Scientific Research Publishing

Advances in Infectious Diseases, 2022, 12, 685-702
https://www.scirp.org/journal/aid
ISSN Online: 2164-2656
ISSN Print: 2164-2648

Enhanced Adherence Counselling, Support Groups and Viral Load Suppression amongst HIV-Positive Adolescents in a Tertiary Health Care Facility in Cameroon

Agbor Nyenty Agbornkwai[1*], André Izacar Gaël Bita[2], Stephane Amatagana Mabouna[3], Ismaila Esa[4], Ajong Brian Ngongheh[3], Ateh Stanislas Ketum[3], Derek Akateh[3], Yannick Lechedem Ngunyi[3,5], Arnold Agwe Tanah[3,5], Gisele Christian Miangu Wolloh[5], Grace Tadzong-Awasum[1]

[1]Catholic University of Central Africa, Yaounde, Cameroon
[2]Médecins Sans Frontières Belgique, Bangui, Central African Republic
[3]Ministry of Public Health, Yaounde, Cameroon
[4]Cameroon Baptist Convention Health Board, Yaounde, Cameroon
[5]University of Buea, Buea, Cameroon
Email: *a_nyenti@yahoo.com

How to cite this paper: Agbornkwai, A.N., Bita, A.I.G., Mabouna, S.A., Esa, I., Ngongheh, A.B., Ketum, A.S., Akateh, D., Ngunyi, Y.L., Tanah, A.A., Wolloh, G.C.M. and Tadzong-Awasum, G. (2022) Enhanced Adherence Counselling, Support Groups and Viral Load Suppression amongst HIV-Positive Adolescents in a Tertiary Health Care Facility in Cameroon. *Advances in Infectious Diseases*, **12**, 685-702.
https://doi.org/10.4236/aid.2022.124048

Received: September 10, 2022
Accepted: November 7, 2022
Published: November 10, 2022

Abstract

Background: Globally, HIV viral load suppression rate, which is an indirect measure of the efficacy of antiretroviral (ART) medication, is 47% and 52% in Africa. In Cameroon, the viral load (VL) suppression rate is 44.7% and poor adherence is widely documented as being responsible for the large gap in VL Suppression. Enhanced adherence counselling (EAC) sessions, and enrolment and participation in support groups are specific interventions to improve ART adherence and improve viral load suppression. **Purpose**: This study assesses the uptake and contribution of support groups and EAC sessions in the management of adolescents with unsuppressed VL results at Centre Hospitalier d'Essos, Yaounde. **Methods**: A retrospective correlational quantitative patient files review was conducted for 138 files of HIV positive adolescents aged between 10 - 19 years with HIV VL above 1000 copies/ml enrolled in care between January 2009 and December 2019. Data from the questionnaire was entered into CSPRO version 7.4. and analyzed by using SPSS version 25.0. **Results**: A total of 138 participants (75 females and 63 males) with a mean age of 15 ± 3 years were included in our study. Sixty-nine (50%) participants were in World Health Organization (WHO) stage I; 32.6% were in Stage II; 13.0% and 4.3% were in stages III and IV, respectively. Thirty (21.7%) had a history of tuberculosis and 76% of the adolescents were being

cared for primarily by their parents. The charts of the adolescents revealed that there was an association between completion of EAC sessions in adolescents with unsuppressed VL and eventual VL suppression (R.R = 2.5; CI 0.848 - 6.162; p = 0.033). However, there was no significant association between support group enrolment and active participation, and eventual VL Suppression. Furthermore, combining EAC and support group interventions was strongly associated with eventual VL Suppression in this group of initially unsuppressed adolescents (R.R = 7.5; C.I 2.544 - 22.360; p < 0.001). **Conclusion:** Suppression rates were good after completion of EAC sessions and participation in support group enrolment for adolescents with a high VL. As we move towards having 95% of ART-treated adolescents achieve and maintain viral suppression, there is a need to reinforce EAC sessions and support group enrolment in ART clinics targeting this priority group.

Keywords

High Viral Load, Enhanced Adherence Counselling, Support Groups, HIV, Adolescents

1. Introduction

According to The Joint United Nations Programme on HIV/AIDS (UNAIDS) in 2019, about 37.9 million people are living with HIV (PLHIV) worldwide and 770,000 people died at the end of 2018 with HIV/AIDS (UNAIDS, 2019). Eliminating HIV infection by 2030 in Cameroon depends on how much the country will achieve for the third 95 of the UNAIDS three 95 goals which are: to identify 95% of PLHIV, place 95% of identified PLHIV on ART, and achieve VL suppression in 95% of PLHIV on ART by 2030. This requires an approach that includes optimization of HIV case finding, optimal linkage to ART services for identified HIV positive ART naive clients, and EAC for HIV positive clients on ART with unsuppressed VL. Over the last decade, research has demonstrated the profound impact of HIV treatment in preventing the sexual transmission of HIV [1] [2] [3]. This is referred to as "Treatment as Prevention" or TasP [4]. The success of TasP depends on patient adherence to the right ARVs, on maintaining suppressed viral load levels and on the knowledge or awareness of the benefits of viral suppression [4]. Viral load suppression is an important and direct indicator of viral replication, hence is a suitable reflection of the efficiency of antiretrovirals (ARVs). As a result, with suppression of VL, there is a possibility of a significant reduction in HIV transmission (zero transmission with undetectable viral load), reduction in opportunistic infections and improvement of quality of life [3]. Hence it remains imperative that people living with HIV (across all age groups) start their treatment and adheres to treatment to attain suppressed VL titres. This is however not the case as several factors which determine adherence and resistance to ARVs play to offset the expected cascade.

