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Evaluation of the Third 90 of the 90-90-90 Cascade for the Period 2019-2020 in the Central African Republic

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Abstract

Introduction In Central-African Republic, according to UNAIDS in 2019, out of approximately 100,000 people living with HIV, 70% (72,000) knew their HIV status and 47,000 (46%) were on ARV therapy; however, there is a paucity of data on viral load suppression in people on ARV therapy. The objective of this study was to assess the third 90 of the UNAIDS strategy for the years 2019 and 2020 in the CAR. **Methods** We analyzed the available viral load data extracted from the data base of the medical analysis laboratory (SYSLAM) of the Institut Pasteur of Bangui for the years 2019 and 2020. The viral loads were determined based on plasma collected in an EDTA tube with Cepheid's GeneXpert® 16-module controllers. Viral load data were extracted from SYSLAM, converted to Excel format, and analyzed with STATA version 14 software. The significance threshold for the statistical tests was set at 5%. **Results** This study included 22,895 patients, of who 72% were female. The average age was 40.82 years, and the majority of the patients (80%) came from the city of Bangui. Regarding the virological parameters associated with this study, 66% of the patients had significant viral load suppression according to the WHO recommendations and 34% were in virological failure. Patients over 50 years of age (71.85%) and age group 40 - 49 years (69.25%) recorded significant levels of viral load suppression. On the other hand, 63.45% of patients under 18 years of age had virological failure. All of these results were statistically significant ($p < 0.005$). **Conclusion** There should be a concerted effort, to make viral load accessible and available to all patients receiving ARV treatment in the CAR and the management of HIV/AIDS infection of children and adolescents should be given special attention.

Keywords

HIV, ARV, Viral Load Suppression, 90-90-90 Target, Central African Republic

1. Introduction

The next challenge in the fight against AIDS is the goal set by UNAIDS to move towards the elimination of all new infections by 2030 [1]. This aim is based on a global consensus for a 2020 perspective where 90% of people living with HIV should know their HIV status, HIV treatment is offered to 90% of people who know their HIV status, and 90% of people receiving HIV treatment reach an undetectable viral load. According to UNAIDS in 2020, 37.6 million people are living with HIV, and in the same year there were 1.5 million new infections and 690,000 deaths. Out of all the people living with HIV, 84% knew their viral status, 73% had access to treatment, and 66% had an undetectable viral load in 2020.

The Central African Republic, which remains one of countries most affected by the HIV pandemic in West and Central Africa, has adopted a patient-centered control strategy with differentiated approaches. Out of an estimated population of 4,953,015 the HIV prevalence among 15 - 49-year-olds is estimated to be 3.5%. In 2019, it was estimated that approximately 100,000 people were living with HIV, and of these, 70% (72,000) knew their HIV status, and 47,000 (46%) were on antiretroviral therapy. There is, however, a paucity of data on the viral load suppression in people on antiretroviral therapy [2]. The Institut Pasteur of Bangui (IPB), which is one of the two reference structures carrying out viral load measurements, showed in a study carried out in 2018 that only 49.17% of people on treatment had an undetectable viral load [3]. In 2019, out of more than 15,000 viral load determinations available for the entire country, the IPB had performed more than 70%.

The objective of this study was to assess the third 90 of the UNAIDS strategy for the years 2019 and 2020 in the CAR.

2. Materials and Methods

We carried out a retrospective study based on exploitation of the data from the Laboratory Training System (SIL: SYSLAM 64™, Codatec SA, France), which is software that allows daily management of laboratory activities and generated data, archived over several years. The study population comprised all patients attending the IPB or whose samples were sent to the IPB for determination of the viral load by partner health facilities (national hospitals and dispensaries and NGOs, including Médecins Sans Frontière for the Carnot and Paoua centers). The inclusion criteria were people with a confirmed HIV status and who had

been receiving treatment for at least twelve months.

The samples collected were whole blood taken with an EDTA tube, and the plasma was separated after centrifugation. Plasma separated from whole blood was stored at 15˚C - 30˚C for up to 24 hours, at 2˚C - 8˚C for up to 6 days, while for storage longer than six days the plasma was stored at −20˚C before analysis. The plasma was removed from the primary collection tube after centrifugation in a 2 ml Nunc™ tube for preservation. Plasma samples remain stable for up to three freeze/thaw cycles.

