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Factors Influencing the Continuum of Care for Children and Adolescents Treated for HIV at the Pediatric Teaching Hospital of Bangui

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Abstract

Introduction: Reducing and maintaining viral load is crucial to reducing morbidity and mortality associated with HIV infection in children. The aim of this study was to determine the factors influencing the maintenance of children and adolescents on antiretroviral therapy in the continuum of care. **Methodology:** This was a descriptive and analytical cross-sectional study conducted from August 1 to August 31, 2023. It included all children living with HIV, under 15 years of age, with at least two viral load results and whose parents consented to participate in the study. Participants were recruited during their child's treatment renewal consultations. **Results:** The study included 143 children, mostly boys (55.2%), with a mean age of 11.54 years (±2.8). More than half (55.2) were unaware of their HIV-positive status, and most treatments were administered by parents (60.8%). Of the 99 children with an undetectable viral load at the first test, 23 (23.2%) showed a viral rebound at the last test, mainly due to poor treatment compliance ($p < 0.001$). **Conclusion:** Virological rebound after suppression in children is worrying. It is crucial that the national AIDS program improves Therapeutic Education, trains health workers to communicate results and encourages ongoing dialogue with young people to reinforce adherence and maintain viral suppression.

Keywords

Influencing Factors, Continuum of Care, Children/Adolescents, HIV, Bangui

1. Introduction

Viral load (VL) suppression is the key to reduced morbidity and improved life expectancy for people living with HIV (PLHIV) [1]. But PLHIV face the challenge of virological rebound, which inevitably leads to treatment failure [2]. According to the Joint United Nations Programme on Acquired Immune Deficiency Syndrome (UNAIDS), by 2022, 39 million people worldwide will be living with HIV infection, including 1.5 million children aged 0 - 14. The regions most affected by this scourge are sub-Saharan Africa, Asia and the Pacific [3].

Eliminating VCT is one of the goals set by the World Health Organization (WHO). Other targets include 95% of PLHIV knowing their serostatus, and 95% of PLHIV on antiretroviral therapy (ART) [4]. 71% of PLHIV will have achieved CV suppression by the end of 2022 [5].

Virological rebound is a real problem for the success of ART in children and adolescents living with HIV (CAHIV) [6] [7]. Several factors contribute to virological rebound in the paediatric population; these factors include compliance problems, limited paediatric drug formulations, variable pharmacokinetics, changes in body weight requiring dose adjustments etc. [1].

Since 2021, the national AIDS program has adopted a new first-line treatment regimen based on the Dolutegravir-based combination for children and adolescents and Raltegravir for neonates [8]. To improve the quality of life of children living with HIV, CV suppression must be maintained for as long as possible. This requires good adherence to treatment and support for children on antiretroviral therapy [1]. Systematic monitoring of CV as an indicator of treatment efficacy, both at individual and program level, is now considered a quality standard for HIV initiatives [1] [4] [9]. Tools to improve ART adherence in children, while developing new paediatric formulations of antiretrovirals. Although morbidity and mortality have decreased, a significant proportion of patients do not achieve a sustained virological response to treatment [10]. Numerous studies have been carried out on the virological response to ART among EAVVIH in Ethiopia, Kenya, Swaziland and Cameroon [1] [6] [7] [11]. In the Central African Republic, very few studies have been carried out on sustained virological response in children. It is in this context that our study aims to identify the factors influencing viral load suppression in children treated at the Bangui pediatric university hospital.

2. Patients and Methods

This was a cross-sectional study with analytical aims, running from August 1 to 31, 2023. The study population was any child living with HIV and followed at the outpatient treatment center of the pediatric complex. Inclusion criteria were: any parent or carer aged 15 and over who had accompanied a child under 15 on working days for ART renewal; any parent or carer aged 15 and over who had consented to the study; children with at least two viral load results had been included. Recruitment was exhaustive.

A viral load is suppressed when it is less than 1000 copies/ml, coded 1; it is not

suppressed when it is greater than 1000 copies/ml, coded 0 according to WHO recommendations. We also studied socio-demographic variables, date and results of viral load tests, level of compliance, therapeutic regimens at initiation, change of treatment, disclosure of seropositivity, mode of drug administration.

