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ISSN: 1179-1373 (Online) Journal homepage: www.tandfonline.com/journals/dhiv20

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To cite this article: David Livingstone Ejalu, Peter Simon Okello, Sean Steven Puleh, Joanita Nangendo, Jonathan Izudi, Sabrina Bakeera-Kitaka, Achilles Katamba, Anne R Katahoire, Joan N Kalyango, Adithya Cattamanchi, Fred C Semitala & Moses R Kamya (2026) Viral Load Suppression After Intensive Adherence Counselling Among Previously Non-Suppressed Adolescents and Young People with HIV in East-Central Uganda, HIV/AIDS - Research and Palliative Care, , 588885, DOI: 10.2147/HIV.S588885

To link to this article: https://doi.org/10.2147/HIV.S588885

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Published online: 03 Mar 2026.

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ORIGINAL RESEARCH

Viral Load Suppression After Intensive Adherence Counselling Among Previously Non-Suppressed Adolescents and Young People with HIV in East-Central Uganda

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Background: Viral load suppression remains suboptimal among adolescents and young people living with HIV in Uganda (AYPLHIV). Although Intensive Adherence Counselling is recommended for individuals who remain virally non-suppressed while on antiretroviral therapy, its contribution to suppression among AYPLHIV is not well understood. This study aimed to determine the level of viral load suppression achieved following intensive adherence counselling among previously non-suppressed AYPLHIV in east central Uganda.

Methods: We conducted a sequential explanatory mixed methods study among 580 participants aged 10–24 years receiving care at 32 health facilities. Quantitative data were abstracted covering a five-year period from 2019–2024. Suppression levels and subgroup differences were assessed using chi-square tests. A qualitative study was conducted with 12 purposively selected participants and thematic analysis were guided by the Capability, Opportunity, Motivation and Behavior framework.

Results: Participants had a median age of 16.4 years and a median ART duration of 4 years. Overall, out of the 580 participants, 313 (53.9%) achieved viral load suppression after counselling. Participants living more than 5 km compared to less than 5km from a health facility (p=0.003) and those counselled by counsellors rather than nurses (p<0.001) had significantly higher suppression level. Lower suppression level was observed among participants who had not disclosed their HIV status versus those who disclosed (p=0.011) and those reporting fear or stigma compared to those not reporting (p=0.010). Qualitative findings indicated that understanding the purpose and benefits of intensive adherence counselling (Capability), financial barriers and provider interactions (Opportunity), and non-disclosure (Motivation) influenced suppression outcomes among AYPLHIV.

Conclusion: IAC resulted in modest improvements in VL suppression among AYPLHIV. Low retention and contextual barriers, including distance, stigma and non-disclosure, limited its effectiveness. Tailored IAC strategies addressing subgroup-specific barriers are needed to improve VL suppression.

Keywords: viral load suppression, intensive adherence counselling, ART adherence

Introduction

Viral load (VL) suppression remains a major global challenge in the HIV response, particularly in sub-Saharan Africa (SSA), where adolescents and young people experience a disproportionate burden.[1,2] By 2023, an estimated 1.55 million adolescents aged 10–19 years and 3.1 million young people aged 15–24 years were living with HIV worldwide.[3] Yet, VL suppression rates in these age groups is low, ranging from 44% to 88%.[4,5] SSA continues to bear the highest HIV burden

https://doi.org/10.2147/HIV.S588885
Received: 14 December 2025
Accepted: 26 February 2026
Published: 4 March 2026

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and exhibits marked regional inequalities in VL suppression, ranging from 82.3% in West Africa to as low as 32.9% in Eastern and Southern Africa.[6,7] In Uganda, adolescents and young people living with HIV (AYPLHIV) remain particularly vulnerable with only 39.3% of children aged 0–14 years and 39.6% of young people aged 20–24 years achieving viral load suppression.[8,9]

Sustained suppression is essential for improving health outcomes among AYPLHIV and is strongly dependent on consistent antiretroviral therapy (ART) adherence.[10,11] Uganda adopted the World Health Organization (WHO) recommended strategy of intensive adherence counselling (IAC) for clients with non-suppressed viral load. Since 2016, IAC has been scaled up nationwide to address adherence barriers and reduce virological failure by training and deploying counsellors across most ART-providing health facilities in East-Central Uganda.[12–14] The IAC intervention is a structured support program designed for people with HIV (PWH) who remain virally unsuppressed after at least six months on ART, including those with viral load rebound.[12,15] The intervention support clients in developing tailored strategies to overcome identified adherence obstacles.[15–18] The intervention consists of a minimum of three sessions, typically conducted at monthly intervals, and follows the structured "Five A's" framework. First, the counsellor assesses adherence and identifies emerging challenges. Second, the counsellor provides advice on overcoming these challenges. Third, barriers are collaboratively analyzed and potential solutions generated, Fourth, the counsellor and client jointly agree on optimal solutions and develop adherence plan accordingly. Finally, the session is summarized, future appointments are clarified. All sessions are documented using the Ministry of Health's standardized IAC form. Following at least three sessions, a repeat viral load test is conducted. If the viral load remains elevated (≥200 copies/mL), counselling continues for up to six months before another assessment. Clients who remain virally unsuppressed despite demonstrated good adherence are transitioned to second-line ART in accordance with national guidelines.[12]