HIV-1 viral load measurements were performed by real-time PCR on Cepheid automated 16-module GeneXpert®devices. GeneXpert instrument systems automate and integrate sample preparation, nucleic acid extraction and amplification, and target sequence identification in samples. The Xpert HIV-1 Viral Load test is an *in vitro* reverse-transcription polymerase chain reaction (RT-PCR) test for the detection and quantification of HIV-1 RNA in samples. The test can quantify HIV-1 RNA in the range of 40 to 10,000,000 copies/mL and it has been validated for the quantification of HIV-1 RNA of group M (subtypes A, B, C, D, F, G, H, J, K, CRF01_AE, CRF02_AG, and CRF03_AB) and groups N and O.

Sociodemographic data (age, gender, geographic location, treatment center) and viral load data were extracted from the SIL, converted to Excel format and analyzed with STATA (Statistical Analysis Software, version 14, Stata Corp LLC, College Station, Texas, USA). The Chi^2 test and the odds ratio (OR) calculation and its 95% confidence interval (95% CI) were used to compare frequencies. The significance threshold for the statistical tests was set at 5%.

3. Results

Data extracted from the SYSLAM data base of the IPB's medical analysis laboratory for the years 2019 and 2020 identified 22,895 patients, of whom 72% were female and 28% male. The mean age was 40.82 years (extremes: 0 to 90 years). Patients over the age of 40 were the majority in the study (56%). Patients from the city of Bangui were very widely represented during the study at more than 80%. Regarding the virological parameters associated with this study, 66% of the patients had significant viral load suppression according to the WHO recommendations, of which 52.5% had an undetectable viral load, and 34% were in virological failure. Table 1 provides the sociodemographic variables and the viral loads of our study.

In total, data from several treatment centers in the city of Bangui and two provincial cities were taken into account in this study. According to the treatment centers, the outpatient treatment center (OTC) of the Communautaire hospital, the National Reference Center for Sexually Transmissible Infections and of Antiretroviral Therapy (CNRISTTAR), and the day hospital of the National University Hospital Center of Bangui (CNHUB) were the most frequented centers. Table 2 below provides the distribution of patients according to the treatment centers.

Table 1. Study population characteristics.

	Number Frequency	
Gender	*n*	*%*
F	16,558	**72**
M	6337	28
Age bracket		
≤18 years	1431	6
19 - 29 years	2061	9
30 - 39 years	6437	28
40 - 49 years	7354	**32**
≥50 years	5612	**26**
Town		
Bangui	18,911	**82.6**
Carnot	2268	10
Paoua	1644	7
Other*	72	0.4
Year		
2019	11,012	48
2020	11,884	**52**
Viral Load categories		
Undetectable	12,008	**52.5**
40 - 999 Cp/ml	3098	13.5
>1000 Cp/ml	7790	34

Table 2. Distribution of the study population by treatment center.

	Number Frequency	
Treatment center	*n*	*%*
CNHUB	1392	**6.08**
CNRISTTAR	2802	**12.24**
COMPLEXE PEDIATRIQUE	1016	4.44
OTC HOP.[a] Communautaire	6576	**28.72**
HOP. Communautaire	417	1.82
HOP. Amitié	995	4.35
HOP. Domitien	1130	4.94
CAMP Fidèle OBROU	599	2.62
C S[b] COMBATTANT	569	2.49
C S BEGOUA	561	2.45
C S BOY-RAB	583	2.55
MSF CARNOT	2278	9.95
MSF PAOUA	1646	7.19
*OTHERS**	2332	10.19

[a]: Hospital; [b]: Health Center.

Of the 22,895 patients for whom viral load data were available, 67% of the women had viral load suppression compared to 63.32% of the men. Patients over 50 years of age and those in the 40 - 49 years of age group at 71.85% and 69.25%, respectively, had the highest rates of viral load suppression. On the other hand, for those under 18 years of age, 63.45% of the patients were in virological failure (VL > 1000 copies/ml). In the analyses, these differences were statistically significant ($p < 0.05$). **Table 3** below provides the characteristics of the study population according to the viral load.