In Cameroon, with an HIV prevalence of 2.8% [5], 44.7% of patients have a

suppressed VL [6]. However, across the different age groups, there are several differences with suppression rates ranging from 22.5% amongst females aged 15 - 24-year-old to 62.9% amongst females aged 55 - 64-year-old, which both are far from the UNAIDS target of 90% [7]. Despite several efforts made, viral load suppression in adolescents remains a challenge in Cameroon. In Cameroon, poor adherence and weak psychosocial support have been earmarked as strong contributors to unsuppressed VL, especially among adolescents [8]. Enhanced adherence counselling, which is used to evaluate and support adherence to ARVs in patients with unsuppressed VL is routinely done. Unfortunately, the documentation of these intervention measures in cases of high Viral Load (HVL) amongst adolescents, the assessment of the efficiency of these intervention measures with a view to upscale, and the harmonisation of these intervention measures remain grey areas in HIV care in Cameroon, and these will be the focus of this study. This study sought to highlight the role of enhanced adherence counselling and support groups to eventual VL suppression in initially unsuppressed adolescents in Cameroon.

2. Materials and Methods

2.1. Study Design

The study was a retrospective quantitative correlational cohort study among adolescent at the Centre Hospitalier Essos (CHE). Data was collected from Treatment Charts or ART patients' files of HIV positive adolescent patients enrolled into care at the HIV treatment Center of the CHE between January 2009 and December 2019, and from the HVL register.

2.2. Study Site and Participants

The study was conducted in the Centre Hospitalier Essos (CHE)-Yaounde, in the Centre Region of Cameroon. It is a tertiary health facility in the Centre Region of Cameroon. This study site has been a referral health care facility for management of HIV infected children and adolescents since 2005. CHE has one of the largest HIV treatment units in Cameroon with currently more than 5000 patients on ARVs in 2019. Furthermore, this patient cohort consists of about 500 adolescents on ARVs who are followed up here by a multidisciplinary team of paediatricians, psychologist, case managers and psychosocial agents.

The study was conducted between June 2020 and March 2021 (Period to consider for enrolling a patient in the sample). Data was collected between 1st December 2020 and 28th February 2021.

This study involved the use of records/files of HIV positive adolescents on ART followed up at the HIV treatment centre in CHE and who had an initial high viral load result.

Inclusion criteria

- Patient files of HIV positive adolescents (10 - 19 years) recruited into the clinic cohort between January 2009 and December 2019.

- Patient files of an HIV positive adolescents on ART for at least six months.
- Patient files of an HIV positive adolescents who are aware of their status (disclosure completed).
- Patient files of HIV positive adolescents with two documented viral load results, one high viral load result and a subsequent viral load result after enhanced adherence counselling.

2.3. Sampling

The patient files of all HIV-positive adolescents meeting the inclusion criteria were line listed using their ART treatment center codes. These codes were entered into excel and simple random sampling using Excel was used to select the patient files of participants for the study.

Sample size

The required minimum sample size for the study was calculated using the expected rate of 7% unsuppressed VL among 10 - 19 years old patient as found by Bulage, L. *et al.*, (2017) [9], by using the following statistical formula (Lorentz formula). The minimum sample size was therefore 100 patient files of participants enrolled in the study.

$$n = \frac{Z^2 * P(1-P)}{d^2},$$

where $d = 5\%$; $P = 7\%$ and $Z = 95\%$, therefore, $n = (1.96)^2 \times 0.07\ (1 - 0.07)/0.05^2 = 100$ participants

2.4. Technique and Instrument for Data Collection

Data was collected using a pre-tested structured questionnaire.

Information was collected from:

- Individual patient records/files
- High viral load (HVL) register

The questionnaire collected information on specific patient socio-demographic and clinical characteristics (stage of disease at enrolment, viral load and ARV history, EAC sessions, support group and adherence history). The questionnaire was structured into 4 sections: Sociodemographic characteristics and clinical history, support group and EAC participation, adherence evaluation and outcome. Pretesting of the questionnaire was done using several files at CHE to make sure all the information requested by the questionnaire were available from the two chosen sources (patient files and HVL register). All ambiguous questions were modified, and it was ensured that all the information requested by the questionnaire was available in the two primary sources for this study.

2.5. Data Management and Analysis

Data from the questionnaire was entered into CSPRO version 7.4. Data was also

stored using an external hard drive and the researcher's Google drive to serve as a backup. Data was analyzed using SPSS version 25.0. Measures of central tendencies (mean and standard deviation, median and interquartile range) were used to describe the quantitative variables or characteristics of patients while modes were used to describe qualitative variables. Chi square test was used to evaluate the relationship between the dependent variables and each of the independent variables with 95% confidence interval.

2.6. Ethical Consideration

Ethical clearance was obtained from the Institutional Review Board of the Catholic University of Central Africa (reference number: 2020/020101/CE/RSH/ESS/MSP) and administrative authorization was obtained from Centre Hospitalier Essos (reference number: 18/20/DCHE/DA/CE-CHE/CNPS). Confidentiality and anonymity of patients were ensured using only their case numbers for identification. All data was stored and accessed only by the primary investigator and data entry was done only with patient codes.

However, considering

- the retrospective nature of the study
- no formal contact anticipated between the participants and the research team

A waiver of informed consent was therefore requested from the board considering the retrospective nature of the study.

Administrative authorisation was also obtained from the administration of Centre Hospitalier Essos.

Protection of patient personal information was ensured by use of only ART codes for data collection and all collected data was protected in a secure electronic data base. Human data was obtained and guarded in accordance with the Declaration of Helsinki.

3. Results

3.1. Sociodemographic Characteristics

Our study included 138 participants with specific sociodemographic characteristics as seen in Table 1 below. The mean age of participants was 15 ± 3 years and 75 (54.3%) were females. Sixty-nine (50%) participants were at World Health Organization (WHO) stage I; 45 (32.6%) stage II; 18 (13.0%) and 6 (4.3%) had stages III and IV respectively. Thirty (21.7%) had a history of tuberculosis and 76% of the adolescents were being cared for primarily by their parents.

3.2. Viral Load, ARV, and Opportunistic Infection History

The median first VL after at least six months of ARV treatment was 12,184 copies/ml. The minimum first unsuppressed VL was 1034 copies/ml, and the maximum was 319,627 copies/ml. In 123 (89.1%) participants, the 1st line ARV regimen was used. One hundred and thirty-eight (100%) took the right dose of medications and opportunistic infections occurred in 30 (21.7%) participants.