Despite IAC implementation, evidence from Uganda shows an increasing proportion of AYPLHIV failing to achieve VL suppression after IAC.[19–21] The full potential of IAC has not been realized, adolescents remain unsuppressed and AYPLHIV continue to face substantial risks, including immunological decline, premature mortality, an increased likelihood of transmitting HIV.[14,22] This age group continues to face substantial challenges in maintaining treatment adherence and attending IAC sessions.[23,24] Evidence remains limited regarding the extent to which IAC improves VL suppression among AYPLHIV in East Central Uganda. To address this gap, we assessed the level and distribution of VL suppression following IAC across different AYPLHIV subgroups and used the Capability, Opportunity, Motivation - Behavior (COM-B) model to explain observed variations.[25] The COM-B model provided a comprehensive framework for understanding the multilevel factors that influenced VL suppression. In the context of this study, capability encompassed adolescents' psychological capacity to apply adherence skills, as well as their physical ability to consistently take ART. Opportunity reflected physical and social conditions that enabled or constrained sustained engagement in care. Motivation captured both reflective and automatic responses that influenced adherence behavior.

Materials and Methods

Study Setting

This study was conducted in Jinja City and the districts of Jinja, Mayuge, and Kamuli, selected from the 12 districts that constitute the greater Busoga sub-region in east-central Uganda. Data were collected from 32 public health facilities providing ART services, comprising 20 sub-county level Health Centre IIIs, nine county-level Health Centre IVs, and three district-level general hospitals. These facilities, located across rural and peri-urban areas, provide IAC in accordance with national HIV treatment guidelines.[15]

Study Design

The study employed a mixed-methods sequential explanatory design to assess outcomes of IAC among AYPLHIV and to explore factors underlying these outcomes. In the quantitative phase, the data captured key service delivery indicators. Quantitative analyses were further used to examine variations in VL suppression across participant subgroups defined by age, sex, and distance to the health facility. The qualitative phase, informed by the quantitative results, adopted a descriptive design guided by the Capability, Opportunity, Motivation - Behavior (COM-B) model to explain the factors

contributing to observed differences in quantitative outcomes. Integration occurred at the interpretation stage, where quantitative evidence on the magnitude and patterns of viral load suppression was synthesized with qualitative explanations to provide a comprehensive understanding of these differences.

Study Population and Selection Criteria

This study was conducted among AYPLHIV aged 10–24 years, a population that continues to face substantial challenges in achieving viral suppression, a key element of the third "95" of the UNAIDS 95–95–95 targets.[2,22] The study population included AYPLHIV with documented first viral load results after at least one IAC session, as well as caregivers and health workers involved in IAC delivery. Qualitative follow-up interviews were conducted with AYPLHIV, counsellors, nurses, and caregivers engaged in the IAC process. Both virally suppressed and unsuppressed AYPLHIV were eligible, provided disclosure had been confirmed by a counsellor. Caregivers participated only with authorization from the adolescent or young person to prevent inadvertent disclosure. Eligible AYPLHIV had complete clinical records, including documented IAC enrolment dates and a first viral load result. We excluded those enrolled in IAC with known persistent high viremia associated to drug resistance. Health workers were included if they had at least six months' experience in ART clinics and were directly involved in IAC. Exclusion criteria included missing key clinical data, indirect involvement in IAC, lack of authorization for caregiver participation, or refusal to provide informed consent or assent.

Sampling Procedures

We used a proportionate-to-size sampling approach to allocate samples across participating ART clinics based on the number of AYPLHIV who completed IAC during the study period, with larger clinics contributing more records.[26] Within each facility, records were selected through simple random sampling using a lottery method, with sampling conducted without replacement to reduce selection bias and ensure equitable representation. For the qualitative component, purposive sampling with a maximum variation strategy was applied to capture diverse perspectives.[27] Participants were selected based on IAC outcomes, facility level, geographic setting, distance from the facility, demographic characteristics, and stakeholder category (AYPLHIV, caregivers, and healthcare providers). This strategy ensured broad representation across key subgroups and strengthened the depth and transferability of the qualitative findings.

Sample Size Estimation

Sample size was estimated using a standard formula for binary outcomes, as viral load suppression was dichotomized. Estimates were informed by prior evidence indicating that 80% of AYPLHIV achieve optimal adherence with at more than 95% adherence score and 20% have suboptimal adherence with less than 95% adherence score. Viral load suppression was observed in 69% of optimally adherent individuals compared with 50% among those with poorer adherence. Calculations assumed a 95% confidence level ($Z\alpha = 1.96$) and 80% power ($Z\beta = 0.84$). To account for clustering across multiple health facilities, a design effect of 2 was applied, consistent with WHO guidance and prior studies.[28–32]The resulting minimum sample size was 580 AYPLHIV, sufficient to detect meaningful differences in viral load suppression among participants receiving IAC. For the qualitative component, sample size was determined by thematic saturation, which was achieved after 12 interviews through concurrent preliminary analysis.