4. Discussion

This study aimed to reportHIV-1 viral load data and the percentage of people living with HIV receiving antiretroviral treatment with viral load suppression after at least one year of follow-up in the Central African Republic. The data collected concerned the city of Bangui and two provincial cities, representing 72% in 2019 and 81% in 2020 of the HIV-1 viral load data available for the CAR. We identified 22,895 patients with at least one viral load measurement available at the time of the study. The majority (80%) of the patients came from Bangui, and 72% were female. These data are superimposed on those of the study conducted in 2018 [3] and raise the issue of accessibility to the viral load of patients located in the provinces. The two main reference facilities that perform determinations of this virological marker are located in Bangui. The CAR is a country that has been plagued by repeated socio-political and military crises, and many factors such as insecurity, inadequacies in treatment centers, as well as the absence of a formal mechanism for transferring samples to reference laboratories may explain the inaccessibility to viral load data of the majority of patients in outlying areas. This problem of accessibility to viral load data in the provinces is an impediment to achieving the 90-90-90 cascade, which has since been revised upwards to 95-95-95 [4]. Given the difficulties with indexing samples to make viral load data available to all patients on antiretroviral therapy in the CAR, the point-of-care (POC) approach in district hospitals that has been successful in a number of sub-Saharan African countries should be the preferred option [5] [6] [7] [8] [9] [10].

For the city of Bangui, where the resources for obtaining viral loads are available, the results of this study showed a disparity in the treatment centers, with an under-prescription of viral loads compared to the national guidelines for antiretroviral treatment in the CAR [11].

Overall, 66% of the patients had significant viral load suppression according to the WHO recommendations, of which 52.5% had an undetectable viral load (VL < 40 copies/mL). These data, while encouraging given the Central African context, are in keeping with the average reported by UNAIDS in 2020 for all countries, but they remain far from the target of 90% of patients receiving ARV treatment who need to have their viral load suppressed in 2020, as planned in the strategy in 2014. Studies in other African countries and around the world have shown a higher level of viral load suppression than our study [12]-[17].

Table 3. Viral load results and distribution in the study population.

Characteristics	Viral load					
	Undetectable n (%)	40 - 999 Cp/ml n (%)	>1000 Cp/ml n (%)	P-value	OR	CI (95%)
Gender				0.001	1.32	[1.25; 1.4]
F	9009 (**54.41**)	2084 (12.59)	5465 (33.00)			
M	2999 (47.32)	1260 (16)	2325 (36.69)			
Age bracket				0.001	0.76	[0.74; 0.78]
≤18 years	348 (24.32)	175 (12.23)	908 (**63.45**)			
19 - 29 years	918 (44.54)	291 (14.12)	852 (41.34)			
30 - 39 years	3344 (51.95)	908 (14.11)	2185 (33.94)			
40 - 49 years	4103 (**55.79**)	986 (13.46)	2265 (30.8)			
≥ 50 years	3295 (**58.7**)	738 (13.15)	1580 (28.15)			
Town				0.001	1.16	[1.11; 1.21]
Bangui	10,188 (**53.88**)	2483 (13.12)	6240 (33)			
Carnot	979 (43.17)	329 (14.51)	960 (42.33)			
Paoua	816 (49.63)	269 (16.36)	559 (34)			
OTHER*	24 (33.33)	17 (23.61)	31 (43.06)			
Year				0.001	1.77	[1.68; 1.86]
2019	6584 (**59.79**)	1313 (11.92)	3115 (28.29)			
2020	5424 (45.64)	1785 (15.02)	4675 (**39.34**)			
Treatment center				0.001	1.04	[1.02; 1.06]
CNHUB	735 (52.8)	195 (14.01)	462 (33.19)			
CNRISTAR	1569 (**56**)	393 (14.03)	840 (29.98)			
COMPLEXE PEDIATRIQUE	258 (25.39)	131 (12.89)	627 (**61.71**)			
OTC Hop Communautaire	4173 (**63.46**)	843 (12.82)	1560 (23.72)			
HOP. Communautaire	221 (53)	61 (14.63)	135 (32.37)			
HOP. Amitié	451 (45.33)	121 (12.16)	423 (42.51)			
HOP. Domitien	631 (55.84)	183 (16.19)	316 (27.96)			
CAMP Fidèle OBROU	291 (48.58)	73 (12.19)	235 (39.23)			
CS COMBATTANT	289 (50.79)	75 (13.18)	205 (36.03)			
CS BEGOUA	296 (52.76)	63 (11.23)	202 (36.01)			
CS BOY-RAB	230 (39.45)	88 (15.09)	265 (45.45)			
MSF CARNOT	985 (43.24)	333 (14.62)	960 (42.14)			
MSF PAOUA	817 (49.64)	269 (16.34)	560 (34.02)			
*OTHERS**	1062 (45.54)	270 (11.58)	1000 (42.88)			

