



Factors Associated with Virological Suppression of HIV Viral Load in Patients on Antiretroviral Therapy in Conakry, Guinea

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Abstract: Viral load testing is a key indicator for assessing ART success and diagnosing drug resistance in people living with HIV/AIDS on antiretroviral therapy. This study aimed to assess virological suppression among people living with HIV / AIDS on antiretroviral therapy in Guinea. This was a three years descriptive cross-sectional that involved adult HIV-positive patients treated in different sites in Conakry. The study population consisted of patients living with HIV/AIDS, followed up at Conakry ART care and treatment sites, samples collected from the study population were sent to the National Institute of Public Health for viral load testing between January 2018 and June 2021. The viral load was quantified by the Generic Biocentric technique and the detection threshold set at 350 copies/ml. Factors associated with virological suppression were analysed by univariate or multivariate logistic regression. Statistical analysis were performed by R software version R4.0.3. A total of 9815 samples were collected and viral load data analyzed at the national public health laboratory. The sample was dominated by women (72%), with an average age of 29. Of these, 6,706 (68%) of people on ART had viral load suppression. The univariate analysis showed that women were (22%) more likely to have VL suppression (p-value < 0.001) moreover, the chance for all HIV-positive people on treatment to achieve viral load suppression was related to the length of treatment. The results of this study show viral load suppression greater than 68%. The length of antiretroviral therapy, female gender, and advancing age of PLHIV were associated with VL suppression. Targeted awareness raising actions must be undertaken with patients who have an important risk.

Keywords: Factors Associated, Virological Suppression, Antiretroviral Therapy, Conakry, Guinea

1. Introduction

About forty years since the discovery of the Human Immunodeficiency Virus (HIV), nearly 35 million people have died, and about 36 million people live with the disease [1]. With the support of the Global Fund to the Guinean government, antiretroviral treatment (ART) was made accessible to HIV-positive patients in 2007 [2]. Until 2017, Guinea had 142 sites established and integrated in the care of people living with HIV/AIDS (PLWHA), of which only 86 were functional [3]. According to the latest Demographic and Health Survey (DHS) in 2018, HIV prevalence in Guinea is estimated at 1.5% [4].

Since the United Nations AIDS Programme (UNAIDS) set its target of three out of 95 by the end of 2020, viral load has become the essential tool for assessing the success of ART of PLHIV [5, 6]. It also allows biological monitoring of PLHIV [7].

The first viral load (VL) tests was performed in Guinea in 2006 on a cohort of PLHIV by the NGO DREAM (an Italian Christian organisation involved in caring for people living with HIV/AIDS). It was not until 2013 that viral load testing was roll out to all HIV positive patients on treatment in Conakry [4].

According to a global progress report on the fight against AIDS in 2020, Guinea has 61,897 people on ART, of whom 26,213 had a viral load test (22%). Based on the UNAIDS 95s target, Guinea is at 52% for the 1st 95, 52% for the 2nd 95 and 22% for the 3rd 95 [6]. In relation to the new UNAIDS target for 2030.

Viral load testing is a key indicator for assessing ART success and diagnosing drug resistance in people living with HIV/AIDS on antiretroviral therapy [8].

Even though the Guinea, government with the support of partners, has made substantial efforts to implement the UNAIDS 95 target, Guinea still has challenges to reach the third 95 target. Several studies have described viral load testing in one category of people living with HIV/AIDS in Guinea [6, 9-11]. No study has focused on VL monitoring of patients on ART at national level and characterizing the factors associated with VL suppression. Knowing the proportion of PLHIV achieving VL suppression and its associated factors could help develop new strategies for achieving the third 95 of the UNAIDS target.

The objective of this study was to investigate the frequency and factors associated with viral load suppression among PLHIV in the care sites in Conakry.

2. Methods

2.1. Setting and Study Design

Conakry, the capital of the Republic of Guinea, covers an area of 450 km² and is populated by nearly 2,300,000 inhabitants, meaning a quarter of the Guinean population [11].

Conakry is reported to have 22 ART and treatment sites [2] that provide care for a large cohort of PLHIV whose

virological follow-up and monitoring is provided by the National Institute of Public Health. The National Institute of Public Health (INSP) ensures the biological and virological monitoring of ART patients from the care and treatment sites in Conakry outside the Donka National Hospital [3]. The 22 ART care and treatment sites in Conakry are mainly: four communal medical centres, three departments at the Ignace Deen National Hospital, the ASFEGMASSI outpatient treatment centre, the Armed Forces Health Service, the Mother and Child Centre, Bernay Fotoba, the Medical Centre of the Bauxites of Guinea camp, four private clinics and six health centres.

