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Research Article

Implementation of the HIV Test-and-Treat Strategy in PEPFAR Supported Health Facilities in Yaoundé-Cameroon: Antiretroviral Side Effects, Retention and Viral Load Suppression Outcomes

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Abstract

Introduction: The test-and-treat strategy related to HIV, seems to have yielded inconsistent results in Cameroon. We explored how biomedical aspects and side effects related to HIV first-line ART regimen might impact adherence to treatment, and overall outcomes of HIV infected individuals, within the test-and-treat strategy in Cameroon.

Methods: We conducted a qualitative and quantitative study with PLHIV. BMI values, liver and kidney related lab examinations were determined at inclusion and 6 months later, including VL. Follow up information were collected on a monthly basis. FGD sessions were carried out and analyzed by Atlas Ti 6.2.

Results: 155 PLHIV were included, and contributed 423 person-months of follow-up. TDF/3TC/EFV was prescribed to 63 participants (40.6%; - $CI_{95\%}$: 32.8% - 48.8%) at inclusion, whereas 92 received TDF/FTC+EFV at inclusion (59.4%; - $CI_{95\%}$: 51.2% - 67.2%), as first line treatment (p = 0.02144). 9 participants died during the study (CMR: 5.8%). Out of 930 expected follow up visits, 346 (37.2%; [$CI_{95\%}$: 34.1% - 40.4%]) occurred. 31 participants received their viral load results, and 93.5% were virally suppressed. Being a female (AOR = 3.05, 95%CI: 1.65 – 7.36), adhering to ART (AOR=2.05, 95% CI: 1.21 – 5.24) and not experiencing any side effects (AOR = 2.15, 95%CI: 1.25 – 5.66) were significantly associated with suppressed VL. Also being a male (AOR = 3.01, 95%CI: 1.25 – 6.34), having high levels of creatinine at initiation (AOR=2.01, 95% CI: 1.69 – 6.32), not adhering to ART (AOR=3.50, 95% CI: 1.98 - 7.01) and receiving treatment in district hospital biyemassi (AOR = 2.21, 95%CI: 1.69 – 7.36) were significantly associated with mortality. Under the qualitative component, 76 codes, 07 themes and 16 subthemes were identified. Among the themes identified were the limiting factors/enabling environment, overall perceptions, skills development, denial, missed appointments and other considerations in relation to PLHIV and ARVs, and side effects.

Conclusion: Poor retention in ART treatment continues to be the main issue in the implementation of the test-and-treat strategy. Occurrence of side effects, poor communication between service providers and PLVIH, as well as lack of therapeutic education, were identified as being some of the root causes of poor retention and adherence to ART.

Keywords: HIV; Test-and-Treat; ARV; Side Effects; Adherence; Viral Load

Introduction

The test and treat strategy in connection with the elimination of HIV throughout the world, was initiated in 2015 by the World Health Organization (WHO). A strategy that was meant to "avoid millions of AIDS-related deaths and 28 million new infections by 2030" [29]. And it is in fact this strategy which is currently being implemented in Cameroon, within the framework of the holistic care for PLHIV. It is indeed a matter of applying an approach that integrates both primary and secondary prevention of HIV. A strategy which is based on three main objectives, viz. in any community, for example, to ensure that 90% of people infected with HIV know their status (1st 90), ensure that among 90% of those infected and who know their status, 90% of them are initiated and maintained on ARV treatment (2nd 90), and finally that 90% of those initiated to ARV treatment, have a suppressed viral load (3rd 90). So these are UNAIDS targets for HIV eradication throughout the world by 2030 [25]. The three (3) 90 here above described lead to the fact that each HIV/AIDS control program should be able to identify at least 90% of HIV infected people in its field of intervention, be able to initiate into ART, at least 90% of those found HIV infected, and finally, ensure that those initiated into ART, are virally suppressed. This is the UNAIDS HIV cascade, which is intended to be achieved through the Test and Treat strategy [25]. And as it was stated by the UNAIDS, the ultimate goal of all this is to reduce the number of new HIV infections (Incidence) and thereby reduce the prevalence and overall impact of the HIV epidemic [6].

