attending support group meeting (OR 0.393, 95% CI, 0.116 - 1.328), knowing the importance of support

group meetings (OR 0.383, 95% CI, 0.52 - 2.811) and living with someone (OR 0.665, 95% CI, 0.168 - 2.629) were not significantly (P > 0.05) associated with poor adherence to ART. Table 5 shows predictors of adherence to ART among Adolescents Living with HIV /AIDS.

Table 5. Predictors of adherence to ART among adolescents living with HIV (Bivariate Analysis) (N = 196).

	Poor Adherence to ART				
Variable	**N**	**%**	**OR**	**95% CI**	**P-value**
Age Category					
10 - 14	145	74	2.3	0.77 - 7.1	0.135
15 - 19	51	26	Ref		
Gender					
Male	82	41.8	1.7	0.78 - 3.89	0.177
Female	114	58.2	Ref		
Duration on ART					
<5 years	48	24.5	2.9	0.83 - 10.46	0.034*
5 - 10 years	85	43.4	3.4	1.08 - 10.80	0.016
>10 years	63	32.1	Ref		
Primary Caregiver					
Others	45	23.0	0.53	0.19 - 1.47	0.222
Both	61	31.2	0.78	0.21 - 2.82	0.703
Father	22	11.2	0.34	0.11 - 1.01	0.052*
Mother	68	34.7	Ref		
Religion					
Other	15	07.7	0.108	0.604 - 162.804	0.108
Christian	172	87.8	0.309	0.006 - 1.241	0.309
Moslem	09	04.6	Ref		
Disclosure of HIV Status					
Disclosed	151	77	0.581	0.163 - 2.071	0.402
Not Disclosed	46	23	Ref		
Family Support					
Received Family Support	174	89	0.561	0.113 - 2.789	0.480
Not Received Family Support	22	11	Ref		
Satisfaction from Received Care					
Satisfied with Care Received	187	96	0.031	0.001 - 0.819	0.038
Not Satisfied with Care Received	08	04	Ref		

Continued

Attendance of Support Meeting					
Attend Meeting	133	78	0.393	0.116 - 1.328	0.133
Not Attend Meeting	63	32	Ref		
Knowledge of Importance of Support Meeting					
Know the importance	168	86	0.383	0.52 - 2.811	0.345
Not Know the importance	28	14	Ref		
Living with someone in past 3 Months					
Living with Someone	157	80	0.665	0.168 - 2.629	0.560
Not Living with Someone/Living Alone	39	20	Ref		
Experience of any Discrimination					
Not Experienced Discrimination	117	60	4.640	0.324 - 16.263	0.016*
Experienced Discrimination	79	40	Ref		

Overview of the Qualitative Data

From the in-depth interviews (IDI) and focus group discussions (FGDs) some four subthemes of the themes were identified which included facilitators of ART adherence, barriers to ART adherence, suggestions for improvement and socioeconomic challenges for adolescent mothers.

Facilitators of ART Adherence

This theme focuses on factors that support consistent ART use, and the facilitators of ART adherence included mobile phone/alarm clock, family support, self-motivation, social group/NGOs and health care support. Some respondents have indicated these below:

Mobile phone/alarm clock, "*I mostly use my alarm or I just rely on myself since I know the impact of not adhering* "Respondent (R) 2 FGD

Family Support, "*My Father, helps me to take my pills*" - IDI Respondent 21

Self-Motivation, "*What keeps me moving and trying is the fact that I don't want to infect my babies*" - Respondent 2 FGD

Social Group/NGOs, "*NGO, hospital support group*" - IDI Respondent 20 "*Educative social group meetings*" - IDI Respondent 17

Health Care Support, "*Counselling, calls to check on, monitoring of adherence to ART*" - IDI Respondent 19

Barriers to ART Adherence

This theme captures the challenges patients face in maintaining consistent ART use, and had subthemes which stood for barriers and included Forgetfulness, school work/commitments logistical issues, stigma related barriers, inconvenient timing, psychological distress, and treatment fatigue. The following were some of their expressions:

Forgetfulness, "*I forgot*" - IDI Respondent 21, "*Oversleep and forget*" - IDI Respondent 19

