

# Evaluation of Virological Parameters in People Living with HIV on ARVs in Chad

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**How to cite this paper:** Sanoussi, H.A., Mbaihodji, J., Abderrazzack, A.F., Mahamat, N.A.A., Ahmat, M.A. and Brahim, B.O. (2025) Evaluation of Virological Parameters in People Living with HIV on ARVs in Chad. *Open Journal of Medical Microbiology*, 15, 55-63.

<https://doi.org/10.4236/ojmm.2025.151004>

**Received:** January 10, 2025

**Accepted:** March 28, 2025

**Published:** March 31, 2025

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## Abstract

**Introduction:** HIV infection remains a major public health problem, caused by a virus of the retroviridae family that destroys the host organism's immune system. The result is a syndrome known as acquired immunodeficiency syndrome. In developed countries, the introduction of antiretroviral treatment is coupled with effective virological monitoring to limit the emergence of resistance. The general objective was to study the evolution of virological parameters in PLHIV on ARV therapy in Chad. **Methodology:** We carried out a retrospective, prospective, descriptive cohort study with analytical aims on a fixed number of patients living with HIV-1 at the Centre polyvalent Alnadjma in the biomolecular analysis laboratory of APMS and the laboratory of the Hôpital Militaire d'Instruction (HMI). Venous samples were collected in EDTA tubes for plasma viral load determination and, after centrifugation at 3500 g/5min, the plasma was recovered in anticoagulant-free tubes for plasma viral load determination using the Biocentri apparatus, in accordance with protocol procedures. **Results:** A total of 372 patients were monitored. In terms of socio-demographic results, 72.6% of patients were female, and 39.5% were housewives. For viral load assessment, 93.3% of our patients had a viral load greater than 1000 copies/ml at M0. After M18 of treatment, we obtained 94.6% of patients with a viral load greater than 1000 copies/ml at M18. **Conclusion:** Our study assessed virological success after 12 months of treatment in HIV-infected patients. Good adherence to treatment will lead to better viral load suppression.

## Keywords

HIV, Virological Evaluation, ARV, Chad

## 1. Introduction

Retroviruses are defined by their structure, but above all by their mode of replication [1].

These RNA viruses, thanks to the enzyme they carry, reverse transcriptase (RT), will have their retro genomics transcribed into viral DNA, which can then integrate the chromosomal DNA of the host cell under the name of provirus [1].

HIV infection remains a major public health problem, caused by a virus of the Retroviridae family that destroys the host organism's immune system. The result is a syndrome known as acquired immunodeficiency syndrome [2].

In developed countries, the introduction of antiretroviral treatment, coupled with effective virological monitoring, limits the emergence of resistance [3]. In Africa, the situation is worrying. Indeed, acquired resistance tends to be higher there, and is increasing as access to ART expands. Yet access to ART has revolutionized patient care, improving quality of life and preventing many HIV/AIDS-related deaths [3]-[5].

Global AIDS epidemiology statistics based on UNAIDS data show 39.9 million [36.1 - 44.6 million] people living with HIV worldwide in 2023, with sub-Saharan Africa accounting for 62% of new HIV infections. In 2023, in all other regions, more than 73% of new HIV infections were in sub-Saharan Africa. Est accounted for 62% of new HIV infections. By 2023, in all other regions, over 73% of new HIV infections were among men and boys [6].

According to WHO estimates, only 17 million of them are receiving ART. ART coverage is therefore insufficient and disparate, both between developed and developing countries and within the African continent, between East and Southern Africa (54%) and West and Central Africa (28%) [7].

The Chad is experiencing a generalized epidemic, with a prevalence of 1.6% in the 15 - 49 age group, with variations according to sex, province and population sub-groups. The care of people living with HIV in Chad has undergone major changes in recent years. The number of people accessing ARV treatment continues to grow year on year, with 82,082 people on ARV in 2021 out of an expected target of 110,000. Since 2019, the WHO has been recommending Dolutegravir (DTG)-based protocols as first-line treatment for HIV/AIDS patients due to efficacy, tolerability and a good genetic barrier to resistance compared with the protocols used until now. The General objective is to study the evolution of virological parameters in PLHIV on ARVs in Chad.

## 2. Material and Method

### 2.1. Material

#### 2.1.1. Study Setting

Center polyvalent Alnadjma in the biomolecular analysis laboratory of APMS and the laboratory of the Hôpital Militaire d'Instruction (HMI) served as the setting for our study.