Although the strategy is truly innovative and applies perfectly to communicable infections from one individual to another, this strategy nevertheless raises questions as to its applicability and acceptability by the supposed beneficiaries. It should also be understood that, just like any other innovation, its implementation has been accompanied by some incomprehension and misunderstanding both on the part of the health service providers and those of the general public. Everything happens, as if with the test and treat, the health system is holding a double language. A double language which consists of telling the infected person that she or he is not sick, and at the same time asking her/him to take a treatment for an illness she/he does not have yet concretely. Hence the complexity of this situation, especially for those who are called upon to take ARVs as soon as they are tested HIV positive, sick or not. Not only should the treatment be taken as soon as the person is tested HIV positive, but in addition he/she should take this treatment throughout his/her life. Thus, when the infected person is not sufficiently prepared for the constraints of this treatment, or when he/she does not understand the importance of this treatment for its survival, he/she would be tempted to give up treatment instead of continuing to take it. The phenomenon of people who start antiretroviral therapy and who leave it immediately seems to have become increasingly important, with the introduction of the Test-and-Treat strategy [12]. In a context where phenomena such as denial, stigmatization, tendency to traditional medicine or the promises of healing from pastors or priests, people living with HIV who are on ARV treatment often have several reasons for wanting to give up these treatments and turn to alternative solutions. We must therefore recognize and take into account here, not only biomedical but also socio-cultural dimensions of HIV infection, particularly in a country like Cameroon. All these dimensions should indeed be considered in order to better understand how the Test-and-Treat strategy can affect the people who are subject to it. Thus, denial, HIV status non-acceptance were linked to perceptions of HIV risk, lack of risk perception of the consequences of HIV infection, or other forms of barriers may have a negative impact on the treatment link and the entire three (3) 90s cascade [3].

As a matter of fact, with the Test and Treat strategy, it was not a question of adding a new molecule or a different dosage of the administration of the already existing molecules. It is in fact a difference in the calendar, or rather in the date of initiation of the treatment. Indeed, before the introduction of Test and Treat strategy, every person infected with HIV had to fulfill a certain number of criteria before being initiated into treatment. These criteria for treatment initiation in Cameroon included those prescribed by the WHO classification [13].

Thus, people infected with HIV before 2015, had the time and the opportunity to digest not only the anxiety of the announcement of a positive HIV result, but also the possibility of preparing themselves mentally and psychologically for the idea of having to endure a treatment that is long-term, and even for life. This is no longer the case with the Test and Treat strategy. This is to say that the psychological component of the preparation of the infected person for its long-term treatment, has now been evacuated, not to say deleted. If one also refers to the fact that most people who are screened are often in unexpected conditions, one can understand the distress of these people not only for the announcement of a positive result, but for the initiation of treatment. The unexpected conditions of screening here are in fact the provider initiated testing and counseling (PITC). In fact, the provider-initiated approach of HIV screening suggests that the service provider in a health facility should be the one offering HIV testing to those who are at risk of HIV infection. This means that under these conditions, a person can get tested for HIV, without having been prepared in advance for it.

In this context, many studies have in fact already been carried out, in relation to the Test and Treat strategy. While some studies underlined the importance of the "Find and Treat" rather than the "Test and Treat", others tried to demonstrate the possible link between high levels of CD4 count and adherence to antiretroviral therapy still within the context of the test and treat strategy. For others, the emphasize was put on the change of antiretroviral therapy regimen, the appearance of side effects, in particular the effect on kidney and liver, level of toxicity, but also level of tolerance to some drugs. In general, most of these studies tried to demonstrate the impact of the Test and Treat strategy, in term of appearance of side effects, drugs toxicity and the effects on certain vital organs such as kidney and liver. Our concern here, was not to try to link the strategy of the Test and Treat with certain aspects such as the side effects, the toxicity of ARVs or their effect on certain vital organs. Our concern, however, was to try to better understand how this strategy may or may not affect adherence to treatment and what might be the outcome in terms of viral load suppression. In this respect, the general purpose of our study was designed to investigate on the possible effects of first-line antiretroviral treatment regimen on HIV-infected persons and their perception of the treatment, within the context of the test-and-treat strategy, and the holistic HIV case management. Therefore, our main aim was to on the basis and how of biomedical data of participants at inclusion, observe and explore how they are followed up and how side effects might impact adherence to antiretroviral treatment, perception of ART, and viral load suppression, of HIV infected patients, within the framework of the test-and-treat strategy in Cameroon.

Methods

Description of the study design and area

We conducted a multiple-center observational and prospective cohort study, among ARV naive persons living with HIV (PLHIV), in 3 district hospitals in Yaoundé.

Participants who agreed to be included at the study, underwent lab examinations (creatinine, transaminases, and proteinuria) as well as collection of BMI values. These lab examinations enabled us to distribute the participants into groups, those exposed to one of the variables defined above (creatinine, transaminases, proteinuria, and BMI values) and those non-exposed. Exposure status was to be determined through lab examinations [at inclusion and after 6 months of ARV treatment].