School work/commitments, "*…have challenges taking care of myself and my baby without support from my partner*" - Respondent 3 FGD

Stigma related barriers, "*I was stressed and people were where the pills were*" - IDI Respondent 38

"*…would have preferred something like injection… will not have to face stigma from peers when you want to take your tablets.*" - Respondent 2 FGD

Logistical issues, "*Stock out of former ART type*" - IDI Respondent 6,

"*Lack of transportation*" - IDI Respondent 15

Inconvenient timing, "*Inconvenient timing*" - IDI Respondent 8, "*Not taken at normal prescribed time*" - R10

Psychological distress, "*I was stressed and people were where the pills were*" - IDI Respondent 11

"*I had psychological disturbances*" - IDI Respondent *10*

Treatment fatigue, "*I am the only one taking the medication in the family*" - IDI Respondent 19

"*The biggest problem regarding taking ARV treatment is taking the drug everyday*" IDI Respondent 8

Suggestions for Improvement

With regards to adolescents' recommendations for enhancing ART adherence and overall HIV management. There is need for increased education and community awareness. Some of the suggestions are: more counselling/Sensitization, peer support network, long-acting ART, financial support, and stigma reduction

More Counselling/Sensitization, "*More counselling, call on medical corps to continue the search for a cure*" - IDI Respondent 20

Peer Support Network, "*Peer support network, more counselling*" - IDI Respondent 19

Long-Acting ART, "*Getting a drug that can be taken once a month*" - IDI Respondent 31

"*If the drug can be taken once a week, I will like it*" - IDI Respondent 11

"*We would have preferred something like injection that you come to the hospital monthly*" - R4 FGD

Financial Support, "*Help me with transport*" - IDI Respondent 24

Stigma Reduction, "*More counselling, sensitization*" - IDI Respondent 29

Socioeconomic Challenges for Adolescent Mothers

This theme, unique to the FGDs, highlights the socioeconomic burdens faced by adolescent mothers living with HIV, particularly in the absence of partner or family support. Some of the adolescents expressed their challenges in the following statement:

Childcare Responsibilities, "*Taking care of ourselves and the babies without support from our partners*" - R1 FGD, "*Taking care of ourselves and the babies without support from our partners* - R1 FGD

4. Discussion

In this study, ART adherence among 196 adolescents living with HIV (ALHIV) was 81.6%, below the UNAIDS 95% target for optimal viral suppression [27]. Higher education was significantly associated with better adherence P = 0.001), while stigma—experienced by 40.7% of participants—negatively influenced outcomes. Other key predictors included duration on ART (OR 3.4, P < 0.05), caregiver type, satisfaction with health care providers, and absence of discrimination. Qualitative findings reinforced these patterns, identifying stigma, forgetfulness, and logistical barriers, alongside protective factors such as family support, peer networks, and self-motivation. These results point to the need for a multistage adherence model integrating supportive policies, community engagement, and task-shifting to strengthen adolescent HIV care.

The 81.6% adherence rate is not good enough, meaning too many adolescents are skipping their medication. This raises serious health concerns, as it increases the risk of virologic failure (VF) by which the treatment stops controlling the virus, HIV drug resistance (HIVDR) in which the medication stops working entirely, and onward transmission or spreading the virus to others. These findings, specifically from the two Bamenda health districts in Cameroon's Northwest Region, show that adherence problems are complex, especially because the area is affected by sociopolitical conflict.

The study highlights that poor adherence is not just about an individual forgetting their pills. Instead, it is caused by a mixture of structural barriers like systemic issues or disruptions to getting to the clinic. access disruptions and not having enough to eat such as in food insecurity; Also individual challenges like mental strain; psychological distress and getting tired of treatment; treatment fatigue.

The significant role of education shows that when adolescents are informed, they are better able to prioritize their treatment (ART). The fact that 40% of adolescents face stigma is a major problem, as this widespread stigma reduces their self-confidence and social support, leading to feelings of isolation and ultimately, poor adherence. In short, the study confirms its goal which is was also to identify adherence as a complex problem influenced by personal, social, and system-wide factors.

Our study found an ART adherence rate of 81.6% among adolescents living with HIV (ALHIV).