Data were collected from patient records on factors associated with viral suppression and rebound in children and adolescents living with HIV on antiretroviral therapy. Data were collected using a pre-designed and pre-tested individual questionnaire and Stata 16.1 software for data tabulation, editing, processing and analysis.

To determine the factors associated with viral suppression and rebound in children and adolescents living with HIV on antiretroviral therapy, we performed bivariate logistic regression modeling to provide correct Odds Ratio estimates. Variables with a p-value of less than 0.2 in the univariate analysis were considered for the multivariate analysis. In the multivariate analysis, variables with a p-value of less than 0.05 were retained. The Variance Inflator Factor (VIF) was used to assess multicollinearity between the different independent variables. This research was carried out in compliance with ethical principles for health research.

3. Results

A total of 143 children were included in the study. Ninety-nine had a suppressed viral load at first test and 44 had an unsuppressed viral load.

Table 1. Distribution of children by age and gender.

Age group (years)	Gender				Total	
	Male		Female			
	Number	%	Number	%	Number	%
0 - 4	1	1.27	1	1.56	2	1.4
5 - 9	17	21.52	15	23.44	32	22.38
10 - 15	61	77.22	48	75	109	76.22
Total	79	55.24	64	44.76	143	100

Out of 143 patients, we recorded 79 male children (55.24%), with a sex ratio of 1.23. Over 76% of patients were between 10 and 14 years of age. The overall mean age was 11.54 ± 2.80 years (Table 1).

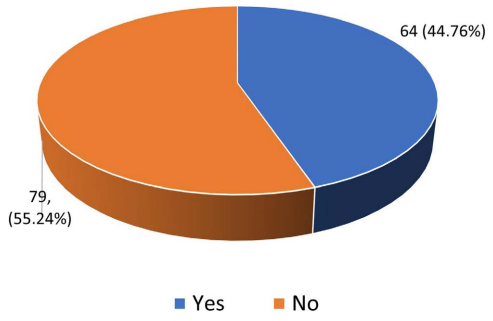

Figure 1. Disclosure of HIV status.

The majority of children and adolescents (55.24%) did not know their HIV status (Figure 1).

Table 2. Socio-demographic characteristics of the parents of the children monitored.

Socio-demographic characteristics	Number (n = 143)	Percentage
Existence of living parents		
Both parents alive	59	41.26
Only mother alive	24	16.78
Both parents deceased	35	24.48
Only father exists	25	17.48
Level of education of children's carers		
Higher	20	13.99
Secondary	96	67.13
Primary	25	17.48
Out of school	2	1.4
Occupation of children's carers		
Employed	26	18.18
Informal	84	58.74
Agropastoral	10	6.99
Student	4	2.8
Unemployed	19	13.29

Over 41% of the children in our care still had both parents living.

Our study showed that 81% of the parents/guardians in charge of the children we monitored had a high level of education (Table 2).

Of the 99 children with a suppressed viral load at the first test, 23 (23.2%) experienced a viral load rebound at the last test. The only factor significantly associated with rebound was poor adherence to treatment (<0.001).

Our work found a significant link between non-adherence to treatment and viral load rebound. All else being equal, children with poor adherence were more than 36 times more likely to have a treatment rebound during ART follow-up than adherent children, as shown in Table 3 below.

Table 3. Factors influencing viral suppression.

Variables	Viral load rebound		p-value	ORb (95% CI)	p-value	ORa (95% CI)	p-value
	Yes	No					
Socio-demographic characteristics							
Age			0.29				
Less than 10 years	10	24		1.67 (0.64 - 4.33)	0.3	-	-
10 years and over	13	52		1		-	-
Gender			0.71				
Male	14	43		1		-	-
Female	9	33		0.84 (0.32 - 2.17)	0.71	-	-
Patients' level of education			0.81				

