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Triggers of sub-optimal HIV viral load suppression amongst vulnerable children on art in parts of Lagos State Nigeria: Experience of USAID supported ICHSSA-2 project

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HIV remains a disease of public health importance, with an estimated 39.0 million people living with the virus globally as of 2022. The Association for Reproductive and Family Health (ARFH) is implementing the Integrated Child Health and Social Services Award (ICHSSA-2) project in Lagos with support from USAID. Triggers of unsuppressed viral load were examined among HIV-infected children and adolescents enrolled in the project. A descriptive cross-sectional analysis of routine data was conducted among 207 children and adolescents living with HIV (C/ALHIV) aged 1 to 17 years, enrolled in USAID-supported healthcare facilities across eleven (11) Local Government Areas (LGAs) in Lagos State. The data were analyzed using descriptive statistics, and the significance of the association was determined using the Chi-square test. Slightly above one-third (36.7%) of the C/ALHIV enrolled were between the ages of 14 and 17 years, while only 8.7% were within the age group of 1 to 4 years. The highest proportion of C/ALHIV (24.2%) was from Ajeromi LGA. Missed pills accounted for more than half (51.7%) of the reasons identified for unsuppressed viral load among clients, followed by a busy schedule (15.4%), forgetfulness, and missed appointments (8.2%), respectively. More than half (51.4%) of the clients who reported missed pills were males. The identified triggers of sub-optimal HIV viral load and corresponding LGAs were found to be statistically significant (p < 0.05). Incorporating these identified triggers as part of routine adherence counseling for clients during clinic and home visits will undoubtedly contribute to and accelerate progress towards achieving the UNAIDS 3rd 95 goal.

Key words: Children, adolescents, HIV, viral load, suppression, Lagos, Nigeria.

INTRODUCTION

HIV remains a disease of significant public health importance, with an estimated 39.0 million people living with the virus globally as of 2022 (UNAIDS, 2022; WHO, 2023). Disturbingly, an estimated 630,000 AIDS-related deaths occurred in 2022 alone (WHO, 2023). According to the World Health Organization (WHO), 1.5 million (1.2

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million to 2.1 million) children (0-14 years) live with HIV, and 53% of all people living with HIV are women and girls (WHO, 2023). Nigeria ranks fourth in terms of HIV burden in the world (UNAIDS, 2020), with about 1.9 million people living with HIV and AIDS (NAIIS, 2018). Over two-thirds of new HIV infections in children occur in sub-Saharan Africa, which bears the largest burden globally (UNAIDS, 2021). The HIV pandemic has a severe impact on Nigeria, the most populous nation in Africa, and Lagos State is one of its epicenters, with a significant number of pediatric HIV infections.

According to Saxena et al. (2020), one of the challenges faced by children and adolescents living with HIV (C/ALHIV) is the possibility of an unsuppressed viral load, which increases the risk of disease progression, opportunistic infections, and higher mortality rates. Age, sex, length of antiretroviral treatment (ART), current ART regimen, and medication adherence are predictors of viral suppression globally, including in Lagos, Nigeria (Dixon-Umo and Ikpeme, 2020; Egbonrelu et al., 2021; Yiltok et al., 2020). Stigma and discrimination, linked to socioeconomic disadvantages, pose substantial obstacles to viral suppression (Leddy et al., 2019). Managing HIV infection in children is particularly challenging in Nigeria due to limited resources. Despite significant advancements in prevention of mother-to-child transmission (PMTCT) and increased access to antiretroviral therapy (ART) after diagnosis, a fraction of children with HIV infection continues to experience chronic unsuppressed viral loads.

Viral load (VL) is the gold standard for HIV treatment monitoring, indicating the amount of HIV RNA in blood plasma. A VL of less than 1000 copies/ml in low and middle-income countries signifies good treatment adherence, lower risk of HIV transmission, and signals ART effectiveness (NAIIS, 2018; Shiferaw et al., 2019). Viral load suppression in children living with HIV has remained challenging in many low-income countries, with unsatisfactory viral suppression rates throughout the demographic group (Fokam et al., 2019). VL suppression is a crucial metric for evaluating treatment success in children and adolescents living with HIV who remain consistently engaged in care. Patients undergo VL testing at least every six and twelve months, followed by an annual test. If a patient's VL is found to be high (>1000 cells/mL of blood) after at least six months on ART, they are provided with enhanced adherence counseling (EAC) (Anito et al., 2022).