This rate is consistent with what is typically seen in Sub-Saharan Africa (SSA), where adherence rates for ALHIV usually fall between 60% and 85% [28] [29]. This is consistent with a larger systematic review that reported pooled adherence rates for ALHIV in SSA around 72% to 80%. Both our study and the review found that factors like stigma and family support are key influences on whether adolescents stick to their treatment. Similarly, a study in Addis Ababa found a high adherence rate of 79.1% among adolescents aged 13 - 19 [30]. The slight difference between their 79.1% and our 81.6% may be due to differences in sample size and the fact that our study included a wider age range (10 - 24 years).

While our overall rate is similar to others, the specific factors that *protected* against poor adherence in our study were slightly different; we found a significant protective effect of education (P = 0.001) and we also highlighted the importance of caregiver involvement. Other studies often find no significant link between adherence and factors like gender or treatment duration. The reason our study highlighted education and caregiver involvement so strongly might be because we focused on conflict-affected areas. In these unstable settings, socioeconomic vulnerabilities (like lacking education or stable parental support) are intensified, making these factors much more critical to adherence.

In contrast, a 2025 scoping review by Magura *et al*., 2025 [29] identified barriers such as psychological distress and logistical issues as universal in SSA, but noted higher adherence in stable regions through digital interventions, which were underexplored in our setting. These discrepancies may be attributed to the methodological differences, such as our mixed-methods and geographical location of study sites, sample sizes to mention but these.

These findings contribute to the evidence based on ART adherence in ALHIV by proposing a scalable multistage model that integrates differentiated service delivery (DSD), mHealth reminders, and nutrition support, similar to those in WHO 2025 guidelines [2] [31] [32]. Practically, they advocated for targeted interventions like peer-led support groups and stigma-reduction campaigns in conflict zones, potentially reducing loss-to-follow-up rates which is currently 58% in Cameroonian paediatrics and advancing UNAIDS 95-95-95 goals [26]. On a broader scale, this study highlights equity issues, such as gendered burdens on female adolescents and adolescent mothers, informing policy reforms for inclusive HIV programming in SSA. Similar issues have been reported in a Nigerian study by Limbada *et al*., and Vicent CCN *et al.* [32] [33].

This mixed-methods cross-sectional study involving 196 ALHIV aged 10 - 19 years in Bamenda Health Districts, Cameroon, a conflict-affected region, revealed a predominantly younger cohort 74% aged 10 - 14 years), with high Christian affiliation with 88%, secondary education (54%), and long-term ART exposure (21% on ART for 11 - 15 years). Recruitment was urban-centric, with 59% from Bamenda Regional Hospital, highlighting access disparities. Overall, self-reported good ART adherence was high at approximately 82% - 86% across sections, but this was tempered by significant barriers like missed appointments (62%), forgetfulness (44% of non-adherence), stigma, and logistical issues [34] [35]. This adherence rate suggests moderate success in ART retention amid challenges, meaning that while many ALHIV maintain regimens through facilitators like family support and reminders, systemic failures risk virological failure (VF) and resistance, potentially undermining UNAIDS 95-95-95 targets in SSA [26]. Such results likely stem from improved pediatric ART access post-PMTCT expansions, yet are eroded by conflict-driven disruptions from example transport barriers and psychosocial stressors [36]. Follow-up could involve longitudinal tracking of viral loads to validate self-reports and assess long-term outcomes.

Linking to similar studies, this adherence rate aligns with [37] who reported 86% adherence among Ethiopian ALHIV via community clubs, similar due to shared SSA emphasis on support networks mechanistically reducing forgetfulness, and why from comparable resource-limited settings with perinatal cohorts. The findings are consistent too with the study by Kayiranga D *et al.* who reported that despite advances in treatment and prevention efforts, adolescents continue to be disproportionately affected by HIV and are a group with poor adherence to antiretroviral medication [38]. It also mirrors Kamau *et al.* (2023)'s [39] a 78% pooled adherence in orphaned SSA ALHIV and how through caregiver facilitation ART adherence improved This study finding differs from Hlophe *et al.*, 2025)'s [14] who reported a lower 65 % in broader SSA adolescents, the difference that might have resulted from objective measures like viral suppression (VS) capturing underreported non-adherence unlike this study's self-report bias. Differences with Villiera J B *et al.'s* [13] Ugandan findings of adherence barriers like fatigue arise how from qualitative depth highlighting stigma, and why from conflict amplifying logistics in Cameroon.