Data Collection Procedure

We conducted a five-year retrospective review of routinely collected HIV care data from selected health facilities using both electronic medical records (EMR) and paper-based sources. Data were captured using a structured Kobo Toolbox extraction tool. Five research assistants with clinical and digital data management experience underwent a three-day standardized training led by the Principal Investigator, covering study objectives, variable definitions, HMIS/EMR data elements, use of the digital extraction tool, confidentiality procedures, and the consenting process. A pilot extraction of 10 records was conducted and findings used to refine the tool. Data quality measures we implemented included built-in skip logic and mandatory fields in the tool, as well as cross-validation between EMR and paper-based HMIS registers.

For the qualitative interviews, the interview guide used was developed based on the COM-B model. Except for the health workers, all other interview guides were translated into Lusoga and back-translated to ensure conceptual

equivalence. All interviews were audio-recorded, transcribed verbatim, and verified for accuracy. To minimize self-report bias, interviews were conducted privately, participants were assured that responses would not affect care, and neutral probes were used. The interviews were conducted between September and November 2024. During full abstraction and interviews, the Principal Investigator provided on-site supervision and weekly reflexive team debriefings were conducted to address potential interviewer bias.

Study Variables

The primary outcome was viral load suppression, assessed using the first viral load test conducted after initiation of the IAC process. This binary outcome was defined as achieving viral suppression or not, irrespective of the number of IAC sessions attended. Viral suppression thresholds followed Uganda Ministry of Health guidelines: <1,000 copies/mL before July 2023 and <200 copies/mL from July 2023 onward.[12,15] The intermediate outcome was ART adherence, measured by pill counts and classified as poor (<85%), fair (85–94%), or good (≥95%). The secondary outcome was retention in IAC, defined as completion of all prescribed session in the IAC cascade up to the first viral load monitoring test.[12,15] We also examined variations in viral load suppression by sex, age, marital status, residence, distance to the health facility, duration on ART, stability status, pre-IAC adherence, number of IAC sessions attended, and adherence levels across the IAC cascade.

Data Analysis

Quantitative data collected via Kobo Toolbox were exported to Microsoft Excel for initial quality assurance, including completeness checks, coding, sorting, and data cleaning, before being imported into STATA version 14.0 for analysis. Univariate and bivariate analyses were conducted to describe participant characteristics and to assess viral load suppression, retention, and ART adherence across the IAC cascade. Differences in viral load suppression across participant subgroups were examined using chi-square tests of independence. Qualitative data were analyzed using a framework analysis approach based on the six phases described by Ritchie and Spencer, guided by the COM-B model.[33] The process involved data familiarization systematic coding in Atlas.ti, development of themes and subthemes, iterative theme review, definition and charting of themes within a COM-B aligned matrix, and synthesis and interpretation of findings. Qualitative rigor was ensured through credibility, dependability, confirmability, transferability, and reflexivity, supported by strategies such as prolonged engagement, member checking, triangulation, verbatim transcription, independent coding, team debriefs, maximum-variation sampling, and ongoing reflexive discussions.

Results

Socio-Demographic Factors of Non-Suppressed AYPLHIV in East Central Uganda

This study randomly sampled 580 non-suppressed AYPLHIV previously enrolled in IAC (Table 1), the majority of whom were girls (62.8%), with boys comprising 37.2%. Most participants were aged 10–14 years, with a median age of 16.4 years (IQR 12.9–21.2). The median duration on ART was 4 years (IQR 2–6). A large proportion resided in rural settings (74.8%), and a majority were never married (75.9%). Nearly two-thirds (64.7%) were attending school at the time of the study, with almost half (46.7%) receiving HIV care from Health Centre III facilities. A minority (17.6%) were classified as orphaned and vulnerable.

Retention and ART Adherence Among AYPLHIV Enrolled in IAC in East Central Uganda

Results indicate that at the initiation of IAC (baseline, IAC-0), only 166 of 580 AYPLHIV (29%) demonstrated good adherence. Following the first counselling session (IAC-1), this proportion rose markedly to 372 of 503 participants (74%). By the final session (IAC-3), good adherence had increased further, reaching 349 of 376 participants (92.8%). With respect to retention along the IAC cascade, the proportion attending IAC reduced from 100% in IAC-0 to only 376 (64.8%) of the 580 AYPLHIV who initiated IAC completed all scheduled sessions (Figure 1).