At endpoint of the follow-up period, VL level of each living participant, was determined, in order to evaluate the failure or the effectiveness of the treatment. However, during the period of follow-up, information related to the respect of their appointments by study participants was collected on a monthly basis. The occurrence of side effects related to HIV first line treatment regimen was measured during the final assessment of each participant (6 months after inclusion). In Cameroon and as far as first line treatment is concerned, the following two regimens are used, according to the National Guidelines for care and support of PLHIV:

1. Tenofovir + Lamivudine + Efavirenz
2. Tenofovir + Emtricitabine + Efavirenz

These two regimens served as criteria for the measurement of side effects related to HIV first line treatment regimen, as well as viral load suppression, For us to acquire in-depth understanding of issues related to side-effects and non-adherence from a behavioral point of view, we used Focus Group Discussions (FGD). And for that purpose, we enrolled participants who at one time or another have been defaulters to their treatment. FGD enabled us to gain more in-depth information and better understand how PLHIV feel about side effects of the first line HIV treatment regimen in Cameroon. Four (4) Focus Group Discussions (FGD) were carried out, 2 groups of males (One group of those aged 18 to 27; and one group of those aged 28 to 37) and 2 group of females (One group of those aged 18 to 27; and one group of those aged 28 to 37). The total number of participants was 24 (N = 6 per FGD). Primary data from Focus Group Discussions (FGD) were analyzed with Atlas-Ti 6.2.The study design was intended to gather a critical mass of information on the abilities, attitudes and the feelings of PLHIV regarding antiretroviral treatment and its effects, The fact of having gathered in-depth information with these 4 different sex and age groups, allowed us to put together not only what constitutes the common aspirations and challenges of people living with HIV, but also their challenges. It was also a question of investigating on the particularities of each group, in terms of sex and age difference.

The use of Atlas Ti 6.2 has indeed provided the means to identify the ideas, themes and sub-themes that have emerged from the 4 group discussions.

Sampling areas

Information, blood samples and urine samples were collected from persons living with HIV in the following PEPFAR supported health facilities.

- Sampling area 1: District Hospital Biyemassi in Yaoundé.
- Sampling area 2: District Hospital Cite Verte in Yaoundé.
- Sampling area 3: District Hospital Cite Verte in Yaoundé.

Specimen and information collection

Specimen

Blood and urine samples were collected from each participant at inclusion, as well as at endpoint (6 months after inclusion). Blood samples were used to test the kidney and liver function of each participant at baseline and at the end of the study, through Creatinine and transaminase tests (ASAT and ALAT). Also for each participant, a blood sample was taken for the viral load exam, to assess the level of success of the treatment after six months. In the same vein, Urine samples were also collected from participants, for Proteinuria, Bilirubin an Urobilinogen, still to assess the functioning of kidneys and liver.

Information

Concerning information collection, participants were interviewed using a Computer Assisted Personal Interview (CAPI) program on an electronic tablet, with the Kobo collect software. A service provider in charge of care and support of PLHIV in each of the health facility selected for the study, administered the questionnaire to each participant, and recorded all the answers into an electronic tablet. Each participant was identified only by an anonymous identifier, as it is the case in the register of the said health facility. No name or other personal identifier was collected from participants, in relation to the study. Our study which is entitled "Implementation of HIV Test-and-Treat Strategy in Cameroon: Antiretroviral Side Effects, Adherence and Viral Load Suppression Outcomes (ITAVILSO)" is based on the effects that HIV first line treatment regimen may have not only on beneficiaries (PLHIV), but also on the overall continuum of care in the country.

In this respect, we considered the influence of side effects of the HIV first line treatment regimen on adherence, viral load suppression and therefore on the overall case management of HIV infected individuals. In that line, an observational prospective cohort study was conducted. In each of the facility where the study was implemented, individuals screened HIV positive, was offered to participate. In case a participant agreed to take part at the study, he/she underwent lab examinations, such as creatinine, transaminases, as well as biological measurements such as proteinuria, and body mass index (BMI). With the exception of the viral load, which was only measured after the 6 months of the study, all the other measurements were done at the beginning and at the end of the study. At inclusion, the results obtained from lab examinations and from other biological measurements, allowed us to distribute participants in two groups. The group of those those exposed to one of the variables defined above (creatinine, transaminases, proteinuria, and BMI values) and those non-exposed. After 6 months of follow up, a final assessment made of 3 components, was carried out as follow:

- Multivariate analysis (binary regression);
- FGD on the perception and insights of participants in relation to side effects and non-adherence;
- FGD will come as a final exercise to help understand the feelings and insights from participants in relation to side effects and adherence to treatment.
- A monthly collection of data and information on side effects and adherence to HIV antiretroviral treatment, from each participant was conducted during medication pick up.

The main concern here was to gather information from participants at the study, in relation to whether or not they have witnessed side effects, and also on their level of adherence to treatment.

Sampling techniques

Prospective cohort study

Using EpiTools epidemiological calculators for the calculation of sample size for a prospective cohort study, our sample size was determined to 62. However, for us to increase the power of our sampling, we have decided to multiply the total sample by 2.5, and therefore expecting to have 155 participants, in total. The study was a multiple-center observational and prospective cohort study. Out of all the PEPFAR supported sites located in Yaoundé the capital city of Cameroon, 3 sites were randomly selected, viz. the District Hospital of Biyemassi, the Distict hospital of Cite Verte and the District Hospital of Nkoldongo.