There are multiple factors that can negatively impact the management of HIV, including suboptimal health, noncompliance with medication instructions, drug resistance, and side effects. According to the World Health Organization (WHO), children are particularly vulnerable to this issue. In fact, the sobering statistic reveals that half of the newly diagnosed HIV patients suffer from viral resistance to both efavirenz (EFV) and NVP, which can impede effective treatment (Shiferaw et al., 2019; Berihun et al., 2023). When treatment does not work, it can lead to clinical failure, immunologic failure, viral failure, or a combination of these. The goal of therapy after treatment failure is to achieve and maintain viral suppression (Shiferaw et al., 2019).

Despite advancements in Prevention of Mother-to-Child Transmission (PMTCT) and increasing access to ART after diagnosis, poor adherence has consistently been identified as a significant contributor to unsuppressed viral load in children (Tanyi et al., 2021). Poor adherence, poverty, inadequate treatment, and insufficient social support in children contribute to poor viral load outcomes in C/ALHIV patients, with co-infections and comorbidities like tuberculosis and malnutrition exacerbating the challenge (Dovel et al., 2023; Abana et al., 2023). Children with poor adherence had a greater probability of virologic failure, thus, it is critical to comprehend adherence patterns and identify obstacles to medication adherence among children and adolescents living with HIV (C/ALHIV) in Lagos State when creating focused interventions to enhance favorable treatment outcomes (Natukunda et al., 2019).

The Joint United Nations Programme on HIV/AIDS (UNAIDS) in 2014 announced the 95-95-95 goals for ending the AIDS epidemic by 2030 - 95% of all people living with HIV (PLWH) are diagnosed, 95% of those diagnosed are on anti-retroviral therapy (ART), and 95% of those on ART are virally suppressed. The aim of antiretroviral therapy (ART) for HIV infection is to achieve and maintain virologic suppression, thereby preventing disease progression, transmission, and AIDS-related illnesses and death (Okonji et al., 2021). Age, sex, length of antiretroviral treatment (ART), current ART regimen, and medication adherence are predictors of viral suppression globally, including Lagos, Nigeria (Egbonrelu et al., 2021). Adherence to ART is crucial to achieving and sustaining viral suppression among pediatric and adolescent populations. The aim of this study is to identify the factors causing sub-optimal viral load suppression among HIV-positive children and adolescents (1-17 years) receiving ART and enrolled in the USAID-supported Integrated Child Health and Social Services Award (ICHSSA-2) project in Lagos State, Nigeria. The findings from this study will help inform stakeholders, policymakers, and practitioners in the design of appropriate and evidence-based interventions to improve treatment outcomes and reduce the HIV burden among children and adolescents.