Table 1 Participant Demographic Characteristics

Variables	Levels	Frequency (n=580)	Percentage
Sex	Female	364	62.8
	Male	216	37.2
Age in years	10-14	252	43.5
	15-19	137	23.6
	20-24	191	32.9
Residence	Rural	434	74.8
	Urban	146	25.2
Marital status	Married	140	24.1
	Never married	440	75.9
Duration on ART	1-4 years	365	62.9
	5-9 years	131	22.6
	10 and above	84	14.5
Education status	Out of school	205	35.3
	In school	375	64.7
Employment status	Formal	7	1.2
	Non-formal	198	34.1
	Student	375	64.7
Orphaned and vulnerable	No	478	82.4
	Yes	102	17.6
Health facility level	H/C III	271	46.7
	H/C IV	210	36.2
	Hospital	99	17.1

Post IAC Viral Load Suppression Rate Among AYPLHIV by Number of Sessions Attended

As presented in Table 2, of the 580 participants enrolled, 313 (54.0%) achieved VL suppression on the first monitoring test following IAC. Among the 77 participants who attended only the baseline IAC session prior to VL testing, 28 (36.4%) achieved suppression. Of the 35 AYP who attended up to two sessions, 16 (45.7%) were suppressed. Among the 92 AYP who attended up to three sessions, 45 (48.9%) achieved suppression. Notably, the largest proportion, 376 (64.8%) completed all recommended IAC sessions, among whom 224 (59.6%) attained viral load suppression.

Distribution of Post IAC Viral Load Suppression Among AYPLHIV in East Central Uganda

Table 3 summarizes VL suppression among AYPLHIV following IAC. VL suppression differed significantly by geographic proximity to the health facility, with participants residing within 5 km exhibiting higher suppression rates compared to those living farther than 5 km ($p = 0.003$). Suppression rates also varied by IAC provider; a greater proportion of clients counselled by professional counsellors achieved VL suppression compared to those counselled by nurses ($p < 0.001$). Disclosure of HIV status to family members was associated with higher VL suppression relative to non-disclosure ($p = 0.011$), as was the reporting of fear and perceived stigma ($p = 0.010$). Participants demonstrating consistent ART adherence and retention throughout the IAC cascade attained significantly higher suppression levels than those with irregular adherence and attendance ($p < 0.001$). Moreover, attendance at all IAC sessions was associated with a markedly higher VL suppression compared to missing sessions (43.6%; $p < 0.001$). No significant differences in suppression were observed according to sex, age group, marital status, education level, place of residence, duration on ART, clinical stability, ART regimen line, or health facility level (all $p > 0.05$).