Continued

Secondary	6	18		1		-	-
Never nursery or primary	17	58		0.88 (0.30 - 2.56)	0.81	-	-
Living parents			0.91				
Both parents are alive	10	35		1		-	-
Both parents are deceased	4	15		0.93 (0.25 - 3.45)	0.92	-	-
One or the other alive	9	26		1.21 (0.43 - 3.41)	0.72	-	-
Prants'/guardians' level of education			0.12				
Higher and secondary	16	64		1		1	
Never and primary	7	12		2.33 (0.79 - 6.88)	0.12	2.63 (0.54 -12.75)	0.23
Employee			0.09				
No	21	57		3.5 (0.75 - 16.33)	0.11	2.28 (0.32 - 16.04)	0.41
Yes	2	19		1		1	
Transportation difficulties			0.59				
Yes	20	69		0.68 (0.16 - 2.86)	0.59	-	-
No	3	7		1		-	-
Clinical and therapeutic features							
Announcing the result			0.6				
Yes	8	31		1		-	-
No	15	45		0.48 (0.07 - 3.37)	0.46	-	-
WHO clinical stage			0.65				
Less advanced stage	13	47		1		-	-
Advanced stage	10	29		1.25 (0.48 - 3.21)	0.65	-	-
TAR administration			0.29				
From Parents	17	47		1		1	
By the child himself	6	29		0.19 (0.02 - 1.75)	0.14	0.78 (0.19 - 3.11)	0.72
TAR period			0.39				
2 to 5 years	5	18		1		-	-
6 to 9 years	14	35		2.63 (0.28 - 24.39)	0.39	-	-
10 years to under 14 years	4	23		0.29 (0.02 - 4.75)	0.39	-	-
Observing			**<0.00**				
Yes	5	69		1		1	
No	18	7		35.48 (10.07 - 125.03)	**<0.001**	36.34 (9.70 - 136.17)	**<0.001**

4. Discussion

Our study estimated the prevalence of viral load suppression at 69.23% at the first

test. Of the participants who successfully suppressed their viral load at this stage, 76.7% were able to maintain this suppression at the second test. Indeed, a suppressed viral load offers people living with HIV a longer life expectancy, reduces the risk of opportunistic infections, slows down viral replication and strengthens their immune system [9]. This proportion observed at the second test is higher than that reported by Melashu *et al.* in Ethiopia in 2019 [9], but lower than that found by Tsikhuts *et al.* in Kenya in 2022 [1]. The variations in prevalence between these different studies could be attributed to recent improvements in strategies to influence adherence, reduce adverse effects of ART and facilitate access to health centers for treatment renewal.

The present study also determined the proportion of children living with HIV who experienced a rebound in viral load after suppression, and the factors associated with this rebound. The proportion of children with virological failure at first test was 30.78%. Among those who had viral load suppression at the 1st test, 23.2% experienced a rebound. Pediatric virological failure is a recurring problem in resource-limited settings [9] [12]. If children fail to maintain an optimal level of viral suppression and experience a rebound, this could compromise their quality of life, with an increased risk of mortality. The prevalence of children living with HIV who experienced a rebound in viral load after suppression was 23.2% among children under 15 at the CHUP in Bangui, Central African Republic. This proportion is quite high, and should be of concern to all players in the healthcare system. The reasons for this high prevalence could be the failure to keep appointments, and also the poor therapeutic education provided by healthcare staff, which results in many children having a therapeutic rebound. Some authors have found a prevalence almost similar to ours, such as the study which showed that the prevalence of rebound in Ghana in 2021 was 21% [13].

However, this prevalence is lower than the 41% reported by Maina *et al.* in Kenya in 2020, the 40% reported by Kahabuka *et al.* in Tanzania in 2024 [14] [15], the 27% reported by Kakkar *et al.* in Canada in 2020 [16] and the 19% reported by Childs *et al.* in Great Britain and Ireland [17]. This reduction is thought to be due to improved antiretroviral treatment adherence strategies among adolescents and young children, and above all to health service-related factors such as waiting times at outpatient treatment centers, drug availability and quality of care, as well as drug-related factors such as high doses, number of tablets and side effects, which are being addressed by the Ministry of Health through the "Direction de la lutte contre les maladies transmissibles and the Centre National de Lutte contre le SIDA".