Qualitative method (Focus Group Discussion)

In relation to Focus Group Discussions (FGD), participants (6 per FGD), were drawn from the list of defaulters of the health facility. Four FGD were conducted, two for female participants, and two for male participants. We had homogeneous group per FGD in terms of sex and but also as much as possible in terms of age groups (n = 24).

Inclusion criteria

PLHIV were eligible for inclusion in the study, provided

- They were 18 years old and above, and that they were volunteers to participate.
- They were treatment-naive.
- They were initiated under the first line of HIV treatment regimen in Cameroon.

Non inclusion criteria

PLHIV were not included in the study, if

- They were less than 18 years old, or if they refused to participate.
- They had been initiated into ARV treatment, before the starting date of the study.

Exclusion criteria

PLHIV were excluded from the study, in case of

- Unwillingness to continue to participate;
- Transfer out of study site;
- Death.

Data analysis

In general, and with respect to the complexity of our subject, several types of analysis were used. Indeed, the whole phenomenon under study is understood as a complex system.

From the qualitative survey (focus group discussions), analysis was made, using Atlas Ti 6.2. Atlas Ti is a software that allowed us to carry out the qualitative analysis of data taken from text documents, such as focus group discussions. Four focus group discussions (FGD) were organized in the three (3) sites of the study. Participants were identified from the study list and they further gave their consent to participate at the discussions. FGD sessions were conducted by a moderator (PI of the study) and a person in charge of recording data collected (field notes and audio recording). The recordings and the field notes of the FGD were transcribed verbatim. The second phase consisted in coding data collected and analyzing them using Atlas. ti 6.2 software package for qualitative data analyses. A code list as well as well as a dictionary core were generated for data analysis, using a thematic framework.

As far as quantitative analysis is concerned Kobo Data Collect and Excel 2010 (univariate analysis) and R were used (multivariate analysis). Data collected from questionnaires with electronic tablets using Kobo data collect, were transferred in Excel and then R version 3.6 and STATA version 13 were used for further analysis. Processing, cleaning and entering of data were made according to the following steps:

- The Principal investigator was responsible for conducting Focus Group Discussions (FGD);
- Quantitative data (for quantitative analysis) were conducted by some identified service providers in the selected sites, using electronic tablets;
- The Principal investigator ensured cleaning of all returned survey questionnaires, to check for non-responses and inconsistency;
- Data entry of all information was under the responsibility of the Principal investigator however, data were entered using electronic tablets, and transmitted every day to the Kobo collect system;
- Computed information was stored in three different storage memories (Kobo collect, computer and pens drive).

In general, the following analyses were carried out:

- Unadjusted and Adjusted Odds ratios (ORs) with 95% confidence intervals (95% CIs).
- Chi Square statistic
- Multivariate logistic regression.

Ethical considerations

Before the start of the study, research authorizations were obtained from the various district hospitals in which the research was to be carried out (District Hospital Biyemassi, District Hospital Cite Verte and District Hospital Nkoldongo). This finally led us to the obtaining of the Ethical Clearance at the level of the Centre Region-

al Ethics Committee for Human Health Research; CE N° 00838/CRERSHC/2018 of the 28 August 2018.

All the participants at the study were requested to complete an informed consent form prior to their inclusion. The informed consent forms were available in English and French, the two (2) official languages of the country. Each participant was identified by an anonymous and unique identifier number. As a matter of fact, all participants were assigned a unique participant identification number (PIDN) that was not related to any personal identifiers of the participant. All data collected electronically were saved to a central computer, as well as in a portable hard drive. At the conclusion of data collection, all electronic devices were gathered and stored under the responsibility of the principal investigator in locked cabinets.

Results

Quantitative data

155 persons living with HIV were included into the ITAVILSO study between November 2018, and July 2019, knowing that the inclusion phase varied from one site to another. Of these 155 participants, all (100%) were linked to ART, contributing 423 person-months of follow-up. The socio-demographic characteristics, monthly monitoring, compliance and adherence data, as well as determinants of retention, VL suppression, mortality and other variables of all these individuals are described and presented in this section. Further on are presented group discussion groups results, held with four subgroups of our sample [two groups of women (n = 8 of each group) and two groups of men (n = 8 of each group)]. At inclusion and out of the 155 participants, 48 (31.0%) were male and 107 (69.0%) were female with the following distribution per site: - DH Biyemassi (30.8% male and 69.2% female) – DH Cite Verte (43.2% male and 56.8 female) – DH Nkoldongo (22.0% male and 78.0% female). The ratio female: male at inclusion at the ITAVILSO study was 2.2:1, indicating that more than double of our sample was made of women.