METHODS

Lagos State is located in South–West, Nigeria, on the Bight of Benin on longitude 20 42'E and 32 2'E, and latitude 60 22'N and 60 2'N, respectively. The state is bounded in the North and East by Ogun State, in the West by the Republic of Benin, and in the south
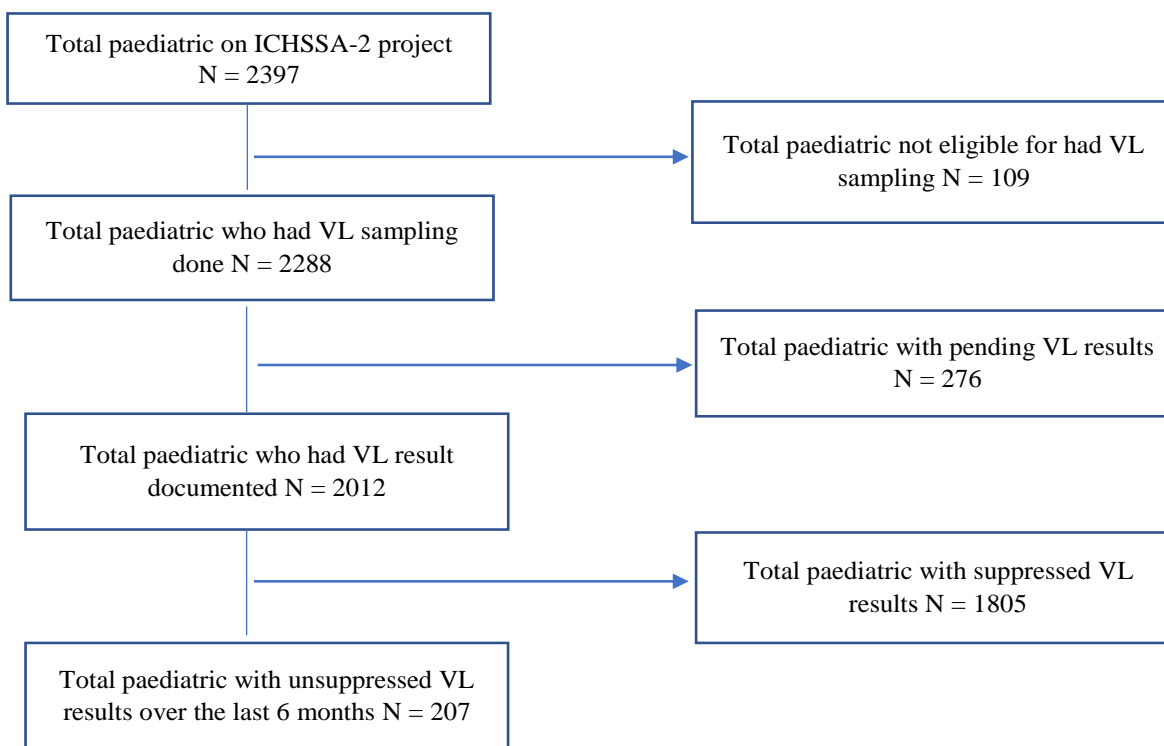
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┌─────────────────────────────┐
│ Total paediatric on ICHSSA-2│
│      project N = 2397       │
└─────────────────────────────┘
              │
              ├──────────────────────────────────────►  ┌──────────────────────────────────┐
              │                                          │ Total paediatric not eligible for  │
              │                                          │ had VL sampling N = 109            │
              │                                          └──────────────────────────────────┘
┌─────────────────────────────┐
│ Total paediatric who had VL │
│   sampling done N = 2288    │
└─────────────────────────────┘
              │
              ├──────────────────────────────────────►  ┌──────────────────────────────────┐
              │                                          │ Total paediatric with pending VL   │
              │                                          │ results N = 276                    │
              │                                          └──────────────────────────────────┘
┌─────────────────────────────┐
│ Total paediatric who had VL │
│  result documented N = 2012 │
└─────────────────────────────┘
              │
              ├──────────────────────────────────────►  ┌──────────────────────────────────┐
              │                                          │ Total paediatric with suppressed   │
              │                                          │ VL results N = 1805                │
              │                                          └──────────────────────────────────┘
┌─────────────────────────────┐
│ Total paediatric with       │
│ unsuppressed VL results over│
│ the last 6 months N = 207   │
└─────────────────────────────┘
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Figure 1. Flow diagram showing total number of paediatrics on ART eligible and ineligible for VL sampling, and those suppressed and unsuppressed VL over the last 6 months (April 2023 – September 2023).

by the Atlantic Ocean. Its territorial extent encompasses an area of 358,862 hectares or 3,577 sq. km. (Odusola et al., 2023). Association for Reproductive and Family Health (ARFH) is implementing the USAID supported Integrated Child Health and Social Services Award (ICHSSA-2) project, in Lagos State, Nigeria, to mitigate the impact of HIV/AIDS on Vulnerable Children and their Households. The ICHSSA-2 project supports the provision of HIV and social services in USAID-supported 53 health facilities across 11 focused LGAs (Ajeromi, Apapa, Agege, Badagry, Kosofe, Ikorodu, Lagos Island, Lagos Mainland, Ojo, Shomolu, and Surulere) in Lagos State. According to the NAIIS 2018 report, Lagos is one of the red states in Nigeria, in terms of HIV burden, due to its population density, commercial hub activities, seaports, and high mobility of residents. The ICHSSA-2 Project is currently supporting 2,397 children and adolescents on ART, in Lagos State, with 83% VL coverage and a suppression rate of 91% (NOMIS, 2023).