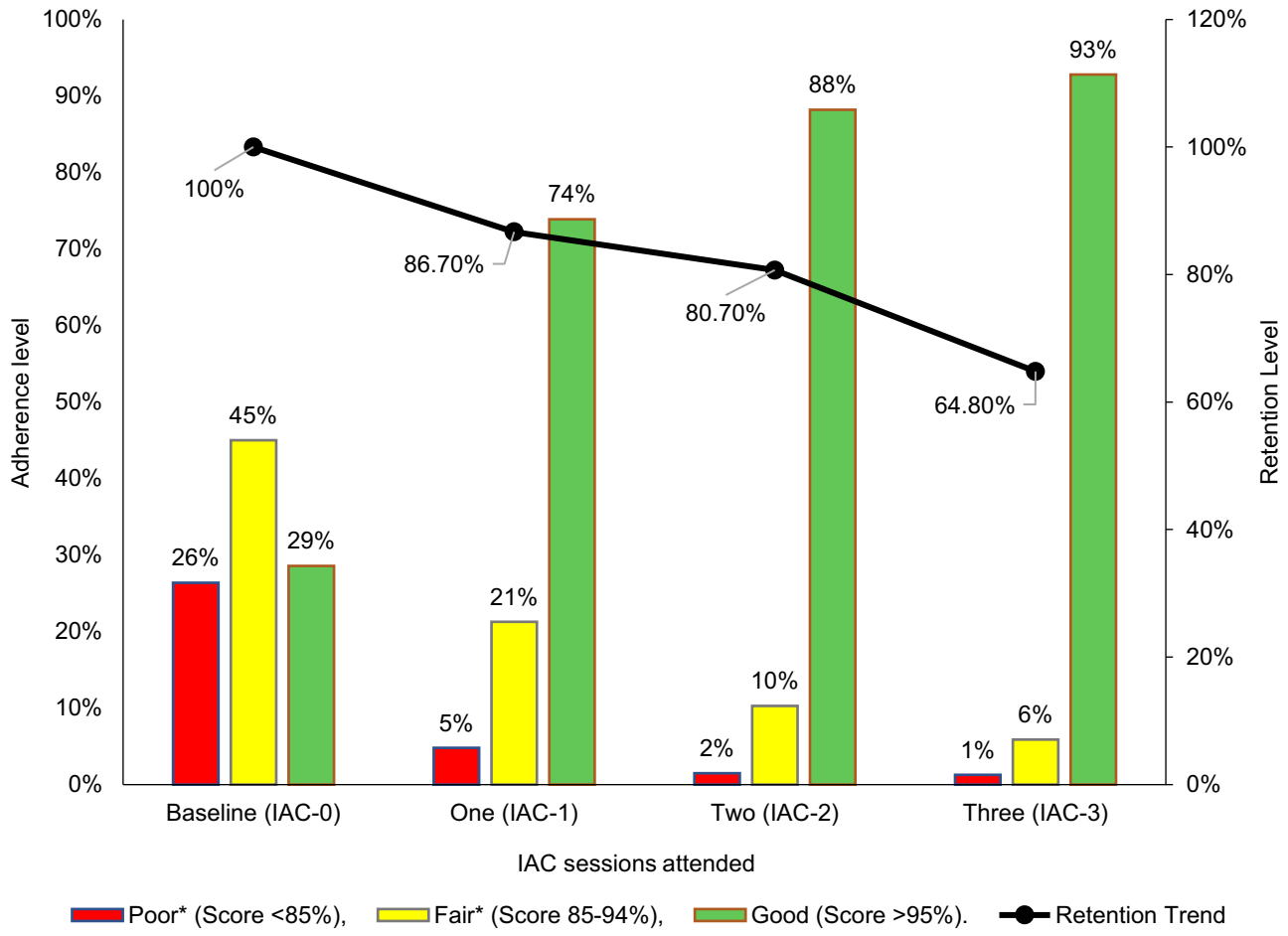


Figure 1 Trends of Retention and ART adherence among AYPLHIV enrolled in IAC in east central Uganda.

Sample Distribution of Participants Involved in the Qualitative Interviews

Table 4 presents the distribution of the 12 participants involved in the qualitative interviews. The sample included six AYPLHIV, comprising four adolescents (aged 15–19 years) and two young adults (aged 22 and 24 years). Among these, three participants had suppressed and two had not suppressed after IAC. Duration on ART varied from 1 to 15 years. Both male and female were selected with education levels ranging from primary to tertiary. The health workers consisted of two nurses and two counsellors aged between 31 and 45 years with qualifications ranged from certificate to degree level. Two female caregivers (aged 40 and 65 years) were also included. All participants were drawn from Health Centre III (HC III), Health Centre IV (HC IV), and hospital settings from both rural and urban locations.

Table 2 Distribution of Viral Load Suppression Rate by the Number of IAC Sessions Attended

Number of IAC Sessions Attended Before VL Test	Total Number Tested	VL Monitoring Test Result	
		Not Suppressed	Suppressed
One	77(13.3%)	49 (63.6%)	28(36.4%)
Two	35 (6.0%)	19(54.3%)	16(45.7%)
Three	92(15.9%)	47(51.1%)	45(48.9%)
Four	376 (64.8%)	152(40.4%)	224(59.6%)
Total	**580 (100%)**	**267(46.0%)**	**313 (54.0%)**

https://doi.org/10.2147/HIV.S588885

Table 3 Distribution of Viral Load Suppression by Client Characteristics

Variable	Category	Frequency (%)	Suppressed After AIC		Chi (p-value)
			No (%) n=267	Yes (%) n=313	
Sex	Female	364(62.8)	172(47.3)	192(52.7)	0.445
	Male	216(37.2)	95(44.0)	121(56.0)	
Age	10-14	252(43.5)	124(49.2)	128(50.8)	0.376
	15-19	137(23.6)	58(42.3)	79(57.7)	
	20-24	191(32.9)	85(44.5)	106(55.5)	
Marital status	Married	140(24.1)	58(41.4)	82(58.6)	0.209
	Not married	440(75.9)	209(47.5)	231(52.5)	
Education status	Out of school	205(35.3)	91(44.4)	114(55.6)	0.557
	In school	375(64.7)	176(46.9)	199(53.1)	
Residence	Urban	146(25.2)	65(44.5)	81(55.5)	0.671
	Rural	434(74.8)	202(46.5)	232(53.5)	
Distance to the facility	More than 5km	264(45.5)	139(52.6)	125(47.4)	0.003
	5km and below	316(54.5)	128(40.5)	188(59.5)	
Duration on ART	1-4 years	365(62.9)	167(45.7)	198(54.3)	0.984
	5-9 years	131(22.6)	61(46.6	70(53.4)	
	10 and above	84(14.5)	39(46.4)	45(53.6)	
Orphaned and vulnerable	No	478(82.4)	228(47.7)	250(52.3)	0.082
	Yes	102(17.6)	39(38.2)	63(61.8)	
IAC provider	Nurse	74(12.8%)	56(75.7%)	18(24.3%)	< 0.001
	Counsellor	506(87.2%)	211(41.7%)	295(58.3%)	
Stability status	Stable	473(81.6)	221(46.7)	252(53.3)	0.484
	Unstable	107(18.5)	46(43.0)	61(57.0)	
Good adherence in all sessions	No	320(55.2)	170(53.1)	150(46.9)	<0.001
	Yes	260(44.8)	97(37.3)	163(62.7)	
Attended all sessions	No	204(35.2)	115(56.4)	89(43.6)	<0.001
	Yes	376(64.8)	152(40.4)	224(59.6)	
ART regimen	First line	518(89.3)	238(45.9)	280(54.1)	0.463
	Second line	62(10.7)	29(46.8)	33(53.2)	
Disclosed status to family	No	49(8.5)	31(63.3)	18(36.7)	0.011
	Yes	531(91.5)	236(44.4)	295(55.6)	
Reported fear and stigma	No	354(61.0)	178(50.3)	176(49.7)	0.010
	Yes	226(39.0)	89(39.4)	137(60.6)	