While 64.5% ($CI_{95\%}$: 56.4% - 72.0%) of the participants stopped school in secondary level, 16.8% ($CI_{95\%}$: 11.3% - 23.6%) stopped in primary level, whereas 18.7% ($CI_{95\%}$: 12.9% - 25.8%) went up to the higher education level.

Distribution of age groups was skewed to right. Majority of the participants (61.9% - CI: 53.8% - 69.6%) were between 18 and 37 years old, whereas the others between 38 and 66 were 38.1% (CI: 30.4% - 46.2%). With a median age of 34 (39.0 in men and 33.0 in women), a Standard Deviation of 10.9 (11.1 in Men and 10.6 in Women), the Kolmogorov-Smirnov (K-S) Test of Normality demonstrated that the data does not differ significantly from that which is normally distributed (p-value = 0.10299). IQR of ages = [27-42] (see Table 1).

Characteristic	Total (n = 155)		Men (n = 48)		Women (n = 155)		
	n	%	n	%	n	%	p-value
Health Facilities							0.001
DH Biyemassi	59	38.1%	23	14.8%	36	23.2%	
DH Cite Verte	44	28.4%	19	12.3%	25	16.1%	
DH Nkoldongo	52	33.5%	6	3.9%	46	29.7%	
Sex							.00001
Male	48	31.0	-	-	-	-	
Female	107	69.0	-	-	-	-	
Age, years							
18-19	3	1.9	1	0.6	2	1.3	
20-24	21	13.5	4	2.6	17	11.0	
25-29	28	18.1	6	3.9	22	14.2	
30-34	29	18.7	5	3.2	24	15.5	
35-39	26	16.8	9	5.8	17	11.0	
40-44	15	9.7	7	4.5	8	5.2	
45-49	9	5.8	5	3.2	4	2.6	
≥50	24	15.5	11	7.1	13	8.4	
Mean (SD)	36.0	(10.9)	39.4	(10.9)	34.4	(10.6)	.008456
Median (range)	34.0	(18-66)	39.0	(18-60)	33.0	(18-66)	
Highest Level of Education							0.107
Primary	26	16.8	4	2.6	22	14.2	
Secondary	100	64.5	32	20.6	68	43.9	
University	29	18.7	12	7.7	17	11.0	

Table 1: Health facilities and demographic characteristics of participants by sex, at the ITAVILSO study, July 2019.

TDF/3TC/EFV was prescribed to 63 participants (40.6%; - $CI_{95\%}$: 32.8% - 48.8%) at inclusion, whereas 92 received TDF/FTC+EFV at inclusion (59.4%; - $CI_{95\%}$: 51.2% - 67.2%), as first line treatment (p = 0.2144). At inclusion, 9 participants (5.8%; - $CI_{95\%}$: 2.7% - 10.7%) were underweight (BMI < 18,5), 87 (56.1%; - $CI_{95\%}$: 47.9% - 64.1%) had a normal BMI (18,5 - 25,0), 33 participants (21.3%; - $CI_{95\%}$: 15.1% - 28.6%) were overweight (BMI between 25,1 to 30,0), and 26 participants (16.8%; - $CI_{95\%}$: 11.3% - 23.6%) were obese (BMI > 30,1). 137 participants (88.4%; - $CI_{95\%}$: 82.3% - 93.0%) declared they didn't have none of the mentioned diseases ahead of their inclusion at the study (62.6% female [CI95%: 54.5% - 70.2%] and 25.8% male [$CI_{95\%}$: 19.1% - 33.4%]). However, 2 (1.3%; [$CI_{95\%}$: 0.2% - 4.6%]) participants, all female admitted suffering from Overweight, 1 (.6%; [$CI_{95\%}$: .0% - 3.5%]) also a female, admitted already suffering from Diabetes as well as another female (.6%; [$CI_{95\%}$: .0% - 3.5%]) who reported already suffering from both

Overweight and Diabetes. Only one male (.6%; [$CI_{95\%}$: .0% - 3.5%]) admitted suffering from Kidney Disease. Overall, 13 (8.4%; [$CI_{95\%}$: 4.5% - 13.9%]) participants (3.9% female [$CI_{95\%}$: 1.4% - 8.2%] and 4.5% male [$CI_{95\%}$: 1.8% - 9.1%]) reported not knowing if they had any other illness. Concerning first line treatment administered to participants, 92 participants (59.3%; [$CI_{95\%}$: 51.2% - 67.2%]) received TDF/3TC/EFV (Tenofovir; Lamivudine; Efavirenz), while 63 (40.7%; [$CI_{95\%}$: 32.8% - 48.8%]) received TDF/FTC+EFV (Tenofovir; Emtricitabine; Efavirenz). A Z-score for the comparison of these two (2) proportions showed that these proportions were significantly different at $p < .05$ (Z-score = 2.281), meaning that those who received TDF/3TC/EFV were statistically higher than those of the participants who received TDF/FTC+EFV (see Table 2).