A descriptive cross-sectional analysis of routine data was conducted on eligible 207 children and adolescents living with HIV (C/ALHIV) within the age range 1-17 years enrolled in USAID-supported healthcare facilities across 11 selected Local Government Areas of Lagos State. The C/ALHIV were all on the first-line ART regimen for at least 6 months and had a viral load (VL) result of ≥1000 copies/ml post-analysis between April 2023 – September 2023. In Nigeria, according to the national guideline, the first Viral Load (VL) test is done 6 months after initiation on ART. The C/ALHIV who are not eligible for VL sampling, with no VL result documented, and those with suppressed VL result were excluded from the analysis (Figure 1).

Anonymized data of C/ALHIV with unsuppressed VL result ≥1000 copies/mL from April – September 2023 were extracted into Google

sheet from the electronic database record called National OVC Management Information System (NOMIS). NOMIS is a secured and trusted national electronic platform for the management of data for OVC programs in Nigeria as adopted by the Federal Ministry of Women Affairs and Social Development (FMWASD). NOMIS can only be accessed by those granted login. The data captured age, sex, LGA, date of VL sample collection, current and previous VL results.

The project engaged Facility and Community Case Managers (F/CCMs) who were trained on OVC Case Management system and statutorily monitor and provide treatment and social assistance, with tracking of VL results of HIV positive children enrolled in the ICHSSA-2 project. The F/CCMs probed the unsuppressed clients/caregivers on factors causing sub-optimal VL suppression, and this was frequently updated into the Google sheet. The Google sheet was secured, handled fairly, and protected against any unauthorized or illegal access. The ICHSSA-2 project Strategic Information (SI) team verifies and validates all data entered into NOMIS. Thereafter, both internal and external Data Quality Assessment is conducted by the SI team, USAID SI team, and OVC National team. Likewise, the Google sheet has layers of verification in place – Facility Case Managers, Program Monitors, and ARFH ICHSSA-2 Staff. The data were routinely checked for accuracy and quality. The extracted data were imported into STATA statistical software version 15.0 for analyses. Incomplete patients' information was reviewed and completed by the F/CCMs. Descriptive statistics were used to analyze the frequency and percentage distribution of age, sex, Local government, and factors responsible for sub-optimal VL unsuppression. Pearson Chi Square was done to determine the statistical significance of the study with a p-value < 0.05. The ICHSSA-2 project is a USAID funded project and has

Table 1. The Age, sex and LGA distribution of participants with unsuppressed VL enrolled into the study.

Variable	Frequency (N=207)	Percent	Mean age (years)	SD	95% CI
Age (years)					
1-4	18	8.7			
5-9	57	27.5	2.9	0.1	2.8-3.0
10-13	56	27.1			
14-17	76	36.7			
Sex					
Female	102	49.5	1.5	0.0	1.4-1.6
Male	105	50.5			
Local government areas (LGAs)					
Ajeromi	50	24.2			
Agege	24	11.6			
Apapa	9	4.4			
Badagry	23	11.1			
Ikorodu	23	11.1			
Kosofe	10	4.8	4.6	0.2	4.2-5.0
Lagos Island	37	17.8			
Lagos Mainland	15	7.3			
Ojo	8	3.9			
Shomolu	2	1.0			
Surulere	6	2.9			

ethical approval already. The ICHSSA-2 project is implemented by the Association for Reproductive and Family Health through the United States Agency for International Development (USAID), Cooperative Agreement (720 -620-20-CA-00004). Written informed consent was obtained from the Caregivers of Vulnerable Children (VC) before enrollment in the ICHSSA-2 project. A thorough explanation of the project and assurance of confidentiality was made by the project's Community or Facility Case Managers to the subjects. Ethical approval for this manuscript has been declared in the proposal that findings from the project will be published.

RESULTS

A complete dataset was obtained from 207 C/ALHIV aged 1 to 17 years who had their viral load results unsuppressed. There was a slight preponderance of male C/ALHIV (105, 50.5%) compared to females (102, 49.5%). About one-third (76, 36.7%) of the C/ALHIV were between the ages of 14 and 17 years, while only 18 (8.7%) were within the age group of 1 to 4 years. The highest proportion of C/ALHIV (50, 24.2%) were from Ajeromi LGA, followed by Lagos Island (37, 17.8%), Agege (24, 11.6%). Shomolu LGA had the lowest (2, 1.0%) (Table 1).

The study found nine different triggers responsible for sub-optimal suppression of VL among C/ALHIV enrolled in the ICHSSA-2 project. Out of the 207 C/ALHIV, 107

(51.7%) accounted for missed pills as triggers for unsuppressed VL, followed by a busy schedule (32, 15.5%), forgetfulness, missed appointments (17, 8.2%), respectively (Table 2). More than half (55, 51.4%) of clients who reported missed doses were males (Tables 3 and 4).