Table 4 Sample Distribution of Participants Involved in the Qualitative Interviews

No	Participant	Sex	Age	Education Level	Facility Level	Facility Location	Duration on ART/Service
1	Adolescent (non-suppressed)	M	15	Secondary	HC III	Rural	15
2	Adolescent (suppressed)	F	16	Secondary	HC IV	Rural	15
3	Adolescent (suppressed)	F	17	Primary	Hospital	Urban	1
4	Adolescent (suppressed)	M	19	Secondary	HC IV	Rural	2
5	Young adult (non-suppressed)	F	22	Secondary	Hospital	Rural	3
6	Young adult (suppressed)	M	24	Tertiary	HC IV	Urban	5
7	Nurse	F	35	Diploma	HC IV	Urban	11
8	Counsellor	F	45	Degree	Hospital	Urban	15
9	Caregiver	F	65	Tertiary	HC IV	Rural	–
10	Caregiver	F	40	Secondary	Hospital	Urban	17
11	Nurse	F	31	Certificate	HC III	Rural	4
12	Counsellor	M	37	Degree	HC IV	Rural	11

Qualitative Findings

To contextualize and explain the quantitative results, we conducted follow-up qualitative interviews targeting variables that demonstrated statistically significant differences in VL suppression following IAC ($p < 0.05$). These variables included distance to the health facility, type of IAC provider, adherence consistency across sessions, attendance of IAC sessions, disclosure of HIV status to family members, and experiences of fear and stigma. Employing the COM-B framework, we explored stakeholders' perspectives to uncover the mechanisms underlying the observed variations in VL suppression across different subgroups. The key themes identified within each COM-B domain are presented below.

Capability Domain

Theme: Psychological Capability

Sub-Theme: Comprehension and Recognition of IAC and ART Benefits

Repeated engagement in IAC was reported by numerous participants to enhance the psychological capability of AYPLHIV by fostering a clear understanding of IAC principles and the health benefits of ART. Participants who attended more sessions described increased motivation to adhere to treatment regimens. Counsellors emphasized that IAC facilitated adolescents' recognition of their personal responsibility for health maintenance, reinforcing adherence-promoting behaviors. Consistently, AYPLHIV who actively participated in multiple counselling sessions highlighted the pivotal role of IAC in transforming their attitudes toward ART and strengthening commitment to sustained adherence. One suppressed adolescent said:

> Before the counselling, I didn't value the pills. Now, I see they make me strong and able to do well in school and I am determined to achieve my dreams. I have to keep healthy by consistently taking my meds. (Adolescent 16 years, suppressed, rural facility)

Another adolescent explained:

> Counselling made me realize it's my responsibility to take my medicine and live well like anyone else. I never missed any counselling session, and I never missed any pills. (adolescent, 17 years, suppressed, urban facility)

Counsellors and nurses reported delivering tailored, consistent, and age-appropriate information to AYPLHIV who regularly attended IAC sessions. Over time, they observed that their clients' understanding of both IAC and ART improved, and their attitude toward treatment was positively enhanced. One health worker emphasized the importance of consistency in improving IAC outcomes:

> When they come, we explain why the medicine matters, and we show them the implications of not taking it, and we support them in many other aspects. Eventually, those who attend the sessions consistently get these messages and support. They try

> harder to take their medication… that's why we see a difference in outcomes between those who attend many sessions, and those who attend one or two sessions. (Counsellor, 15 years' experience, urban facility)

Opportunity Domain

Theme: Physical Opportunity

Sub-Theme: Long Distance, Transport and Financial Constraints

Respondents residing far from health facilities consistently emphasized long travel distances, inadequate transport facilitation, and financial hardship as major physical opportunity barriers. This interrelated set of constraints impeded regular attendance for IAC sessions, consistent medication access, and ultimately viral load suppression. Adolescents living in remote areas described substantial challenges in travelling to facilities for counselling and ART refills compared to those in urban settings, resulting in pill stock-outs. As one adolescent explained:

> The drugs got done and at that time, I was not able to go for refill and counselling, I was transferred to Walukuba Health center which was a bit near, but still it's not a walkable distance…so I just stayed home without drugs until when I got money for transport. (Young person, 22 years, non-suppressed, rural facility)

Similarly, a caretaker lamented how the long distance to the facility is burdensome to her son.