Characteristic	Total		Men		Women		
	(n = 1947)		(n = 1532)		(n = 415)		
	n	%	n	%	n	%	p-value
First Line Treatment							.02144
TDF/3TC/EFV	92	59.4	33	21.3	59	38.1	
TDF/FTC+EFV	63	40.6	15	9.7	48	31.0	
BMI							0.147
Under weight (< 18,5)	9	5.8	2	1.3	7	4.5	
Normal (18,5 - 25,0)	87	56.1	28	18.1	59	38.1	
Over weight (25,1 - 30,0)	33	21.3	14	9.0	19	12.3	
Obese (30,1 and above)	26	16.8	4	2.6	22	14.2	
Previous Diseases							0.192
Over weight	2	1.3	0	0.0	2	1.3	
Diabetes	1	0.6	0	0.0	1	0.6	
Overweight & Diabetes	1	0.6	0	0.0	1	0.6	
Kidney Disease	1	0.6	1	0.6	0	0.0	
None of these	137	88.4	40	25.8	97	62.6	
Don't Know	13	8.4%	7	4.5	6	3.9	

Table 2: First line treatment, BMI and previous diseases among participants by sex, at the ITAVILSO study, July 2019.

After inclusion in the study, each participant was to be observed during six (6) months as a normal any other person living with HIV (PLWH) who is initiated into ART in any other care center. Assuming that none of these participants had received multi month's dispensation as it is prescribed in the national guidelines for HIV treatment (naïve patients). Therefore, they needed to show up every month for ARV pick up. Out of 930 expected follow up visits from 155 participants, 346 follow up visits (37.2%; [$CI_{95\%}$: 34.1% - 40.4%]) were actually carried out (57.1% [$CI_{95\%}$: 51.4% - 62.6%] at DH Biyemassi; 9.1% [$CI_{95\%}$: 5.9% - 13.2%] at DH Cite Verte, and 40.7% [$CI_{95\%}$: 35.5% - 46.0%] at DH Nkoldongo) as it can be seen in Figure 1. Therefore, it can be observed (Figure 2) that the level of defaulters in medication pick up was 62.8% [$CI_{95\%}$: 59.6% - 65.9%] in total (42.9% [$CI_{95\%}$: 37.4% - 48.6%] at DH Biyemassi; 90.9% [$CI_{95\%}$: 86.8% - 94.1%] at Cite Verte, and 50.3% [$CI_{95\%}$: 54.0% - 64.5%] at DH Nkoldongo). BMI was not significantly different at inclusion and at end of study for participants at the ITAVILSO study, either for those who were underweight (p-value = 0.1317), for those who had normal BMI (p-value = 0.8396), or for those who were overweight (p-value = 0.4684) and those who were obese (p-value = 0.2888). During follow-up visits, participants were asked questions concerning their ways of taking their medication, side effects of their drugs, interruption of treatment, forgetfulness to take its treatment, the environment in which they take their medication, as well as about therapeutic education. Described below are data related to all these sections. More than half (59.0%) of participants who showed up during follow up visits declared having a method to remind them about when to take their ARV medication (Table 3), and the comparison between those with a reminder method and those without one, was statistically different (p-value = 0.00096). In addition and for most of them (81.4%; [$CI_{95\%}$: 75.3% - 86.5%]), the preferred method was the phone alarm (Figure 3). Almost 4 participants out of 5 received during follow up visits said they did not witnessed any side effects from their ARV medication (Table 4). However for those who did, the most common side effects (Figure 4) were weakness and fatigue (44.3%; [$CI_{95\%}$: 32.4% - 56.7%]), followed by dizziness (20.0%; [$CI_{95\%}$: 11.4% - 31.3%]).

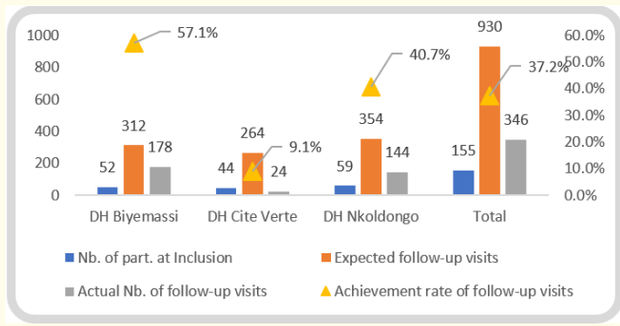

Figure 1: Actual and cumulative Follow up visits as compare to expected follow up visits during the ITAVILSO study. July 2019.