Table 1. Sociodemographic and clinical characteristics of 138 adolescent participants at CHE.

Parameter		Frequency	Percentage (%)
Gender			
	Male	63	45.7
	Female	75	54.3
WHO Stage			
	Stage 1	69	50
	Stage 2	45	32.6
	Stage 3	18	13.0
	Stage 4	6	4.3
Positive TB screen		30	21.7
Use of Other medications	Antibacterial	39	28.3
	Antiviral	00	0.0
	Other	00	0.0
Primary care giver	Parents	105	76.2
	Other family member	33	23.9
	Other	00	0.0

3.3. Adherence before EAC

Good adherence was reported in 54 (39.1%) participants. Adherence was fair in 54 (39.1%) participants and poor in 30 (21.8%) participants as seen in Table 2.

3.4. Barriers to Viral Load Suppression Using EAC and Support Group Interventions

The main barriers to VL suppression identified using the EAC tool were forgetting to take medication (91.3%) and knowledge deficit (91.3%). The other barriers and interventions are summarized in Table 3.

3.5. Uptake of EAC and Support Groups in Adolescents with a High Viral Load

All 138 participants were enrolled into EAC sessions. A total of 126 participants (91.3%) had documented completion of their EAC sessions.

Of the 138 participants, 108 (78.3%) were enrolled in a support group for a mean duration of seven months (Table 4). Forty-eight (34.8%) of adolescents attended both the adolescent and high viral load support groups. The other adolescents exclusively attended either the HVL group (45, 32.6%), the adolescent support group (12, 8.7%) or the disclosure support group (3, 2.2%).

Furthermore, of the 108 participants in support groups, 69 (50%) attended all sessions, 36 (26.1%) missed less than 50% of sessions, and three (2.2%) participants infrequently attended support group sessions.

Table 2. Adherence by frequency of pill intake in 138 adolescents with HVL at CHE.

Parameter		Frequency	Percentage (%)
Patients taking once daily regimens		117	84.8
Doses missed	<2 doses	48	41.0
	2 - 4 doses	45	38.5
	>4 doses	24	20.5
Patients taking twice daily regimens		21	15.2
Doses missed	<4 doses	6	28.6
	4 - 8 doses	9	42.9
	>8 doses	6	28.6

Table 3. Barriers to VL suppression identified during EAC of adolescents at CHE.

Barriers (frequency, percentage)	Intervention	n (%)
Knowledge deficit (126, 91.3%)	Individual counselling for basic HIV/ARV education	117 (92.9)
	Group counselling/peer support group	9 (6.5)
	Written instructions	0 (0.0)
Side effects (75, 54.3%)	Nausea-take food, antiemetic	39 (52.0)
	Diarrhea-rule out infection, medications where applicable, patient hydration	9 (12.0)
	Anxiety/depression-counseling/medications	6 (8.0)
	Headache-rule out OIs, medication	15 (20.0)
	Fatigue-rule out anemia	6 (8.0)
Forgot (126, 91.3%)	Medication organizer	0 (0.0)
	Visual medication schedule-calendar, journal	6 (4.8)
	Reminder devices-alarms, phone reminder	117 (92.9)
	Treatment buddy/supporter	0 (0.0)
	Directly Observed Therapy	0 (0.0)
	Announced pill count at next visit	3 (0.0)
Feeling better (84, 60.9%)	Basic HIV/ARV education	84 (100)
Physical illness (15, 10.9%)	Clinical care to address comorbidities	15 (100)
	Directly Observed Therapy	0 (0.0)
	Treatment buddy	0 (0.0)
Alcohol or Drug use (12, 8.7%)	Individual counselling	12 (8.7)
	Peer support group	0 (0.0)
	Referral to appropriate bodies to address specific issues if they check 3 or more on the CAGE score for alcohol and substance abuse	0 (0.0)
Depression and self-stigma (48, 34.8%)	Individual counselling	39 (81.3)
	Peer support group	9 (18.8)
	Medication	0 (0.0)
	Treatment buddy	0 (0.0)

Continued

Pill burden (12, 8.7%)	Change to fixed dose combination if available	12 (100)
Transportation problems (63, 45.7%)	Review by social worker	63 (100)
	Clinic schedule	0 (0.0)
Incorrect health beliefs (72, 52.2%)	HIV/ARV education	30 (41.7)
	Individual counselling	36 (50.0)
	Peer support group	6 (8.3)
	Group counselling	0 (0.0)
Scheduling difficulty (57, 42.3%)	Education (eg combine with daily routine such as bedtime or brushing the teeth	39 (68.4)
	Reminder devices	18 (31.6)
	Treatment buddy	0 (0.0)
	Link with nearest health facility	0 (0.0%)
Fear of disclosure (42, 30.4%)	Individual counselling on basic HIV education	27 (64.3)
	Group counselling	3 (7.1)
	Couple counselling	0 (0.0)
	Facilitate enrolment into care of family members eg discordant couple, PrEP	0 (0.0)
	Peer support groups	12 (28.6)
	Treatment buddy	0 (0.0)
	Unmarked pill bottle	0 (0.0)
	Refer to social worker, nutritional services	0 (0.0)
Stigma and discrimination (66, 47.8%)	Individual counseling	60 (90.9)
	Group counseling	0 (0.0)
	Peer counseling	6 (9.1)
Poor relationship with health care worker (27, 19.6%)	Address HCP issues	18 (66.7)
	Consider other HCP	9 (33.3)
Frequent visits to facility (78, 56.5%)	Harmonize appointments for multiple services, eg. FP, labs, immunization	60 (100)
Long wait times (66, 47.8%)	Nurse led model	0 (0.0)
	Fast track refill at pharmacy for patients with no complaints	30 (45.5)
	Evening/early morning appointments	0 (0.0)
	Three-month supply	0 (0.0)
	Specific individualized appointment times	36 (54.5)

3.6. Viral Load Suppression after Completion of EAC and Support Group Interventions in Adolescents with Initial High Viral Load Results

Younger age (p = 0.001, CI 0.567 - 2.263), shorter duration in a support group (p = 0.001, CI 1.347 - 4.050) and higher initial VL (p = 0.001) were all significantly associated to high repeat VL testing as seen in Table 5. Additionally, those who attended or were recommended EAC sessions before repeat VL testing were also more likely to have a high repeat VL (p = 0.028, CI 0.114 - 0.339).