> The facility is far, he cannot walk or reach, sometimes I don't have money to give him for transport and for lunch to go to the facility to pick up medication or attend counselling sessions when his appointment is due. (Caregiver, 65 years, rural facility)

Furthermore, AYPLHIV frequently cited the lack of transport money as a reason for missed clinic appointments and delayed ART refills. As one adolescent described:

> I didn't attend some appointments because I had no money for transport, coz I lost the small job I had during the COVID-19 period. I even failed to take some of the medicines I had at home; there was nothing good to eat. (Young person, 24 years, suppressed, urban facility)

Theme: Social Opportunity

Sub-Theme: Health Worker Interactions with and Preferences by AYPLHIV

The nature and quality of interactions between health workers and the non-suppressed AYPLHIV substantially shaped their engagement with IAC. Participants frequently expressed a strong preference for professional counsellors over other cadres, particularly nurses. Adolescents reported feeling more respected, supported, and genuinely cared for by counsellors, and these positive interpersonal dynamics influenced both their motivation to adhere to ART and their willingness to consistently attend counselling sessions. As one adolescent explained:

> The counsellors treat us very well, they talk to us well and mean well for us. They give you time and show you how to take the medicine properly… then you go home happy and motivated. But sometimes nurses can be rude and have no time to listen to your issues. (Adolescent, 16 year suppressed, rural facility)

Negative interactions with healthcare workers, especially those involving rudeness, harsh communication, or threatening behavior, were found to be obstacles to engagement. These encounters made teenagers less inclined to participate in IAC sessions and increased their avoidance of treatment. One participant recalled:

> I honestly and sincerely prefer to be attended to by the counsellor. She's very friendly, and she calmly talks to you… Other health workers are busy with many other patients and can be rude at times. The way they talk or look at you may scare you… You go back home, annoyed and disappointed sometimes without receiving any service, and you feel like never coming back. (Adolescent, 15 years, suppressed, rural facility)

Motivation Domain

Theme: Automatic Motivation

Sub-Theme: Stigma, Fear, and Non-Disclosure of HIV Status

For both younger and older participants, self-stigma and stigma at the community level that is exacerbated by fear and non-disclosure, were identified as significant automatic motivation barriers. Adolescents frequently avoided normal clinic visits or concealed their medication due to feelings of shame and anticipated or inadvertent disclosure. A counsellor explained how adolescents' willingness to publicly attend clinics and regularly adhere to ART was undermined by widespread stigma and worries of disclosure.

> It is hard for some of them who still experience fear, stigma and anxiety to suppress easily. They don't want to be seen frequenting the clinic for IAC. They skip clinic visits; they miss doses or avoid coming for counselling. (Counsellor, 15 years' experience, Urban facility)

When they saw familiar community members at the health facility, adolescents reported avoiding clinic visits or ART refill appointments out of fear of being judged, gossiped about, or unintentionally disclosing their HIV status. As one teenager put it:

> If I've seen a neighbor or someone who knows me around the health center on the day of the clinic appointment, I will just go back… I would rather miss my appointment or miss the drugs than be talked about in the village. (Adolescent, 19 years, suppressed, rural facility)

Caregivers who had not revealed the adolescent's HIV status said they were reluctant to take them to regular IAC sessions because they were worried that numerous counselling sessions would raise suspicions and unintentionally result in early disclosure. As one parent clarified:

> She is still young. She doesn't know her status yet. I told her she has some other chronic condition. I tried talking to her at home by myself, frequenting the clinic for counselling would make her curious to know why they need to convince her to regularly take medicine… she may come to know her status when she is still young, I fear that would disturb her psychologically. (Caregiver, 40 years, urban facility)

Discussion

This study aimed to assess the extent to which VL suppression is achieved following IAC among previously virally non-suppressed AYPLHIV in East-Central Uganda. Our findings demonstrate that IAC contributes to incremental improvements in VL suppression within this population, although only slightly more than half (54%) of participants attained viral suppression after completing IAC. This indicates that the contribution of IAC in improving VL suppression remains suboptimal among younger age groups in this setting. The proportion achieving VL suppression is notably lower than that reported in studies involving adult populations, where IAC has been shown to yield suppression rates between 65% and 75%.[20,34,35] Nonetheless, our results align with existing evidence documenting the comparatively limited performance of IAC among adolescents and young people in Uganda and Kenya.[36,37]

The proportion of participants with good adherence scores increased from 28.6% at baseline to 90% in the final session, indicating improved ART adherence among AYPLHIV in association with IAC. Additionally, we found significant differences in VL suppression between participants who adhered well and those who did not, as well as between those who consistently attended all IAC sessions and those who did not. These data suggest that the counselling intervention is likely effective in addressing adherence barriers, and is consistent with prior studies.[19,38,39] Nevertheless, total attendance fell by more than one-third from baseline to the last IAC sessions, mitigating the potential impact of IAC, as has been shown on other African settings.[18,20,34,39–41] Further studies are needed to determine the variables that contribute to low retention in IAC.

We further examined variations in VL suppression across subgroups of AYPLHIV and found no significant differences by sex, age, marital status, education level, WHO clinical stage, or stability status. These findings indicate that the benefits of IAC are broadly consistent across demographic and clinical categories. However, compared to individuals who lived further away,

adolescents and young people who lived within 5 km of a healthcare facility showed significantly higher suppression rates. This finding aligns with prior evidence indicating that geographic distance remains a structural barrier to sustained engagement in HIV care and adherence, particularly in rural settings where transport costs and opportunity costs are substantial.[42–44] Our qualitative data corroborate this pattern, with participants describing missed doses and inconsistent IAC attendance attributable to transport expenses, financial hardship, and logistical constraints which is in line with findings published elsewhere.[20,45] Suppression also varied significantly by IAC provider, disclosure status and reported fear and stigma. While specialized counsellors may enhance psychological support and coping skills,[46] and disclosure may facilitate social support and treatment accountability,[47] stigma and fear of unintended disclosure remain critical barriers to sustained adherence.[40] We noted that these findings introduce a potential implementation tension. Although community-based or decentralized IAC models may reduce geographic and financial barriers, they may simultaneously heighten anxiety about inadvertent disclosure within close communities. Implementation strategies must therefore balance accessibility with confidentiality. A dual focus on structural accessibility and social protection is thus essential to optimize IAC and VL suppression outcomes among AYPLHIV.