Furthermore, our prevalence was higher than that of Craw *et al.*, who found 7.5% in the USA [18]. This difference in prevalences could also be due to socio-economic differences, study area and study period between our result and that of other authors. Gender and age are not associated with viral load rebound. Some studies have found links between viral load dynamics and these two variables [1] [11] [19], while others have found the opposite [9] [12]. Level of education is a

parameter that has an influence on health decisions, as it is certain that if parents or children themselves do not fully understand how to take medication, this could be the cause of poor compliance, which is the main cause of non-reduction or rebound of viral load. However, the level of education was not associated with viral load rebound, which could be due to the fact that over 80% of the parents or guardians of the children monitored were educated (higher and secondary education), and our result is similar to that of Ahmed *et al.* in Djibouti [20].

We did not find any link between orphan status and viral load rebound. This could be explained by the fact that the majority of children have at least one living parent. For the few who are double orphans, they are generally cared for by a family member.

According to the Morlat report, it is advisable to begin the process of informing children about their HIV status at school age, giving priority to gradual information adapted to the child's maturity and questions [21]. This could make it easier for children to adhere to treatment once they reach adolescence. In this study, 79% of children were not informed of their HIV status. This could be explained by parents' feelings of guilt and the lack of competent personnel in the field of child psychology. Toolkits have been developed to facilitate disclosure of HIV status to children [19]. For the majority of children (60.84%), parents are responsible for medication management, although the study did not identify parents' administration of medication to children as a determinant of viral load rebound. Therapeutic education sessions should be set up for children from pre-school age (3 to 6), using appropriate tools to help them learn to recognize their medication. By school age, they will be able to manage their own medication [22]. Peer education facilitates the participation of the target audience in program planning, implementation and evaluation processes. It empowers both the educator and the beneficiary through its horizontal, participatory learning method. Peer learning emphasizes the collaborative sharing of knowledge between peers, focusing on a wider exchange of ideas, experience and expertise within a group. It is often informal and guided by the collective wisdom of individuals. Children with HIV infection are expected to participate in the same activities as other children, insofar as their physical condition allows. Interaction with other children of the same age promotes social development and self-esteem.

Our study reported that only 51 children out of 143 had data on therapeutic education. This lack of data is sufficient proof of the problem of insufficiently skilled staff in treatment centers.

We found a significant link between non-adherence to treatment and viral load rebound. All else being equal, children with poor adherence were more than 36 times more likely to have a treatment rebound during ART follow-up than adherent children. Adequate adherence to antiretroviral therapy (ART) leading to viral suppression is essential for the health and well-being of adolescents and for reducing HIV transmission. Yet adolescents and young people adhere poorly to treatment for many chronic diseases [23] [24]. Treatment adherence of 95% is

necessary [25] [26] to achieve the therapeutic objectives of prolonging life, reducing the frequency of opportunistic infections, rapidly and sustainably stopping or slowing viral replication, and restoring or improving the infected person's immunity [27] [28].

However, our study revealed that only 66.43% of the children followed were compliant, which is far from the 95% target. This could be explained by transport difficulties, which were 93% in our study, and by the fact that parents/guardians were probably unable to keep appointments. Parents' workloads, and those of school-age children, could also lead to forgetting to take medication. Our findings corroborate those of Mbopi-Kéou *et al.* in Cameroon [29]. A study conducted in South Africa showed that many caregivers of HIV-infected children used coercion and threats of serious consequences for non-compliance as a communication strategy to enforce compliance [13]. This is all the more important when children are not informed of their HIV status. This is the case with our results, which show that just 44.76% of children followed up are informed of their serostatus.

The significant link between non-adherence to treatment and viral load rebound has been found by several authors [15] [30] [31]. The main obstacles to adherence to antiretroviral treatment among adolescents and young people could be patient-related factors such as socio-economic status, stigmatization, health service-related factors such as waiting times at outpatient treatment centers, drug availability, quality of care and drug-related factors such as high doses, number of tablets, side effects [32].

5. Conclusion

Numerous initiatives have been put in place by organizations, healthcare professionals, researchers and other stakeholders to combat the harmful effects of HIV/AIDS, in particular viral replication and the resulting problems of resistance. Currently, viral rebound in children and adolescents represents a major obstacle to the effectiveness of antiretroviral therapy (ART) and limits the use of drugs in future treatments.

Authors' Contributions

All authors have contributed to this manuscript and have read and approved the final version.

Conflicts of Interest

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

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