Table 4. Support group enrollment and attendance of adolescents with HVL at CHE.

Variable	Frequency	Percentage (%)
Support group enrollment	108	78.3
Combined Adolescent and HVL support groups	48	44.4
HVL support group	45	41.7
Adolescent support group	12	11.1
Disclosure support group	3	2.8
Support group Attendance		
Attended all sessions	69	63.9
Missed < 50%	36	33.3
Infrequent attendance	3	2.8

Table 5. Barriers to suppressed repeat viral load in adolescent participants at CHE.

Variable	Suppressed VL n (%)	High VL n (%)	RR	CI	p-value
Mean age	15.32 ± 2.621	13.90 ± 2.367	3.301	0.567 - 2.263	**0.001****
Gender					
Male	33 (44.0)	30 (47.6)	0.935	0.687 - 1.274	0.800
Female	42 (56.0)	33 (52.4)			
Number of EAC Sessions	3.16 ± 0.546	3.05 ± 0.792	0.982	0.114 - 0.339	**0.028***
Duration in support group	7.88 ± 3.650	5.18 ± 2.113	2.698	1.347 - 4.050	**0.001****
First viral load*	7994 (2737 - 25,268)	19,731 (10,142 - 57,641)	3.540		**0.001****
Opportunistic infections					
Yes	21 (28.0)	9 (14.3)	1.400	1.036 - 1.891	0.082
No	54 (72.0)	54 (85.7)			
ART regimen					
1st line	66 (88.0)	57 (90.5)	0.894	0.573 - 1.395	0.642
2nd line	9 (12.0)	6 (9.5)			
WHO staging at initiation					
Stage 1	36 (48.0)	33 (52.4)	0.923	0.679 - 1.254	0.733
Stage 2	21 (28.0)	24 (38.1)	0.804	0.562 - 1.148	0.281
Stage 3	12 (16.0)	6 (33.3)	1.270	0.879 - 1.835	0.383
Stage 4	6 (8.0)	0 (0.0)	/	/	0.031*

P value: **significance threshold of 1%; *significance threshold of 5%.

Furthermore, 57.1% (72) of those who completed three EAC sessions had suppressed VL, and 71.4% (75) of those who attended more than half of support group sessions had suppressed VL.

Children who completed EAC were two times more likely to have a sup-

pressed VL after retesting (p = 0.033, CI 0.848 - 6.162) and those who both completed EAC and were in a support group were seven times more likely to have a suppressed VL after retesting (p = 0.001, CI 2.544 - 22.360) as illustrated in Table 6.

4. Discussion

In our study, the mean age of participants was 15 (±3) years and 54.3% of them were females. This result is like that obtained in Uganda [10] and in Cambodia by Chhim and colleagues (2018) [11]. In the general population, males have a larger tendency of being virally unsuppressed because of several factors. Men express risky behavioural patterns [8], increase alcohol consumption and use of unauthorized drugs and substances and have a poor attendance to health services which lead to poor adherence and hence treatment failure [12] [13] [14]. Furthermore, in children and adolescents, there is a similar pattern, with females more likely to have a suppressed viral load than males [8] [15]. The predominance of female participants in this study could be explained by the larger number of female adolescents followed up in the ART clinic of CHE, in line with better health seeking behaviors in females.

In our study, a large proportion of the participants were on first line ARV regimen (89.1%) at the time of viral load testing. This is like results obtained by Fokam and colleagues in Cameroon (2019) [8] and Martelli and colleagues in Tanzania (2019) [16] and more than 73% observed in South Africa [17]. Adolescents on first line ARV therapy have a greater risk of developing treatment failure for several reasons. Those who were perinatally infected may have been

Table 6. EAC and VL suppression in adolescents with initially unsuppressed VL at CHE.

Variable	Suppressed VL n (%)	High VL n (%)	Relative risk	CI	p-value
Completed EAC vs Incomplete EAC (n = 138)					
Completed EAC	72 (96.0)	54 (85.7)	2.286	0.848 - 1.162	**0.033***
Did not complete EAC	3 (4.0)	9 (14.3)			
Good support group attendance (n = 108)					
>50%	75 (100)	30 (90.9)			
<50%	0 (0.0)	3 (9.1)	/	/	0.057
Support group enrollment (n = 138)					
In a support group	63 (86.4)	33 (52.4)			
Not in support group	10 (13.6)	30 (47.6)	/	/	0.065
Enrolled in EAC and/or joined a support group (n = 138)					
EAC + SG	72 (96.0)	33 (52.4)	7.543	0.544 - 1.360	**0.001****
Only EAC or SG	3 (4.0)	30 (47.6)			

P-value: **significance threshold of 1%; *significance threshold of 5%.

exposed to ARVs earlier on in life and for a longer period and hence a higher tendency of treatment failure due to accumulations of drug resistance mutations over time [18] [19]. Furthermore, in a nationwide study in Cameroon, Tchouwa and colleagues (2018) reported a 10% resistance to ARVs at enrollment which is usually on first line treatment [20], which could explain virologic failure in some adolescents on first line.

Furthermore, all the participants were on the right dose and regimen of medication. Sub therapeutic drug concentrations caused by stock out in pediatric drug formulations and lack of dose-weight adjustments may increase the risk of virologic failure [21] [22]. Hence virologic failure in this group of participants could not be associated with poor ART dosage or wrong ART regimens.

Again, 21.7% of the participants had an opportunistic infection. This is larger than 13.3% obtained in Northern Ethiopia by Hailu and colleagues [23]. The discrepancy could be explained by the inclusion of young adults in the North Ethiopian study and the less efficient immune response against infections in children and adolescents living with HIV [24]. This could be due to several explanations like the pill burden that would be encountered by adolescents that would be on other medications and drug interactions.