The table above shows the comparison between the viral load and the distribution in the study population. At the same time, we also studied the different relationships in the form of the odds ratio (OR). This table shows a relationship between the viral load and: -gender, OR = 1.32, and its 95% confidence interval [1.25; 1.4]; -the age bracket, OR = 0.76, with its confidence interval [0.74; 0.78] at 95%; -the city, OR = 1.16, with its confidence interval [1.11; 1.21] at 95%; -year, OR = 1.77, confidence interval [1.68; 1.86] at 95%; -treatment center OR = 1.04, confidence interval [1.02; 1.06] at 95%.

Women, who had a viral load suppression rate of 67%, had a better outcome than men, and this trend was already noted in the 2018 study ($p = 0.001$; OR = 1.32) [3]. Children and young people under the age of 18 with a viral load suppression rate according to WHO recommendations of 36.55% had the lowest rate in our study population. There were 63.45% virological failures (VL > 1000 copies) according to WHO recommendations. As in 2018, but also based on data from other published studies [18] [19], we noted that viral load suppression was less likely in children than in older people, despite the availability of appropriate antiretroviral therapies. The results of this study highlight the need to devise and implement targeted and differentiated strategies with treatment sites or consultation days dedicated to adolescents. A care package, as well as an education service including training and information for adolescents regarding AIDS, need to be developed to improve the treatments for children and young people living with HIV [20] [21]. In this approach, particular emphasis should be placed on adherence to treatment, which is a major factor inviral load suppression in young people [15].

In this study, we also observed a viral load suppression rate of 71.71% in 2019 compared to 60.66% in 2020 ($p = 0.001$; OR = 1.77). This sharp decline is probably linked to the COVID-19 pandemic, the impact of which on the management of HIV/AIDS infection has been documented. Indeed, in May 2020, UNAIDS had already drawn attention to the risk of disruptions in access to HIV services during the COVID-19 pandemic. Early on, simulations had shown that a major disruption in access to HIV treatment could result in an additional 500,000 AIDS-related deaths in sub-Saharan Africa. The report showed that HIV prevention and treatment services had been disrupted in 10 of the 16 countries studied. It has also been reported on several occasions that people living with HIV do not have enough antiretroviral medications to get through a lockdown of more than 60 days and that others have stopped treatment due to a lack of food [22] [23].

Regarding the data collected in Bangui, reference centers such as the Outpatient Treatment Center (OTC) of the Bangui Communautaire Hospital and the National Reference Center for Sexually Transmitted Infections and Anti-Retroviral Therapy (CNRISTTAR) had better results compared to other health structures in terms of suppression viral load of 76.38% and 70%, respectively ($p = 0.001$; OR = 1.04). These two centers could serve as a model by sharing their experience, and they could supervise the other centers that are still lagging in this regard.

However, estimates of people living with HIV on ARV treatment who have viral load suppression only concern the proportion of patients whose viral load results were available. As in any study, there are a number of limiting factors; since the data were extracted on the basis of data from the medical analysis laboratory of the Institut Pasteur in Bangui, the aspects concerning clinical and therapeutic data, as well as regarding treatment adherence, are lacking, which

has not allowed us to further consider the causes of the therapeutic failures observed.

5. Conclusion

The results of this study, even piecemeal and in a context of under-prescription of the HIV-1 viral load, can be extrapolated to the population of people living with HIV on ART in the CAR. Efforts should be made to make viral load data accessible and available to all patients receiving ARV treatments in the CAR through the dissemination of POC techniques. Finally, the management of HIV/AIDS infection in children and adolescents should be given special attention in order to enable the CAR to achieve the objectives of the next challenge, namely meeting the objectives of the 95-95-95 cascade.

Source of Funding

The HIV-1 viral load measurement activity is being monitored in the CAR by the Global Fund.

Ethics Approval

We received approval from the Scientific Ethics Committee, as well as a certificate of renunciation of informed consent, as the study was based on routinely collected data.

Conflicts of Interest

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

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