2.2. Study Population

The study population consisted of patients living with HIV/AIDS (PLWHA), followed up at Conakry ART care and treatment sites, samples collected from the study population were sent to the National Institute of Public Health for viral load testing between January 2018 and June 2021. Patients with incomplete information were excluded from the study.

2.3. Data Collection

The Molecular Biology Unit of the National Institute of Public Health has a database that stores the viral loads of people on antiretroviral treatment. From this database, we extracted data from January 2018 to June 2021. Data analysis included socio-demographic characteristics (age, sex and residence), the reason for requesting a viral load test, the use of ARVs, the date of ART initiation, the dates of sample collection and laboratory VL analysis, the treatment lines (first, second and third) and treatment regimens as well as the interpretation of the viral load results. According to Guinea's national HIV management protocol, the first line consists of 3TC+TDF+EFV, the second line 3TC+TDF + LPV/r and the third line various combinations based on 2INRT+ Darunavir/Ritonavir or Raltegravir + Etravirine [10, 12]. Patients with a viral load of < 390 copies/ml or less were considered virologically suppressed.

2.4. Laboratory Techniques

RNA was isolated from plasma by an automated method, and amplification was performed as described by the RT-PCR principle using the HIV generic biocentric [13]. The detection limit was set at < 390 copies/μl for a 250 μl plasma sample.

2.5. Data Analysis

The data description was done by calculating proportions for categorical variables and means for quantitative variables. Comparisons were made using the Chi-2 or Fischer test for categorical variables and Student's t-test for quantitative variables. Factors associated with virological suppression were analysed by univariate or multivariate logistic regression. In multivariate analysis, only variables with a p-

value ≤ 0.20 were used in the multivariate model. The Hosmer-Lemeshow test was used—analysis of the accuracy of the model. The risk of suppression was estimated by calculating the Odds Ratio (OR), followed by its 95% confidence interval. The significance level was set at 5%. All statistical analyses were performed using R software version R4.0.3.

3. Results

A total of 10,602 patients were tested for viral load, of which 787 were excluded and 9,815 patients (92.57%) were included in the analysis (figure 1).

The 9,815 patients were HIV1 positive with a mean age of 29 (29.39) with a female predominance (72%). Nearly 98% of our patients were on first-line antiretroviral therapy. The reason for requesting a viral load test was dominated by routine check (88%) following the national ART guideline. Forty-two percent of patients had treatment duration ranged from 0-1 year, and xxx were on treatment for a range from 1-5 years. Viral load suppression was observed in 68.32% of patients (Table 1).

Univariate analysis of the data showed that women were more likely to have a suppressed viral load, with 95 CI 1.22 (1.11; 1.34). Patients on the second line of treatment were 23% less likely to have a suppressed viral load. The longer the treatment, the greater the chance of having a suppressed viral load 1.08 [0.98; 1.19]. It also showed that patients with an advanced age were more likely to have a viral load suppression (table 2).

Multivariate analysis of the data showed that duration of treatment and female gender were independently related to viral load suppression, 95 CI [0.85 (0.75, 0.95)] < 0.005 (table 2).

4. Discussion

The objective of this study was to investigate the frequency and factors associated with viral load suppression in patients living with HIV/AIDS under ART at the HIV care and treatment sites in Conakry between January 2018 and June 2021.

The threshold for detection was set at < 390 copies/ml. This threshold is higher than that used by some VL testing platforms, which is 200 copies/ml (WHO, 2005). However, it is still lower than that set by some national HIV/AIDS programs and even by WHO in the absence of any treatment, which is < 1000 copies/ml [14, 15].

Data from more than ten thousand patients receiving viral load testing at the National Institute of Health Public showed that nearly seven out of ten people had a suppressed viral load. This rate is comparable to that reported by Diourra et al., 80% viral suppression on 379 DBS samples [8]. This rate is below the UNAIDS and National AIDS and Hepatitis Control Programme target of 90% by 2020 [6]. This result also suggests that three out

of ten patients on ART could transmit HIV to their sexual partner. Similar observations have been reported by other authors [16, 17].

In the univariate model of the data from this study, women on antiretroviral therapy were more likely to have VL suppression than men [1.22 (1.11; 1.34) < 0.001]. Kone F et al. showed similar proportions in their study in Côte d'Ivoire [7]. It is known in the literature that women attend health services more than men for needs such as maternity, bodily fragility, and illness. A study conducted in Guinea on the dropout of patients on antiretroviral treatment showed that the proportion of dropouts was higher among men [2].