Good adherence was reported in 39.1% of participants and weak adherence in 60.9% of the participants. The relationship between poor adherence and unsuppressed viral load in adolescents has been widely documented in several studies: in Cameroon [8], South Africa [17], Zimbabwe [25] and in Tanzania [19]. This is biologically plausible as poor adherence result in drug dosages below the level necessary to produce a therapeutic effect and this could enable the development of drug resistance (Sithole *et al.*, 2018). Furthermore, young people begin to assert more autonomous control over their decisions during adolescence and they may then choose to exercise control by not taking medication or attending appointments. The focus of the two interventions highlighted in this study (Enhanced adherence counselling and support group participation) will be to modify adherence to ARVs in adolescents.

Association between uptake and completion of EAC and eventual viral load suppression

Of the 138 charts reviewed, 126 participants (91.3%) had documented completion of their EAC sessions. This is higher than 77% obtained in Uganda [26] and 70.6% in Zimbabwe [27]. The difference could be because of a smaller number of participants in the present study and the systematic enrollment of all participants with unsuppressed viral load samples in EAC sessions prior to further ARV pick up. The uptake of EAC in CHE is good and is a strong foundation for the success of EAC as an intervention to improve adherence in participants with unsuppressed viral load results.

The assessment of barriers to adherence is the cornerstone of the first EAC session and is the foundation for the design of interventions to improve adherence in participants with a high viral load. In this study, the main barriers to VL

suppression identified using the EAC tool were forgetting to take medication (91.3%) and knowledge deficit (91.3%). Identification of forgetfulness as a barrier to adherence has been highlighted in several studies. However, this is less than 100% obtained by Ankrah and colleagues in Ghana (2016) [28] but more than 63% obtained by Shubber and colleagues (2016) [29] from a systematic review and meta-analysis. The higher numbers of adolescents highlighting forgetfulness as the main barrier to adherence in this study is probably because of the focus of this study only on participants with an unsuppressed viral load compared to the other studies where the focus was on adolescents irrespective of their viral load results. Knowledge deficit was not highlighted in other studies as a barrier to adherence and was a key barrier in this study. This could be explained by the detailed exploration of the knowledge of the client on ARVs and adherence using the EAC tool and questionnaire with minor deficits in knowledge recorded as a knowledge gap. However, this provides a platform to strengthen the knowledge of adolescents on the importance of ARVs, adherence and side effects of ARVs which may boost adherence to ARVs.

Furthermore, other barriers to adherence identified in more than half of the participants included feeling better hence no need to continue ARVs, discomfort related to frequent hospital visits, adverse effects of ARVs, incorrect health beliefs, stigma and discrimination and long waiting times. These are like the barriers highlighted in Ghana by Ankrah and colleagues [28] where the main barriers to ARV adherence were forgetfulness, stigma, and adverse effects of ARVs. Similar barriers were also highlighted in South Africa [30], in Zambia [31] and in Uganda [32]. The identification of barriers to adherence serves as the first step to the resolution of adherence challenges in these adolescents.

This was followed by discussions and tailoring of interventions to facilitate removal of these barriers to adherence. Interventions such as individual counselling on basic HIV and ARV (to address knowledge deficit, drug addiction, incorrect health beliefs, stigma, and false sensation of well-being) and use of reminder devices (to address forgetfulness) were the most popular interventions to remove most of the identified barriers to adherence. These were mainly rolled out by one-on-one sessions (EAC sessions) and through support group meetings with focus on addressing knowledge gaps and strengthening behaviors which improve ARV adherence. Similar facilitators were identified in Uganda by Nabukeera-Barungi and colleagues (2015) [32] and in Ghana [28]. However, several other significant barriers to suppressed repeat viral load results and these included younger age, shorter participation in a support group and high initial viral load results. These are like barriers observed in Uganda [26] and Zimbabwe [27]. Younger age is usually associated with infection through mother to child transmission and this is subsequently associated with longer exposure to ARVs and hence higher risk of ARV resistance from mutations. Furthermore, high initial viral load results usually reflect treatment failure, and this cannot be resolved by improving adherence.

Our findings suggest that overall viral suppression after at least three enhanced adherence counseling sessions was at 57.1%. This is like 48% observed in Swaziland [33] and 66.4% in Ethiopia [34]. Nonetheless, the current finding is lower than expected by WHO standards (70%) but aligns with the WHO and UNAIDS recommendation that suspected virologic failure should be addressed by enhanced adherence counseling and repeat viral load measurements before considering treatment switch to a second-line drug [35] Thus, successful completion of enhanced adherence counseling sessions can preserve the first-line treatment regimen. This could decrease the burden on the health system by reducing cost associated with 2nd and 3rd line regimens and could also reduce the transmission of resistant strains from the newly infected people.

However, these results are higher than repeat viral suppression rates reported in Zimbabwe by Bvochora and colleagues [27] and in Uganda [26] which were 31% and 23% respectively. The differences could be because of involvement of adult and pediatric participants in the latter studies, differences in counseling models across countries and differences in virologic resistance across the different countries.

It is worth noting that while completion of EAC was linked to suppressed repeat VL, our study also revealed that the need for more than three EAC sessions was associated with high repeat VL. This stands to reason given that additional EAC sessions are only recommended in people with poor ARV adherence during EAC evaluation, and poor adherence is a principal reason for high VL.

Association between participation in support groups and eventual viral load suppression

Peer support groups have clearly demonstrated impact on improving health-seeking behavior and HIV treatment outcomes for ALHIV, such as linkage, adherence to antiretroviral therapy (ART), retention in care, and viral suppression [36]. A total of 108 participants (78.3%) were enrolled in a support group which were either the high viral load support group, the adolescent support group, or the disclosure support group. Support group models in Zimbabwe [37] and Kenya [38] have demonstrated a strong effect of adolescent support group models on viral load suppression in adolescents. Furthermore, more than 75% of these adolescents attended more than half of the support group sessions. This is important as the effectiveness of the support group sessions will largely depend on the active and regular participation of the adolescents in these support groups.