The results further showed the association between LGA and factors responsible for sub-optimal VL suppression. In the bivariate analysis, Lagos Island had a significant number of clients that showed Missed pills (27), followed by Ajeromi (26) and Badagry (15). However, Agege LGA had 18 busy schedules.

DISCUSSION

The findings from the study showed an association between different factors responsible for unsuppressed viral loads among C/ALHIV. It revealed that missed doses of anti-retroviral (ARV) medication are the most important identifiable factor driving sub-optimal VL suppression among the study population. This finding aligns with outcomes from similar studies conducted in other West African countries, which underscores the link between dose-skipping, inadequate adherence to ARVs, and unsuppressed viral loads (USAID, 2021; Cissé et al., 2019; Zohoun et al., 2019). This suggests that programs

Table 2. Identified triggers of sub-optimal VL suppression among C/ALHIV study clients.

Factors for viral load non-suppression	Frequency (N=207)	Percent
Busy schedule	32	15.4
Comorbidities	4	1.9
Forgetfulness	17	8.2
Herbs	7	3.4
Missed appointments	17	8.2
Missed doses	107	51.7
Pill fatigue	9	4.4
Poor nutrition	12	5.8
Wrongly sampled	2	1.0

Table 3. The association between identified factors and sex distribution among of C/ALHIV by sex among study clients.

Identified factors for sub-optimal VL suppression	Sex		Chi-square	p-value	Age (years)				Chi-square	p-value
	Female	Male			1-4	5-9	10-13	14-17		
Busy schedule	12	20			4	13	11	4		
Comorbidities	2	2			1	1	1	1		
Forgetfulness	10	7			0	4	6	7		
Herbs	4	3			0	1	1	5		
Misses appointment	10	7	9.0220	0.340	2	5	3	7	31.5217	0.139
Misses pills	52	55			10	29	27	41		
Pill fatigue	2	7			0	4	2	3		
Wrongly sampled	1	1			1	0	1	0		
Poor nutrition	9	3			0	0	4	8		

Table 4. The association between the identified factors and LGA distribution among C/ALHIV clients.

Identified factors for sub-optimal VL suppression	Local government areas											Chi square	p-value
	Ajer	Agege	Apapa	BDG	IKD	Kosofe	L. Island	M. Land	Ojo	Sho	Surulere		
Busy schedule	5	18	0	3	0	1	1	2	1	0	1		
Comorbidities	2	0	1	0	0	0	1	0	0	0	0		
Forgetfulness	4	0	0	0	2	0	8	1	0	0	2	221.041	<0.001
Herbs	3	0	0	3	0	0	0	0	1	0	0		
Misses appointment	3	0	2	0	7	0	0	4	0	1	0		
Misses pills	26	0	6	15	13	8	27	4	5	0	3		

Table 4. Cont'd

Pill fatigue	**2**	**0**	**0**	**2**	**0**	**1**	**0**	**4**	**0**	**0**	**0**
Wrongly sampled	2	0	0	0	0	0	0	0	0	0	0
Poor nutrition	3	6	0	0	1	0	0	0	1	1	0

Ajeromi (Aje); Badagry (BDG); Ikorodu (IKD); Shomolu (Sho).

must be more pragmatic in emphasizing the need to prevent missed doses from the point of treatment initiation by incorporating strategies such as reminders via SMS, phone calls to caregivers and/or clients by healthcare workers, Case Managers, and adherence counselors, especially during routine drug refills and home visits to avoid missed doses.