This study showed that having a younger age, having attained moderate education or secondary level, being a Christian, having accessibility to care and having extended ART durations were associated with ART adherence. These could be that adolescents with knowledge of follow-up will also ensure there is enough ART available to be taken to ensure optimal adherence. It could also be that adolescents who followed- up on their medications receive frequent counselling at the PTCs that helped them to ensure strict adherence.

Compared to similar studies, this aligns with Djiyou *et al.*'s [28] Cameroonian ALHIV with median age 16, 76% of respondents were of secondary education level, similar how via PMTCT-driven survival enabling adolescence, and from national ART policies favoring urban centers. A Rwandan study by Kayiranga, D., *et al.* and Kizito *et al.* [11] [38] found comparable results, with a mean adolescent age of 17.4 years and 56% of participants in secondary school. This high retention in Rwanda is likely due to predictable SSA education subsidies, which help reduce dropout rates. The main contrast is Rwanda's older age profile, which reflects its stable post-conflict system's success in keeping teens in school, versus Cameroon's insecurity leading to greater loss to follow-up (LTFU). The findings align with the larger cohort studied by [40] particularly in terms of the early initiation of the program or intervention. However, it differs because the Fokam study lacked caregiver data and had a different programmatic focus than the current study. The meta-analysis by Mengesha M.M. *et al.* (2023) [8] showed that 63% of participants reached the secondary education level. This finding is similar to ours, likely because both groups face stigma barriers to education. The key difference is that their analysis included fewer rural participants, while the current study has a noticeable bias toward urban populations.

The initial statistical test (bivariate analysis) showed that the only significant factor which was keeping clinic appointment was strongly linked to good adher-

ence to treatment. Specifically, patients who respected their appointments were far more likely to have good adherence, an impressive 80% and only 6% of those who did not (P = 0.009). This suggests that being engaged with the clinic or showing up when you are supposed to, is a good sign of whether someone is actually adhering to their treatment. This finding is similar to results from a Yaoundé study by Ketchaji, *et al.* [41] also found that patients who frequently missed appointments (defaulters) were over two-and-a-half times more likely to have poor adherence (aOR = 2.56). They specifically cited issues like poor transport and problems within the Cameroonian healthcare system as the cause of poor adherence. The findings also align with a large review of Sub-Saharan Africa by Hlophe *et al.'s* [14] which identified general healthcare service barriers like long wait times as a key problem.

A notable contrast is that we did not find a link with gender, even though other studies often point out specific risks for males. This is probably because our study focused on a younger age group, where those gender differences might not yet be significant. Our lack of a gender link to adherence matches with the data from Buh *et al.* [42] likely because stigma impacts everyone similarly. They did, however, find that long-term treatment (over 10 years) improved adherence. This difference is probably due to "survivor bias" in the adult study meaning only those who were already successfully adhering for a long time were studied. Our findings on gender were also similar to the inconsistent results found in Kamu *et al.*'s [39] review, which may be related to the equality of care provided to young people with perinatally acquired HIV. Where we differed is on education whereby the Kanu review noted education barriers, but these were not present in our group because most of our participants were already successfully attending secondary school.

The study identified several psychosocial factors that optimise or suboptimized adherence to ART by ALHIV. Those factors that improve adherence were high disclosure whereby 77% of participants had openly shared their health status, strong family support where an overwhelming 89% reported receiving support from their families and high care satisfaction whereby nearly everyone (96%) was satisfied with the medical care they received. On the other hand, the negative factors identified in this study were stigma and vulnerabilities despite the strong support to many significant challenges as 40% of ALHIV reported having experienced discrimination, 20% reported feeling isolated and only a minority (32%) regularly attended support groups. Overall, these findings suggest that strong personal and family support are helping to optimise ART adherence in these adolescents, but they are still very vulnerable to stigma and isolation in their daily lives. These factors likely play an important role in how well they are able to adhere to their treatment.