Across the participants in this study, 71.4% of those who attended more than half of the support group sessions had a subsequent suppressed viral load result. This further reinforces the importance of client education, counseling, and peer support in improving adherence and subsequently improving client treatment outcomes. However, support group enrolment and participation did not significantly influence viral load suppression as an independent intervention.

Association between combining EAC and support group interventions and eventual viral load suppression

In this study, participants who completed enhanced adherence counseling

sessions and were in a support group were seven (7) times more likely to have a suppressed viral load result after retesting. This demonstrates a strong synergistic relationship between the two interventions: EAC and support groups, to support eventual viral load suppression in initially unsuppressed adolescents. Considering that both interventions address the same barriers in different ways, it is important that adolescents benefit from both interventions to address challenges in adherence especially in the context of unsuppressed viral load results.

5. Conclusion

Viral load suppression remains the most important treatment outcome for all patients living with HIV and AIDS. In adolescents, most of the challenges with viral load suppression arise from poor adherence to ARVs. In Cameroon, poor adherence and weak psychosocial support have been consistently highlighted as strong contributors to unsuppressed viral load, especially amongst adolescents. This study was aimed at assessing the association between uptake and completion of enhanced adherence counselling sessions and participation in support groups, and viral load suppression by retrospectively examining patient records of adolescents in the HIV treatment center in CHE. Across these participants, uptake, and completion of EAC were associated with viral load suppression in initially unsuppressed adolescent clients. Furthermore, enrolment and participation in support groups were also key interventions in attaining viral suppression in unsuppressed adolescents. Again, repeat viral load suppression was improved after EAC sessions and enrolment in support group sessions with both interventions being synergistic to improve repeat viral load suppression. However, the requirement for more EAC sessions seemed to be an indication of high repeat VL. These results permit us to highlight the importance of EAC sessions and support group sessions in the routine management of adolescents living with HIV/AIDS, especially in the context of unsuppressed viral load results and adherence gaps. However, this was a hospital-based study involving a single category of level 2 health facility where the standard of care is high. Other studies should be rolled out at different levels of the health pyramid and involving larger sample sizes to reinforce these findings.

Acknowledgements

We thank the administrations and staff of the Centre Hospitalier Essos.

Conflicts of Interest

The authors declare that they have no competing interests.

References

[1] Cohen, M.S., Chen, Y.Q. and McCauley, M. (2016) Antiretroviral Therapy for the Prevention of HIV-1 Transmission. *The New England Journal of Medicine*, **375**, 830-839. https://doi.org/10.1056/NEJMoa1600693

[2] Bavinton, B.R., Pinto, A.N., Phanuphak, N., Grinsztejn, B., Prestage, G.P., Zablotska-Manos, I.B., Jin, F., Fairley, C.K., Moore, R., Roth, N., Bloch, M., Pell, C., McNulty, A.M., Baker, D., Hoy, J., Tee, B.K., Templeton, D.J., Cooper, D.A., Emery, S., Kelleher, A. and Grulich, A.E. (2018) Viral Suppression and HIV Transmission in Serodiscordant Male Couples: An International, Prospective, Observational, Cohort Study. *The Lancet HIV*, **5**, e438-e447. https://doi.org/10.1016/S2352-3018(18)30132-2

[3] Rodger, A.J., Cambiano, V., Bruun, T., Vernazza, P., Collins, S., Degen, O., Corbelli, G.M., Estrada, V., Geretti, A.M., Beloukas, A., Raben, D., Coll, P., Antinori, A., Nwokolo, N., Rieger, A., Prins, J.M., Blaxhult, A., Weber, R., Van Eeden, A., Brockmeyer, N.H., Clarke, A., Del Romero Guerrero, J., Raffi, F., Bogner, J.R., Wandeler, G., Gerstoft, J., Gutiérrez, F., Brinkman, K., Kitchen, M., Ostergaard, L., Leon, A., Ristola, M., Jessen, H., Stellbrink, H.J., Phillips, A.N. and Lundgren, J. (2019) Risk of HIV Transmission through Condomless Sex in Serodifferent Gay Couples with the HIV-Positive Partner Taking Suppressive Antiretroviral Therapy (PARTNER): Final Results of a Multicentre, Prospective, Observational Study. *The Lancet*, **393**, 2428-2438.

[4] CDC (2020) Evidence of HIV Treatment and Viral Suppression in Preventing the Sexual Transmission of HIV. https://www.cdc.gov/hiv/risk/art/evidence-of-hiv-treatment.html

[5] National Institute of Statistics (2020) Republic of Cameroon Demographic and Health Survey 2018. INS and ICF, Yaoundé. https://www.dhsprogram.com/pubs/pdf/FR360/FR360.pdf

[6] CAMPHIA (2018) Cameroon Population-Based HIV Impact Assessment. https://phia.icap.columbia.edu/countries/cameroon/

[7] UNAIDS (2019) UNAIDS Data 2019. https://www.unaids.org/sites/default/files/media_asset/2019-UNAIDS-data_en.pdf

[8] Fokam, J., Sosso, S.M., Yagai, B., Billong, S.C., Djubgang Mbadie, R.E., Kamgaing Simo, R., Edimo, S.V., Nka, A.D., Tiga Ayissi, A., Yimga, J.F., Takou, D., Moudourou, S., Ngo Nemb, M., Nfetam Elat, J.-B., Santoro, M.-M., Perno, C.-F., Colizzi, V. and Ndjolo, A. (2019) Viral Suppression in Adults, Adolescents and Children Receiving Antiretroviral Therapy in Cameroon: Adolescents at High Risk of Virological Failure in the Era of "Test and Treat". *AIDS Research and Therapy*, **16**, Article No. 36. https://doi.org/10.1186/s12981-019-0252-0

[9] Bulage, L., Ssewanyana, I., Nankabirwa, V., *et al.* (2017) Factors Associated with Virological Non-Suppression among HIV-Positive Patients on Antiretroviral Therapy in Uganda, August 2014-July 2015. *BMC Infectious Diseases*, **17**, Article No. 326. https://doi.org/10.1186/s12879-017-2428-3