Similarly, non-adherence due to a busy schedule, missed clinic appointments, and pill burden has a substantial impact on unsuppressed viral loads (VL) among C/ALHIV. This study revealed that missed appointments and pill burden from pill consumption contributed to treatment exhaustion and non-compliance to ARVs. This finding is in line with Desta et al. (2020) research, which suggests that extended ART among adolescents can lead to drug resistance, treatment fatigue, and poor adherence due to missed appointments. The ICHSSA-2 project discovered that even with adherence counselling, children and adolescents living with HIV (C/ALHIV) continue to struggle with daily ARV intake, potentially resulting in non-adherence. Addressing these triggers is imperative to achieving the third 95 UNAID's goal. The ICHSSA-2 project addressed this by encouraging scaling up strategies like focused enhanced counselling adherence (EAC), pre-emptive reminder/tracking systems, caregiver education, and counselling services. Pill fatigue could be associated with HIV non-disclosure, although this still needs more research study. To enhance viral load suppression, appointment systems should be strengthened through more efficient clinic scheduling (family pair), reminders, and incentivizing transportation. Collaborations with community-based organizations implementing similar programs will further facilitate timely and appropriate care. Comprehensive adherence support programs are pivotal in age-appropriate treatment literacy for children and caregivers about the importance of adherence to ARVs and clinic appointments. Strategies like these, informed by evidence-based approaches, can address barriers and optimize health outcomes (Audi et al., 2021).

This study highlights the issue of forgetfulness, the use of traditional herbs, and alcohol in combination with anti-retroviral drugs among children and adolescents living with HIV. Despite being aware of HIV, some caregivers lacked a clear understanding of the virus and continued to use these traditional herbs and alcohol. This study shows that some caregivers mixed ARVs with traditional herbs, which is consistent with Adedoyin et al. (2021) findings, who revealed that forgetfulness and the use of local herbs and alcohol in combination with ARVs are factors associated with unsuppressed VL among C/ALHIV and also related it to a lack of adequate knowledge about HIV despite their awareness. In some cultures, traditional herbal medicines are frequently used as alternative therapies for a range of illnesses, including HIV infection. The concurrent use of traditional herbs with ARVs may be associated with unsuppressed viral loads among children and adolescents living with HIV (Akunne et al., 2023). Bessong et al. (2021) cautioned against the concomitant use of herbs with ARVs, which can lead to negative therapeutic interactions and sub-optimal VL suppression. In curbing the use of traditional herbs with ARVs, more emphasis should be placed on educating caregivers and C/AHIV about the dangers associated with the intake of herbal treatments and alcohol consumption alongside ARVs during their clinic visit is very crucial. Multidisciplinary approaches to counseling are essential to navigate these challenges. Also, collaboration with community-based organizations can help to raise awareness, create support networks, and enable informed decisions about medical treatment.

There is a strong association between the local government area of residence of C/ALHIV and ART with viral load suppression due to poor access in riverine areas, high volatility, and a poor support system of the caregiver. This is in line with findings from Egbonrelu et al. (2021) that suggest the location of people living with HIV is pertinent to viral suppression. It further argues that PLHIV in ART locations face significant barriers to HIV care, including transportation, provider discrimination, and confidentiality concerns.

Conclusion

This study identified factors causing sub-optimal viral load (VL) among enrolled vulnerable children and adolescents living with HIV (C/ALHIV) on antiretroviral drugs (ARVs) in parts of Lagos State. Missed pills are the highest contributing factor, as well as missed clinic appointments, pill burden, and a busy schedule. Equally, the local government area of residence has a strong association with sub-optimal VL suppression. It is, therefore, important for healthcare professionals, managers, donors, and policymakers to understand these factors and develop strategies and interventions tailored to improving drug adherence to achieve favorable treatment outcomes, especially among those newly initiating this lifelong treatment. Therefore, adherence scale-up should be done through focused adherence counseling, reminder systems, caregiver education, and counseling services. Programs like Operation Triple Zero (OTZ) groups to achieve Zero Missed Appointments, Zero Missed Drugs, and Zero VL, with enhanced adherence support initiatives tailored to address identified triggers, will contribute towards improved treatment outcomes in children and adolescents living with HIV in Lagos State, Nigeria.

Limitations

This study has several limitations. It does not account for other potentially confounding sociodemographic factors such as income, educational status, household settings, and size that could impact viral load (VL) suppression. Additionally, the study did not consider the type of treatment regimen and the socioeconomic effects on clinic visits. Due to delays in viral load result reporting, other clients whose results were still pending could not be included in the analysis.

ABBREVIATIONS

C/ALHIV: Children or Adolescent Living with HIV, **ART:** Antiretroviral therapy, **VL:** Viral Load, **ARV:** Antiretroviral, **HIV:** Human Immunodeficiency Virus, **ARFH:** Association for Reproductive and Family Health, **USAID:** United States Agency for International Development, **OTZ:** Operation Triple Zero, **ICHSSA-2:** Integrated Child Health and Social Services Award, **LGA:** Local Government Area.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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