The finding that high disclosure helps adherence is consistent with a Sub-Saharan African (SSA) review by Gudisa and Jun [43] in that they also found that disclosure helps adherence by boosting self-efficacy (a person's belief in their ability to succeed) and by reducing stigma. This similarity is likely due to both studies

operating under shared education policies in the region. Our findings that support helps motivate adherence aligns with the scoping review by Moyo *et al*. [44]. The consistency is noticed in that both studies show that support works by providing emotional aid.

Our findings differed in that Moyo *et al*.'s work emphasized stigma more strongly than ours. This difference is probably because our participants were more integrated into schools, which might offer a more supportive and less stigmatizing environment than other settings.

The current study's finding that an undisclosed status (keeping one's status secret) acts as a barrier to treatment is supported by Kamote *et al*.'s [45] in their Tanzanian study.

The difference is that their study found that this barrier was linked to economic factors (which was not a focus here). This difference exists because their study focused heavily on the impact of food insecurity, a factor not central to our current research.

Our results match with those of the review by Hlophe *et al*. [46] regarding the importance of family literacy as a predictor of good outcomes. This match is likely due to the impact of similar educational interventions. Their review showed different results when it came to the role of non-biological caregivers (like aunts, uncles, or foster parents). This difference probably stems from variations in orphanhood rates and family structures between the study populations.

Overall, adherence to treatment was quite high at 82%. The reasons for non-adherence (missing doses) or when people did not take their medicine correctly, the main reasons were; Forgetfulness which is the biggest reason as it was cited by 44% of ALHIV second by timing issues as taking the medicine at the wrong time was reported by 17% and shame or feelings of embarrassment or stigma, affecting 11% of ALHIV. The reasons for missed appointments (retention gaps) found by the current study to be a larger problem was missing clinic appointments which was reported by 62% of people who missed them, who gave the causes being more related to logistics and daily life and which included transport issues for example difficulty getting to the clinic, mentioned by 33% of ALHIV and forgetfulness for example forgetting the appointment date, reported by 30% of ALHIV.

The study also noted that very few adolescents made lifestyle changes, such as only 2% engaging in regular exercise. These findings show that while most individuals are good at taking their medicine (high adherence), there are significant structural problems like transport and individual barriers like forgetfulness that make it hard for them to stay consistently engaged with the clinic (retention gaps).

The study's findings on adherence align with several other pieces of research work as our adherence rate of 81.6% is similar to the 65% rate found in the broader Sub-Saharan African (SSA) review by [14] because both studies point to stigma barriers and economic constraints as major challenges affecting adherence. The finding as the role of forgetfulness in poor adherence in our study also aligns with the findings of [14] which also linked non-adherence to fatigue and a feeling of

burnout. The findings in our reported rates of forgetfulness are higher than theirs and this difference is likely because our data relied on self-reporting, where people sometimes over-report common issues like forgetting. The current study's results showing the importance of support match the 78% adherence rate seen in orphans studied by Kamau *et al.* [39]. In both cases, this success is attributed to the positive influence of caregivers and the presence of structured aid programs.

Our overall high adherence rate is comparable to the 86% adherence rate achieved through support clubs in the study by Fatti G., *et al.*'s [37] study, however, did not find a focus on lifestyle changes like exercise was important for adherence, whereas our study did. This difference stems from the distinct focus of their intervention (clubs) versus the factors we studied.

The final analysis identified which factors significantly increased or decreased the risk of poor adherence to ART among ALHIV. Two main predictors found by the current study to significantly increase the chance of poor adherence, the first being treatment duration (5 - 10 years on ART) whereby adolescents who had been on ART for 5 to 10 years were 3.4 times more likely to have poor adherence (OR = 3.4). This suggests that the mid-range of long-term treatment is a critical, high-risk period. The second but unexpected predictor was no discrimination whereby adolescents who did not report experiencing discrimination were 4.64 times more likely to have poor adherence (OR = 4.64). This is a surprising finding, which might suggest that those who acknowledge facing discrimination are better supported or more vigilant about their health.

Two factors significantly reduced the chance of poor adherence and were firstly care satisfaction whereby adolescents who reported being satisfied with their care were dramatically less likely to have poor adherence (OR = 0.031) and father caregivers by which having a father as the primary caregiver was protective, making poor adherence less likely (OR = 0.34).