[10] Natukunda, J., Kirabira, P. and Ong, K.I.C. (2019) Virologic Failure in HIV-Positive Adolescents with Perfect Adherence in Uganda: A Cross-Sectional Study. *Tropical Medicine and Health*, **47**, Article No. 8. https://doi.org/10.1186/s41182-019-0135-z

[11] Chhim, K., Mburu, G., Tuot, S., Sopha, R., Khol, V., Chhoun, P. and Yi, S. (2018) Factors Associated with Viral Non-Suppression among Adolescents Living with HIV in Cambodia: A Cross-Sectional Study. *AIDS Research and Therapy*, **15**, Article No. 20. https://doi.org/10.1186/s12981-018-0205-z

[12] Ochieng-Ooko, V., Ochieng, D., Sidle, J.E., Holdsworth, M., Wools-Kaloustian, K., Siika, A.M., Yiannoutsos, C.T., Owiti, M., Kimaiyo, S. and Braitstein, P. (2010) Influence of Gender on Loss to Follow-Up in a Large HIV Treatment Programme in Western Kenya. *Bulletin of the World Health Organization*, **88**, 681-688. https://doi.org/10.2471/BLT.09.064329

[13] Kranzer, K., Lewis, J.J., Ford, N., Zeinecker, J., Orrell, C., Lawn, S.D., Bekker, L.G. and Wood, R. (2010) Treatment Interruption in a Primary Care Antiretroviral Therapy Program in South Africa: Cohort Analysis of Trends and Risk Factors. *Journal of Acquired Immune Deficiency Syndromes* (1999), **55**, e17-e23. https://doi.org/10.1097/QAI.0b013e3181f275fd

[14] Cornell, M., McIntyre, J. and Myer, L. (2011) Men and Antiretroviral Therapy in Africa: Our Blind Spot. *Tropical Medicine & International Health*, **16**, 828-829. https://doi.org/10.1111/j.1365-3156.2011.02767.x

[15] Okonji, E.F., van Wyk, B., Mukumbang, F.C., *et al.* (2021) Determinants of Viral Suppression among Adolescents on Antiretroviral Treatment in Ehlanzeni District, South Africa: A Cross-Sectional Analysis. *AIDS Research and Therapy*, **18**, Article No. 66. https://doi.org/10.1186/s12981-021-00391-7

[16] Martelli, G., Antonucci, R., Mukurasi, A., Zepherine, H. and Nöstlinger, C. (2019) Adherence to Antiretroviral Treatment among Children and Adolescents in Tanzania: Comparison between Pill Count and Viral Load Outcomes in a Rural Context of Mwanza Region. *PLOS ONE*, **14**, e0214014. https://doi.org/10.1371/journal.pone.0214014

[17] Maskew, M., Fox, M.P., Evans, D., Govindasamy, D., Jamieson, L., Malete, G., Mongwenyana, C. and Technau, K. (2016) Insights into Adherence among a Cohort of Adolescents Aged 12-20 Years in South Africa: Reported Barriers to Antiretroviral Treatment. *AIDS Research and Treatment*, **2016**, Article ID: 4161738. https://doi.org/10.1155/2016/4161738

[18] Kebe, K., Thiam, M., Diagne Gueye, N.R., Diop, H., Dia, A. and Signate Sy, H. (2012) High Rate of Antiretroviral Drug Resistance Mutations in HIV Type 1-Infected Senegalese Children in Virological Failure on First-Line Treatment According to the World Health Organization Guidelines. *AIDS Research and Human Retroviruses*, **29**, 242-249. http://www.ncbi.nlm.nih.gov/pubmed/22860571 https://doi.org/10.1089/aid.2011.0300

[19] Muri, L., Gamell, A., Ntamatungiro, A.J., Glass, T.R., Luwanda, L.B. and Battegay, M. (2017) Development of HIV Drug Resistance and Therapeutic Failure in Children and Adolescents in Rural Tanzania: An Emerging Public Health Concern. *AIDS*, **31**, 61-70. https://doi.org/10.1097/QAD.0000000000001273

[20] Tchouwa, G., Eymard-Duvernay, S., Cournil, A., Lamare, N., Serrano, L., Butel, C., Bertagnolio, S., Mpoudi-Ngolé, E., Raizes, E., Aghokeng, A., Abia, S., Bessala, D., Chebo, C., Chifen, O., Ebonloe, J.E., Fodjeu, G., Izard, S., Kamtie, B., Kiawi, E., Kouam, C., Kouanfack, C., Mamang, E., Mandeng, N., Mbu, E.T., Mfokue, B., Mosoko, J., Nandjou, B., Mpoudi, M., Ndam, M., Nlend, A.E., Nlend, B., Nouboué, C., Omgba, P., Owono, T., Oyono, F., Penda, I., Tchetnya, X. and Tchinou, C. (2018) Prevalence of Pretreatment HIV Drug Resistance in Cameroon Following a Nationally Representative WHO Survey. *Journal of Antimicrobial Chemotherapy*, **73**, 2468-2474. https://doi.org/10.1093/jac/dky221

[21] Menson, E.N., Walker, A.S., Sharland, M., Wells, C., Tudor-Williams, G., Riordan, F.A.I., *et al.* (2006) Underdosing of Antiretrovirals in UK and Irish Children with HIV as an Example of Problems in Prescribing Medicines to Children, 1997-2005: Cohort Study. *BMJ*, **332**, 1183-1187. https://doi.org/10.1136/bmj.332.7551.1183

[22] Kamya, M.R., Mayanja-Kizza, H., Kambugu, A., Bakeera-Kitaka, S., Semitala, F. and Mwebaze-Songa, P. (2007) Predictors of Long-Term Viral Failure among Ugandan Children and Adults Treated with Antiretroviral Therapy. *Journal of Acquired Immune Deficiency Syndromes*, **46**, 187-193. https://doi.org/10.1097/QAI.0b013e31814278c0