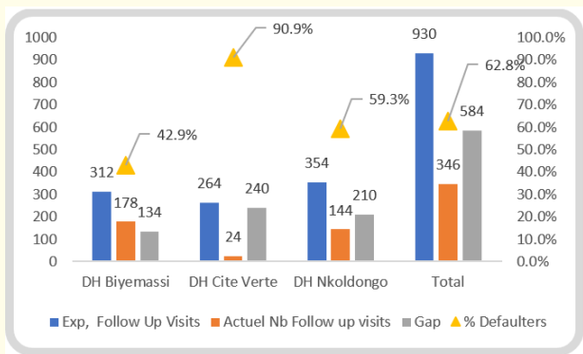

Figure 2: Level of defaulters according to expected follow up visits per site, during the ITAVILSO Study. July 2019.

Had a reminder method	Frequency	Percentage	P-value
Yes	204	59.0% [$CI_{95\%}$: 53.6% - 64.2%]	0.00096
No	142	41.0% [$CI_{95\%}$: 35.8% - 46.4%]	
Total	346		

Table 3: Distribution of participants at the ITAVILSO study, according to whether or not they had a particular reminder method for medication uptake. July 2019.

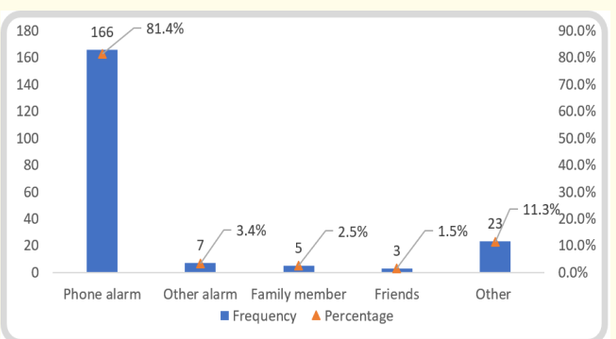

Figure 3: Reminder methods used by participants at the ITAVILSO study for their medication uptake. July 2019.

Had side effects since they started ARV treatment	Frequency	Percentage	P-value
Yes	70	20.2% [$CI_{95\%}$: 16.1% - 24.9%]	0.00001
No	276	79.8% [$CI_{95\%}$: 75.1% - 83.9%]	
Total	346		

Table 4: Distribution of participants at the ITAVILSO study, according to whether or not they had side effects during their antiretroviral treatment (ART). July 2019.

Figure 4: Side effects encountered by participants received during follow up visits at the ITAVILSO study during their ARV treatment. July 2019.

During the period of the study and considering those of the participants who showed up for follow up visits, all of them had already interrupted or forgotten (Figure 5) to take their ARV medication, and 95.7% [$CI_{95\%}$: 93.0% - 97.6%] declared having forgotten just once, whereas others have forgotten more than that. For the last 30 days (Table 5), 11.6% of them said they forgot to take their medication, against 88.4% who did not (p-value < 0.00001). The frequency of forgetfulness (Figure 6) during the last 30 days varied from just once (60.0% [$CI_{95\%}$: 43.3% - 75.1%]) to more than than three times (17.5% [$CI_{95\%}$: 7.3% - 32.8%]) among those who admitted having forgot to take their ARV medication during the last 30 days. 97.7% of participants received during follow up visits said they received health education (Table 6) about the consequences of having to stop their ARV treatment or those of poor adherence to treatment, against 2.3% who did not receive any (p-value < 0.00001). The main sources of information (Figure 7) were the PSW[1] (49.7% [$CI_{95\%}$: 44.2% - 55.2%]) and Nurses (46.4% [$CI_{95\%}$: 41.0% - 51.9%]). Some participants received during follow up visits were forced (Table 7) to stop their ARV treatment (6.6%) whereas 93.4% didn't need to do that and the two proportions were statistically different (p-value < 0.00001). The mean reasons for stopping ARV treatment (Figure 8) were side effects (34.8% [CI95%: 16.4% - 57.3%]), voluntary stop (8.7% [$CI_{95\%}$: 1.1% - 28.0%]), and others (56.5% [$CI_{95\%}$: 34.5% - 76.8%]). Most of the participants (84.1% [$CI_{95\%}$: 79.8% - 87.8%]) declared they were satisfied with their ARV treatment (Figure 9) against 14.5% [$CI_{95\%}$: 10.9% - 18.6%] who were not and the comparison of these proportions at $p < .05$ was statistically significant (p-value < 0.00001). 84.4% of participants against 15.6% who were received during follow up visits declared they were satisfied with the environment (Table 8) they were taking their medication and the comparison of the two proportions was significantly different (p-value < 0.00001). Most of those who declared they were satisfied with their environment (Figure 10), said they were living in a small family (58.2% [$CI_{95\%}$: 52.3% - 63.9%]).

Figure 5: Frequency of medication interruption or forgetfulness of treatment intake by participants at the ITAVILSO study received during follow up visits. July 2019.