Multivariate analyses of the data also showed that treatment duration was independently associated with viral load suppression [0.85 (0.75; 0.95) < 0.005]. Similar observations have been reported by authors in sub-Saharan Africa and in developed countries [18, 19]. This could be explained by the reduction in plasma viral load (RNA) over the years. This result is different to the recommendations of WHO stated that patients on antiretroviral therapy have viral load suppression after six months of treatment.

Patients on first-line ART were more likely to experience viral load suppression. This result is consistent with other authors' observations that the first-line regimen should be initiated in all HIV-positive people starting treatment [20, 21]. As argued by some authors for the change from the former to the latter [22]. However, the lack of genotyping data limits decision to switch ART treatment to second or third line in Guinea. Similar challenges were observed by Ford N and team [23].

This study, like many others, may have some limitations. These include the lack of clinical data to which the laboratory does not have access and would have facilitated the interpretation of the virological and therapeutic results. Another limitation of the study is that the Viral Load data available was at follow-up and initiation of treatment. However, to our knowledge, our study is one of the largest cohorts of follow-up of PLHIV on antiretroviral treatment in Guinea. Even though the study covered an extended period, all the patients enrolled had a viral load measurement with the same technique and personnel. Despite public efforts, the findings of this study shows the proportion of VLR suppression was lower. Given the risk factors identified, the current study suggests that targeted awareness raising actions must be undertaken with patients who have an important risk.

Description

We extracted data from ten thousand six hundred and two patients who received a viral load test between January 2018 and June 2021.

Among them we excluded 782 data that were incomplete. We therefore retained 9815 viral load data. Of these, 9596 were on line 1 and the rest on line 2. In total, 6706 patients had a suppressed viral load against 3109 patients with a detectable viral load.

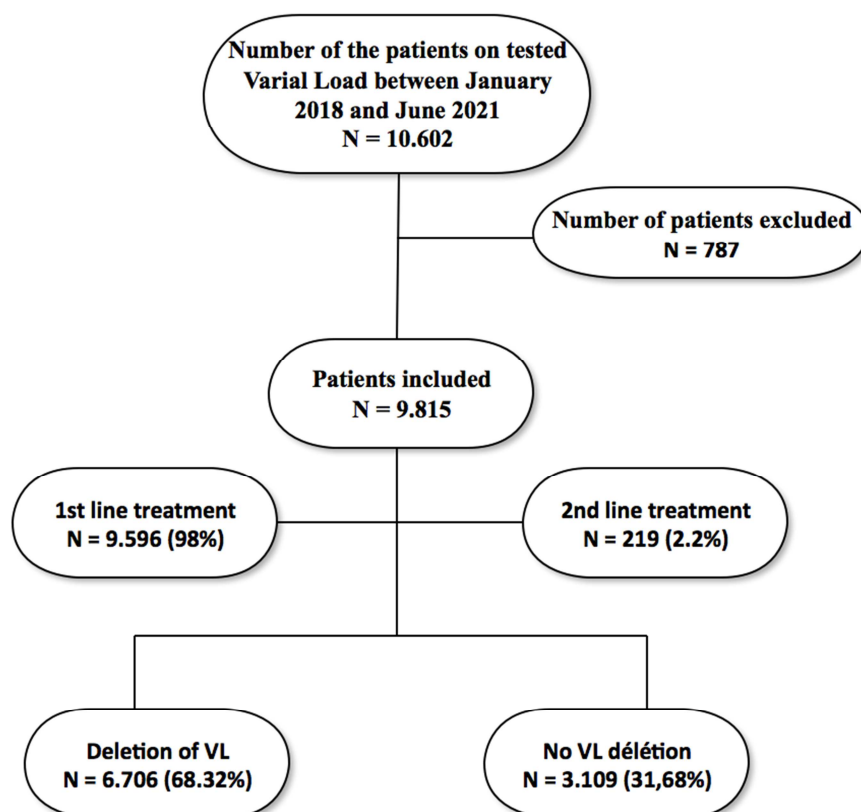


Figure 1. Flow chart summarising all the data from the study.

Table 1. Sociodemographic characteristics of patients with viral load tested between January 2018 and June 2021 at the National Institute of Public Health.

Characteristics	N=9,815 (%)
Gender	
Female	7 067 (72.0)
Male	2 748 (28.0)
Reason for sampling	
VL- Strengthening compliance	161 (1.6)
VL-6months later	572 (5.8)
VL-Follow-up check	8 614 (88.0)
VL-Search	148 (1.5)
VL- Prevention of Mother-to-Child Transmission	5 (<0.1)
VL-initiation	315 (3.2)
Under Antiretroviral treatment	
No	27 (0.3)
Yes	9 788 (100)
Treatment line	
1 st line	9 596 (98.0)
2 nd line	219 (2.2)
Interpretation. Viral Load (VL)	
VL-Not deletion	3 109 (32.0)
VL-Deletion	6 706 (68.0)
Age (mean)	29 (29.39)
Duration of treatment	
0-1	4 158 (42.0)
1-5	3 548 (36.0)
5-11	2 109 (21)
Age at initiation, years	
0-20	553 (5.6)
20-40	7 036 (72)
40-60	2 010 (20)
60-84	216 (2.2)

Table 2. Univariate and Multivariate analysis of factors associated with viral load suppression of patients with viral load tested at the National Institute of Public Health.