[23] Hailu, G.G., Hagos, D.G., Hagos, A.K., Wasihun, A.G. and Dejene, T.A. (2018) Virological and Immunological Failure of HAART and Associated Risk Factors among Adults and Adolescents in the Tigray Region of Northern Ethiopia. *PLOS ONE*, **13**, e0196259. https://doi.org/10.1371/journal.pone.0196259

[24] Ásbjörnsdóttir, K.H., Hughes, J.P. and Wamalwa, D. (2016) Differences in Virologic and Immunologic Response to Antiretroviral Therapy among HIV-1-Infected Infants and Children. *AIDS*, **30**, 2835-2843. https://doi.org/10.1097/QAD.0000000000001244

[25] Sithole, Z., Mbizvo, E. and Chonzi, P. (2018) Virological Failure among Adolescents on ART, Harare City, 2017—A Case-Control Study. *BMC Infectious Diseases*, **18**, Article No. 469. https://doi.org/10.1186/s12879-018-3372-6

[26] Nasuuna, E., Kigozi, J. and Babirye, L. (2018) Low HIV Viral Suppression Rates Following the Intensive Adherence Counseling (IAC) Program for Children and Adolescents with Viral Failure in Public Health Facilities in Uganda. *BMC Public Health*, **18**, Article No. 1048. https://doi.org/10.1186/s12889-018-5964-x

[27] Bvochora, T., Satyanarayana, S., Takarinda, K.C., Bara, H., Chonzi, P., Komtenza, B., Duri, C. and Apollo, T. (2019) Enhanced Adherence Counselling and Viral Load Suppression in HIV Seropositive Patients with an Initial High Viral Load in Harare, Zimbabwe: Operational Issues. *PLOS ONE*, **14**, e0211326. https://doi.org/10.1371/journal.pone.0211326

[28] Ankrah, D.N., Koster, E.S., Mantel-Teeuwisse, A.K., Arhinful, D.K., Agyepong, I.A. and Lartey, M. (2016) Facilitators and Barriers to Antiretroviral Therapy Adherence among Adolescents in Ghana. *Patient Preference and Adherence*, **10**, 329-337. https://doi.org/10.2147/PPA.S96691

[29] Shubber, Z., Mills, E.J., Nachega, J.B., Vreeman, R., Freitas, M. and Bock, P. (2016) Patient-Reported Barriers to Adherence to Antiretroviral Therapy: A Systematic Review and Meta-Analysis. *PLOS Medicine*, **13**, e1002183. https://doi.org/10.1371/journal.pmed.1002183

[30] Van Wyk, B. and Davids, L. (2019) Challenges to HIV Treatment Adherence amongst Adolescents in a Low Socio-Economic Setting in Cape Town. *Southern African Journal of HIV Medicine*, **20**, Article No. 1002. https://doi.org/10.4102/sajhivmed.v20i1.1002

[31] Mesic, A., Halim, N., MacLeod, W., Haker, C., Mwansa, M. and Bienba, G. (2019) Facilitators and Barriers to Adherence to Antiretroviral Therapy and Retention in Care among Adolescents Living with HIV/AIDS in Zambia: A Mixed Methods Study. *AIDS and Behavior*, **23**, 2618-2628. https://doi.org/10.1007/s10461-019-02533-5

[32] Nabukeera-Barungi, N., Elyanu, P., Asire, B., Katureebe, C., Lukabwe, I., Namusoke, E., Musinguzi, J., Atuyambe, L. and Tumwesigye, N. (2015) Adherence to Antiretroviral Therapy and Retention in Care for Adolescents Living with HIV from 10 Districts in Uganda. *BMC Infectious Diseases*, **15**, Article No. 520. https://doi.org/10.1186/s12879-015-1265-5

[33] Jobanputra, K., Parker, L.A., Azih, C., Okello, V., Maphalala, G., Kershberger, B., Khogali, M., Lujan, J., Antierens, A., Teck, R., Ellman, T., Kosgei, R. and Reid, T. (2015) Factors Associated with Virological Failure and Suppression after Enhanced Adherence Counselling, in Children, Adolescents and Adults on Antiretroviral Therapy for HIV in Swaziland. *PLOS ONE*, **10**, e0116144. https://doi.org/10.1371/journal.pone.0116144

[34] Diress, G., Dagne, S., Alemnew, B., Adane, S. and Addisu, A. (2019) Viral Load

Suppression after Enhanced Adherence Counseling and Its Predictors among High Viral Load HIV Seropositive People in North Wollo Zone Public Hospitals, Northeast Ethiopia, 2019: Retrospective Cohort Study. *AIDS Research and Treatment*, **2020**, Article ID: 8909232. https://doi.org/10.1155/2020/8909232

[35] UNAIDS (2017) 90-90-90, an Ambitious Treatment Target to Help End the AIDS Epidemic. UNAIDS, Geneva. https://www.unaids.org/sites/default/files/media_asset/90-90-90_en.pdf

[36] Mark, D., Hrapcak, S., Ameyan, W., Lovich, R., Ronan, A., Schmitz, K. and Hatane, L. (2019) Peer Support for Adolescents and Young People Living with HIV in Sub-Saharan Africa: Emerging Insights and a Methodological Agenda. *Current HIV/AIDS Reports*, **16**, 467-474. https://doi.org/10.1007/s11904-019-00470-5

[37] Willis, N., Milanzi, A., Mawodzeke, M., Dziwa, C., Armstrong, A., Yekeye, I., Mtshali, P. and James, V. (2019) Effectiveness of Community Adolescent Treatment Supporters (CATS) Interventions in Improving Linkage and Retention in Care, Adherence to ART and Psychosocial Well-Being: A Randomised Trial among Adolescents Living with HIV in Rural Zimbabwe. *BMC Public Health*, **19**, Article No. 117. https://doi.org/10.1186/s12889-019-6447-4

[38] PEPFAR Solutions Database (2018) Operation Triple Zero: Empowering Adolescents and Young People Living with HIV to Take Control of Their Health in Kenya. https://www.pepfarsolutions.org/solutions/2018/10/30/operation-triple-zero-empowering-adolescents-and-young-people-living-with-hiv-to-take-control-of-their-own-health