### **2.1.2. Type of Study**

We carried out a retrospective, prospective, descriptive cohort study with analytical aims on a fixed number of patients living with HIV-1 during a given period and compared it on the same database.

### **2.1.3. Study Period**

Our study took place at the Hôpital Militaire d'Instruction (HMI) and the Centre Polyvalent Alnadjma in Ndjamen-Tchad over a period of 18 months, from November 2022 to May 2024.

### **2.1.4. Study Population**

A total of 372 HIV-1 seropositive patients were registered and followed-up.

## **2.2. Sample**

The sample consisted of all HIV-1-positive patients followed up at the Alnadjma multipurpose center and the Hôpital Militaire d'instruction.

### **2.2.1. Inclusion Criteria**

Any person living with HIV-1 under treatment and who consents.

### **2.2.2. Non-Inclusion Criteria**

- Any non-consenting.
- PVHIV not on ARVs.

### **2.2.3. Sample Size**

The sample size was determined by taking all HIV1-infected patients on antiretroviral treatment.

We were able to follow a total of 372 patients from M0 to M18.

## **2.3. Variables Studied**

- Sociodemographic data: sex, marital status, profession, level of education.
- Biological data: viral load.
- Therapeutic data: line of therapy, treatment regimens, level of compliance.
- Factors linked to compliance: sex, age group, biological and therapeutic data.

## **2.4. Data Collection**

Data were collected from patients' medical records in an individual survey form was drawn up for each patient on arrival at the laboratory or from the sample sent.

### **2.4.1. The Parameters Assessed Included**

- Socio-demographic variables: sex, age, marital status, profession, co-infection, residence and other variables were determined for all cases.
- Biological variables: plasma viral load.

### **2.4.2. Collection Technique**

For information on age, sex, duration of treatment and tests ordered, we would

refer to the notification forms correctly completed by the prescribing physicians. For blood tests, information was collected on CD4 lymphocyte count and plasma viral load [8]-[11].

#### **2.4.3. Sample Preparation**

Blood samples are taken on EDTA tubes. Whole blood is used for plasma viral load and, after centrifugation at 3500 g for 5 minutes, plasma is recovered in anticoagulant-free tubes for plasma viral load determination.

### **2.5. Ethical Considerations**

The present work falls within the scope of scientific research. As such, the study was carried out after obtaining administrative authorizations.

The women included in our studies were mothers who had accepted voluntary testing as part of PMTCT in accordance with the universal informed consent procedure.

### **2.6. Operational Definitions**

Virological efficacy: viral load greater than 1000 copies/ml in patients on ART [12].

Good therapeutic adherence: is the match between a prescription and/or preventive regimen and the patient's actual behavior [13].

Viral load: is the number of copies of a virus indicating viral replication in a given volume of fluid [14].

### **2.7. Method**

The tests used to carry out HIV1/2 serological examinations consist of three tests in the national algorithm for confirmation of seropositive patients and viral load for virological follow-up.

### **2.8. Technique [15]-[17]**

The two PCR techniques used (closed platform GeneXpert and open platform Bio-Centri) for plasma viral load determinations

### **2.9. The Molecular PCR Analysis Technique**

The GeneXpert Dx system automates the Biocentric system and integrates sample preparation, nucleic acid amplification and target sequence detection in simple or complex samples using real-time polymerase chain reaction (PCR), depending on the device protocol.

### **2.10. Statistical Analysis**

Data entry, word processing and graphics were collected using the information request form, entered using Microsoft Word and processed using Excel 2013.

Descriptive statistical analysis was performed using SPSS.25.0 software.

### 3. Results and Discussion

From first November 2022 to 31 May, 2024, a total of 372 HIV-1-infected patients constituted our study sample according to the inclusion criteria. The study took place at the Hôpital Militaire d'Instruction (HMI) and at the Centre Polyvalent Alnadjma.

The results obtained after data analysis are presented in the following tables and figures.

#### *Socio-demographic data*

Gender distribution of patients on ARVs

Sexe	Fréquence	Pourcentage
Féminin	270	72.6
Masculin	102	27.4
Total	372	100.0

The table above shows that the female sex is the most represented with 72.6%.

Our results are consistent with other studies conducted by DENE Edith in Mali in 2007 at 73.3% [18] and Lawson ATD in Senegal in 2017 reported respectively a sex ratio of 0.37 and 0.56 in favor of women. Mouhari Touré *et al.* in 2011 found in their study in Togo a female predominance of 68%.