	Univariate analysis		Multivariate analysis			
	Viral Load Non deletion n=3109 (%)	Viral Load deletion n=6706 (%)	OR [CI95%]	p-value	OR adjusted [CI95%]	p-value
Gender						
Male	956 (30.7)	1 792 (26.7)	1.0	Reference	1.0	—
Female	2 153 (69.3)	4 914 (73.3)	1.22 [1.11, 1.34]	<0.001	0.78 [0.71, 0.86]	<0.001
Reason for collection						
Viral Load (VL)-observation	91 (2.93)	70 (1.04)	1.0	Reference.	1.0	Reference
VL -6 months	190 (6.11)	382 (5.70)	2.61 [1.83, 3.74]	<0.001	0.38 [0.26, 0.54]	<0.001
VL -Follow-up	2 611 (84.0)	6 003 (89.5)	2.99 [2.18, 4.11]	<0.001	0.35 [0.26, 0.48]	<0.001
VL -Research	83 (2.67)	65 (0.97)	1.02 [0.65, 1.60]	0.938	1.04 [0.66, 1.64]	0.90
VL-Prevention of Mother-to-Child Transmission	3 (0.10)	2 (0.03)	0.89 [0.10, 5.98]	0.902	1.04 [0.16, 8.22]	>0.90
V-initiation	131 (4.21)	184 (2.74)	1.82 [1.24, 2.68]	0.002	0.53 [0.36, 0.78]	0.001
On antiretroviral therapy						
No	8 (0.26)	19 (0.28)	1.0	1.05	1.0	
Yes	3 101 (99.7)	6 687 (99.7)	0.92 [0.37, 2.04]	0.841	1.05 [0.47, 2.55]	>0.90
Treatment line						
1 st line	3 020 (97.1)	6 576 (98.1)	1.0	Reference.	1.0	
2 nd line	89 (2.86)	130 (1.94)	0.67 [0.51, 0.88]	0.005	1.43 [1.08, 1.88]	0.012
Duration of treatment, years						
0-1	1 385 (44.5)	2 773 (41.4)	1.0	Reference.	1.0	
1-5	1 120 (36.0)	2 428 (36.2)	1.08 [0.98, 1.19]	0.104	0.98 [0.88, 1.08]	0.60
5-11	604 (19.4)	1 505 (22.4)	1.24 [1.11, 1.40]	<0.001	0.85 [0.75, 0.95]	0.005
Age, years						
0-20	230 (7.40)	323 (4.82)	1.0	Reference.	1.0	
20-40	2 304 (74.1)	4 732 (70.6)	1.46 [1.23, 1.74]	<0.001	0.98 [0.77, 1.26]	0.90
40-60	520 (16.7)	1 490 (22.2)	2.04 [1.68, 2.48]	<0.001	1.03 [0.70, 1.52]	0.90
60-84	55 (1.77)	161 (2.40)	2.08 [1.47, 2.97]	<0.001	1.39 [0.75, 2.52]	0.30

5. Conclusion

The results of this study show a low suppression of virological load suppression among the population study. Duration of antiretroviral treatment, female gender, and advancing age were favourable to patients' viral load suppression. Continuation of this study by including genotyping data could refine the level of viral load suppression and manage those in virological failure.

Author Information

The authors

AC designed the protocol, participated in the analysis and writhing of the manuscript. Then P M D and M B D helped with the manuscript.

PMD, MBD, T N, AC, MAS, G L, M D, and A S B contributed to perform laboratory analysis for virological load of HIV.

AC, MBK, M C and AKK performed the data analysis, interpreted result and drafted the manuscript with the input from KK, RC, FBM, AIC, and AT. All others critically revised and approved the final manuscript.

Ethics Approval and Consent to Participate

As the collection was done retrospectively on routine data,

consent was not sought. However, each participant has a unique national code, and the staff in charge of collecting the samples maintained confidentiality. The study was validated by the Scientific Committee of the Public Health Chair of the Faculty of Health Sciences and Techniques of the Gamal Abdel Nasser University of Conakry. The registration number is 046/PS/FSTS/UGANC/2021.

Competing Interests

The authors declare that they have no competing interests.

Comments

I agree with the conditions of this review.

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