Our study found that several predictors commonly studied were not linked to poor adherence in ALHIV, including age, gender, disclosure of HIV status, and general family/social support.

Our finding that being on ART for 5 - 10 years is a high-risk period for poor adherence is consistent with a study by Ketchaji A *et al.* [41] which found a similar risk after more than 5 years (aOR = 2.33). This risk is likely due to treatment fatigue (getting tired of taking medicine daily for years). This is especially relevant in groups like ours who have been on treatment for a long time since birth (perinatal longevity). The mid-range duration of 5 - 10 years being risky also matches with that of Kizito *et al.* [11] review on virological failure (VF) predictors, which links duration and stigma to burnout. Our study found that discrimination was unexpectedly protective (less risk of poor adherence), which differs from Damulak PP, *et al.*'s [47] work where discrimination is usually a major risk factor. This unusual finding in our study might be due to a unique bias in how the data was collected or reported.

Self-reported data might have underrepresented discrimination in this study

due to denial, social desirability, or masked concerns, with ALHIV concealing their status despite underlying fears. Poor adherence could have reduced social exposures for instance avoiding interactions to hide symptoms, thereby limiting opportunities for discrimination, while those facing discrimination might adhere better as a resilience response. Moreover, might be other barriers like the lack of financial, material, and social support from community and health services negatively affected ART adherence. So might be the ALHIV did not experience discrimination which could have been a facilitator to ART adherence but at same time did experience these barriers and that resulted with poor adherence.

This bidirectional link is supported by longitudinal studies and conceptual frameworks showing that stigma initially impairs adherence but can lead to coping mechanisms that improve it among survivors. A United State study noted that participants with low reported stigma still engaged in status concealment, indicating hidden issues.

In high-prevalence regions like sub-Saharan Africa (SSA), normalized stigma may go unlabeled as discrimination, while overt experiences encourage protective adherence. Concealment strategies like hiding medications hinder adherence, but deception like misattributing illness can improve it by securing support without stigma [47].

Adolescents not experiencing discrimination might underreport it due to denial, lack of awareness as subtle microaggressions might go unnoticed or indicate social desirability bias which is wanting to appear "unaffected" in surveys. In contrast, those experiencing discrimination might be more vigilant about ART adherence as a coping mechanism, turning negative experiences into motivation for self-care. This aligns with resilience theories in public health, where adversity can foster adaptive behaviours in some ALHIV.

The absence of experienced discrimination might proxy for other risks, like living in isolated or low-awareness communities where HIV education is poor, leading to complacency and poor adherence. Alternatively, those who might not have been discriminated against could have undisclosed status, though disclosure was not significant here, reducing external stigma and internal motivation for adherence. Socioeconomic confounders like wealthier families facing less overt discrimination but more access to alternatives or mental health issues like depression masking discrimination perception might have also played roles, as bivariate analysis does not adjust for these.

This unexpected finding from our study is consistent with a Ghanian study by Nutor JJ *et al.* [48] which reported that the majority of the participants who reported low internalized stigma reported non-adherence to the ART compared to those who reported high internalized stigma.

This counterintuitive finding contrasts with findings of semi-structured interviews conducted in Zimbabwe with 24 emerging adults who had a recent history of viral non-suppression and with objective to explore barriers and facilitators of adherence to ART and whereby findings show that interventions to reduce stigma,

foster peer support, and therapy for common mental disorders could facilitate emerging adults aged 18 - 29 to adhere to ART [49].

A major contrast comes from Buh A., *et al*.'s [50] adult data, which found that longer duration was protective (improving adherence). This difference exists because their participants were adults who likely have greater autonomy and control over their health decisions than adolescent. Our finding that satisfaction with care is protective strongly aligns with Magura *et al*.'s [29] review on healthcare access. Both studies showed that satisfaction leads to better outcomes, primarily because it helps build trust between the patient and the healthcare provider.

Our findings are consistent with several other studies on what helps and what hinders treatment adherence in Sub-Saharan Africa (SSA) [51].

Our results align with the SSA review by Moyo *et al*. [44] on facilitators that help adherence, such as reminders and support. These facilitators work the same way by providing motivation. This similarity likely stems from shared practices in perinatal education (care provided to mothers and children around the time of birth), which emphasizes these supportive measures early on.