The higher proportion of females may be explained by women's natural anatomical predisposition to the high risk of HIV transmission, or it may be linked to the predominance of females in the Chadian population. It may also be explained by the fact that more women than men visit health facilities.

#### *Distribution of patients on ARVs by age group*

Age	Frequency	Percentage
15 - 25	117	31.5
26 - 35	116	31.18
36 - 45	120	32.22
46 - 55	7	1.9
56 - 65	12	3.2
Total	372	100.0

The table below shows that the 36 - 45 age group was the most represented with 32.22%, *i.e.* an average of  $32.05 \pm 9.8$  years. This result is comparable to that obtained by DAKE in 2022, where the age group [36 - 45] was in the majority with 32.80% [19].

This age bracket corresponds to that of maximum sexual activity exposing to the risks of transmission of sexually transmitted infections.

#### *Patient distribution by education level*

Education level	Frequency	Percentage
Primary	100	26.9
Secondary	27	7.3
Out of school	138	37
Higher	107	28.8
Total	372	100.0

Non-educated people were the most represented in our study (37%), while 28% had a higher level of education, which highlights their involvement in the spread of the pandemic. This result is lower than that of SAMAKE Bamako 2023, which found 39% and MAIGA 36.20% Bamako 2019 of non-educated people respectively [20].

#### *Distribution of patients by marital status*

Marital Status	Frequency	Percentage
Single	39	10.5
Divorced	25	6.7
Married	296	79.6
Widowed	12	3.2
Total	372	100.0

Of all our cases, married people had the highest rate of seropositivity with a percentage of 79.6%, our results are superior to those of Mohamed in Djibouti in 2011 who found 51.28% of married people [21].

#### *Distribution of patients by function*

Function	Frequency	Percentage
Housekeeper	147	39.5
Student	21	5.6
Student	30	8.1
Civil servant	111	29.8
Shopkeeper	63	16.9
Total	372	100.0

Housewives accounted for 39.5% of the total.our results are inferior to those of DENE E. who found in 2011 a dominance of (45%) housewives. According to profession Housewives were the most represented with 27.9%, followed by hair-dressers 13.9% and civil servants 12.9%. R. Haidara [22] found 36.3% housewives, 18.9% shopkeepers and 11.5% artisans.

#### *Trends in plasma viral load of PLWHA on ARVs*

## Viral Load Distribution for Month Zero at Neithen Months

CVMO	Frequence	Procentage
<40 copies/ml	0	0
40 - 1000 copies/ml	25	6.7
>1000 copies/ml	347	93.3
Total	372	100.0
CVM6		
<40 copies/ml	28	7.5
40 - 1000 copies/ml	243	65.3
>1000 copies/ml	101	27.2
Total	372	100.0
CVM12		
<40 copies/ml	292	78.5
40 - 1000 copies/ml	39	10.5
>1000 copies/ml	41	11.0
Total	372	100.0
CVM18		
<40 copies/ml	352	94.6
40 - 1000 copies/ml	5	1.3
>1000 copies/ml	15	4.0
Total	372	100.0

Among our patients 93.3% had a CV greater than 1000 copies/ml at M0, after M18 of treatment, we obtained 94.6% of our patients have an undetectable viral load (<40 copies/ml), our results are superior to that of Hama [23]. who found an undetectable cv 90% after 12 months of treatment. A study conducted by DAKE in 2022 in Bamako found an undetectable viral load of 92.31% after six months' treatment [24].

Good follow-up of DTG treatment enables viral load to be suppressed in a short space of time.

#### 4. Conclusion

Our retrospective study assessed the virological success of dolutegravir after 12 months of treatment in HIV-infected patients treated at the al-nadjma center and military hospital in Ndjama. In our study, 59.7% of patients were female; the age group most represented was [36 – 45] years, with a frequency of 32%; married people, those not attending school and housewives were the most represented. Patients on 1<sup>st</sup>-line therapy were in the majority (80.3%). After 12 months of treatment, 352 of our patients had an undetectable viral load, giving a virological success rate

of 94.6%. Good treatment follow-up will ensure better viral load suppression.

## 5. Agreement

1) All authors of the manuscript have read and accepted its contents and are responsible for all aspects of the accuracy and integrity of the manuscript.

2) This submitted article is an original work not considered or reviewed by any other publication and has not been published elsewhere in the same or similar form.

## Conflicts of Interest

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

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