A key strength of this study is its comprehensive tri-level perspective that concurrently examines retention trajectories, adherence patterns, and corresponding VL suppression outcomes across the IAC cascade. The integration of follow-up qualitative interviews added substantial contextual depth, explaining the observed variability in VL suppression and thereby enhancing the interpretability and explanatory power of the findings. Nonetheless, several limitations warrant consideration. First, the analysis relied on retrospective data dating back to 2019, which may not fully capture contemporary post-IAC VL suppression outcomes. Second, declining participation across successive IAC sessions may have introduced selection bias; individuals who completed all sessions may differ systematically, particularly in adherence behaviors, from those lost to follow-up, potentially inflating observed suppression rates. Third, retention estimates must be interpreted cautiously, as aggregated trends may have been influenced by disruptions associated with the COVID-19 lockdown, limiting their reflection of current service delivery realities. Finally, adherence was assessed through pill counts, a method susceptible to manipulation if clients discarded surplus tablets, potentially leading to overestimation of actual medication intake.

Conclusion

Our findings indicate that IAC was associated with only modest improvements in VL suppression among previously non-suppressed AYPLHIV in East-Central Uganda. Suppression outcomes varied substantially by geographical distance to facility, IAC session attendance, provider cadre, disclosure status, and reported experiences of fear and stigma. These findings reveal that while IAC the model intervention in addressing non, suppression, its effectiveness is contingent on both consistent engagement and the broader psychosocial context within which adolescents manage treatment. The findings also suggest that standard, facility delivered IAC may not sufficiently address the developmental and psychosocial realities of adolescence that require explicitly adolescent-centered approaches such as peer-led or youth-friendly models. Our findings further raise questions about whether simply increasing the frequency or intensity of counselling sessions would meaningfully improve ART adherence. While poor retention suggests a need to strengthen follow-up mechanisms, repetitive counselling without addressing structural barriers including transport costs, school schedules and underlying emotional distress may not lead to realization of full IAC potential. More tailored, context-responsive IAC delivery strategies that potentially incorporate community-based, peer-supported, or hybrid facility– community models may offer greater impact than conventional IAC alone.

Future research should therefore examine the long-term sustainability, feasibility, and comparative effectiveness of adolescent-centered and community-integrated IAC delivery models in this setting. Additional investigation is also required to understand the behavioral, psychosocial, and virological mechanisms underlying the limited performance of IAC among virally non-suppressed AYPLHIV, in order to inform more precise and developmentally appropriate intervention design.

Abbreviations

ART, Antiretroviral Therapy; IAC, Intensive Adherence Counselling, AYPLHV; Adolescents and Young People living with HIV; VL, Viral Load; SOMREC, School of Medicine Research and Ethics Committee; UNCST, Uganda National Council for Science and Technology.

Data Sharing Statement

The datasets utilized and analyzed during this study are available from the corresponding author upon reasonable request, in line with institutional data sharing policies.

Ethical Consideration

This study complies with the Declaration of Helsinki. The study protocol received ethical approval and a waiver of informed consent for retrospective review of patient records from the Makerere University School of Medicine Research and Ethics Committee (SOMREC), under approval reference Mak-SOMREC 2022-396, and from the Uganda National Council for Science and Technology (UNCST), under approval number HS3807ES. All data collectors were trained to collect data in compliance with ethical standards. Written voluntary informed consent was obtained from all participants and caregivers in line with the SOMEREC and UNCST approval while assent was received from participants less than 18 years, after consent was sought from their parents. The original written informed consents and assents included publication of anonymized responses/direct quotes.

Acknowledgments

We gratefully acknowledge the Makerere University Joint AIDS Program (MJAP) for facilitating access to relevant data sources. We extend our appreciation to the Chief Administrative Officers and District Health Officers of Jinja District, Kamuli District, Mayuge District, and Jinja City for providing the requisite administrative clearance for this study.

Author Contributions

All authors made a significant contribution to the work reported from conceptualization, study design, execution, data collection, analysis and interpretation. In all areas, authors took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published and agreed on the journal to which the article has been submitted.

Funding

This research was financially supported by the Fogarty International Centre, the National Institute of Mental Health, and the Office of AIDS Research of the U.S. National Institutes of Health (NIH), through Award Number D43 TW010037. The views and conclusions presented in this publication are those of the authors and do not necessarily reflect the official policy or position of the NIH.

Disclosure

The authors declare no conflicts of interest related to this study.

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