Our results match the barriers identified by Magura *et al*. [29], which included medication stockouts and stigma. Both sets of findings show that these issues create problems with access to care. Magura *et al*.'s work placed a greater emphasis on motherhood as a factor, which differs from our study because our research focused more broadly on gender among adolescents.

The findings from our study on the positive role of counseling are supported by Djiyou *et al*. [28]. This is because effective counseling helps maintain virological suppression (VS), and this consistency is likely due to the quality of urban services available in both study settings.

The barriers faced by mothers highlighted in Akinsolu *et al*.'s [52] review, specifically related to childcare, also align with our work. This commonality exists because both studies reflect systemic inequities that affect women and caregivers.

5. Limitations

This study has some limitations. First, adherence assessment was based on patients' self-report which might affect the estimation effect. Second, the study considered anyone who have ever missed their dose as non-adherent regardless of number of missed dose and time since missed. Despite attempts taken during data collection, the study may be affected by social desirability and recall biases.

Concluding, qualitative insights advocate integrated adolescent services for barriers. There was also potential selection bias, as the current study was hospital-based sampling might have excluded adolescents not engaged in care and who could have systematically different adherence patterns.

6. Conclusion

Overall adherence levels (82% - 86%) among adolescents living with HIV in this conflict-affected context mirror the broader progress seen across sub-Saharan Af-

rica. However, these averages conceal important structural and psychosocial barriers, including treatment fatigue, stigma, and logistical challenges, which are compounded by conflict-related inequities. Our findings highlight the protective role of family support, self-motivation, counselling, and NGO involvement, while also underscoring gaps around stigma reduction and maternal childcare burdens. The alignment of facilitators with regional evidence affirms the value of reminder systems, peer support, and counselling, but conflict settings demand tailored responses such as decentralized services, anti-discrimination measures, and mHealth-enabled reminder and support interventions. Long-acting ART formulations and targeted assistance to caregivers emerge as critical strategies to mitigate fatigue and sustain adherence. Addressing these multilevel dynamics is essential to advancing equity and resilience in adolescent HIV care within the fragile health systems. The study's qualitative findings highlight forgetfulness (44%) and logistical issues (33% transport) as the key barriers to ART by ALHIV. Specifically, forgetfulness, reported by 44% of participants, directly aligns with the potential of mHealth reminders, such as automated SMS or app-based alerts to serve as a proactive, user-friendly tool for prompting timely medication intake and reducing cognitive lapses without requiring additional behavioural changes. Similarly, logistical issues, including transportation challenges cited by 33% of respondents, highlight the value of decentralized services, which could mitigate these burdens by bringing care closer to communities through mobile clinics, home delivery of medications, or telehealth options, thereby improving accessibility and minimizing disruptions to daily routines especially on periods of lockdowns. By explicitly integrating these high-frequency barriers into the design and implementation of such solutions, future programs can enhance adherence rates, reduce health disparities, and ultimately contribute to better long-term HIV management outcomes.

7. Suggestions for Future Studies

Future research should employ longitudinal designs with objective measures like viral loads to track adherence trajectories and causality. Multicenter RCTs evaluating long-acting ART and mHealth in conflict zones could assess impacts, including rural samples and multivariate analyses to control confounders, with qualitative follow-ups on mothers.

Availability of Data

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Authors' Contributions

DEB was responsible for the conception and design of the study, directed data

collection and organization, statistical analysis and drafting of the manuscript.

Authors contributions: DEB, LLN and AMBS conceptualized the study. DEB, LLN, AMBS and NNKJ developed the methodology. LLN contributed to the conception and design of the study, participated in data collection as well as interpretation and drafting of the manuscript. NNKJ contributed to the conception and design of the study, participated in data collection, analysis of data and interpretation of data as well as drafting of the manuscript. AMBS contributed to the conception and design of the study, participated in data collection, analysis of data as well as interpretation and drafting of the manuscript. All authors read and approved the final version of the manuscript for submission. Formal analysis was conducted by DEB, LLN and AMBS. The original draft was prepared by DEB, LLN and AMBS. All authors read and approved the final version of the manuscript for submission.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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