Forgot to take ARV treatment during last 30 days	Frequency	Percentage	P-value
Yes	40	11.6% [$CI_{95\%}$: 8.4% - 15.4%]	< 0.00001
No	306	88.4% [$CI_{95\%}$: 84.6% - 91.6%]	
Total	346		

Table 5: Distribution of participants at the ITAVILSO study received during follow up visits, who forgot to take their ARV medication during the last 30 days. July 2019.

[1]Psychosocial Workers

Figure 6: Frequency of forgetfulness of medication intake among those of the participants at the ITAVILSO study received during follow up visits and who admitted having forgotten to take their medication during the last 30 days. July 2019.

Received health education in relation to ARV medication	Frequency	Percentage	P-value
Yes	338	97.7% [$CI_{95\%}$: 95.5% - 99.0%]	< 0.00001
No	8	2.3% [$C_{95\%}$I: 1.0% - 4.5%]	
Total	346		

Table 6: Distribution of participants at the ITAVILSO study received during follow up visits, and who declared having received health education in relation to ARV medication. July 2019.

Figure 7: Source of health education among those of the participants at the ITAVILSO study received during follow up visits and who declared having received health education in relation to ARV medication. July 2019.

Stopped ARV medication	Frequency	Percentage	P-value
Yes	23	6.6% [$CI_{95\%}$: 4.3% - 9.8%]	< 0.00001
No	323	93.4% [$CI_{95\%}$: 90.2% - 95.7%]	
Total	346		

Table 7: Distribution of participants at the ITAVILSO study received during follow up visits, who were forced to stop their ARV medication before the end of follow up period. July 2019.

At inclusion, each participant was offered laboratory analyses in relation to the functioning of liver (ALAT; ASAT; Bilirubin; Urobilinogen) and kidney (Creatinine; Proteinuria). In total, 155 participants were offered all these laboratory exams at inclusion. Here below are the baseline estimates of these parameters.

Figure 8: Reasons for stopping ARV treatment among those of the participants at the ITAVILSO study received during follow up visits and who forced to stop their medication. July 2019.

Figure 9: Frequency of treatment satisfaction among participants at the ITAVILSO study received during follow up visits. July 2019.

Felt environment was conducive	Frequency	Percentage	P-value
Yes	292	84.4% [$CI_{95\%}$: 80.1% - 88.1%]	< 0.00001
No	54	15.6% [$CI_{95\%}$: 11.9% - 19.9%]	
Total	346		

Table 8: Distribution of participants at the ITAVILSO study received during follow up visits, according to whether or not they felt the environment in which they were taking their medication was conducive or not. July 2019.

Figure 10: Description of conducive environment for medication uptake provided by participants at the ITAVILSO study received during follow up visits. July 2019.

Baseline estimates of biomedical parameters in participants on first line treatment with art

The mean estimates or levels of biomedical parameters in participants at initiation to first line treatment are summarized in Table 9a. The mean (SD) levels of creatinine, transaminase ALT, transaminase AST and BMI at initiation to first line ART were 8.74 (3.01) mg/l, 28.24 (5.88) IU/L, 35.14 (6.12) IU/L and 24.82 (5.03) kg/m^2 respectively. The mean levels of biomedical parameters at baseline were generally higher in participants on TDF/FTC/EFV treatment

regimen compared to those on TDF/3TC/EFV treatment regimen though this difference did not reach statistical significance. The mean BMI was lower in participants on TDF/FTC/EFV treatment regimen compared to those on TDF/3TC/EFV treatment regimen though this difference did not reach statistical significance.

The proportion of participants with high estimates or levels of biomedical parameters at initiation to first line treatment is summarized in Table 9b. The proportion of participants with high levels of creatinine, transaminase ALT, transaminase AST at initiation to first line ART were 5.2% (95%CI: 4.6 – 7.3), 16.1% (95%CI: 14.8 – 19.2) and 27.7% (95%CI: 24.1 – 30.5) respectively. The proportion of participants with high levels of biomedical parameters at initiation to first line ART were generally higher in participants on TDF/FTC/EFV treatment regimen compared to those on TDF/3TC/EFV treatment regimen though this difference did not reach statistical significance. The proportion of overweight and obese participants at initiation to first line ART was 38.1% (95%CI: 31.5 – 46.9). The proportion of overweight and obese participants at baseline was lower in participants on TDF/FTC/EFV treatment regimen compared to those on TDF/3TC/EFV treatment regimen though this difference did not reach statistical significance. The proportion of participants with proteinuria, high levels of bilirubin and Urobilinogen at initiation to first line ART were 9.0% (95%CI: 7.6 – 11.3), 0.6% (95%CI: 0.07 – 1.02) and 0.6% (95%CI: 0.09 – 1.12) respectively. The proportion of participants with proteinuria and high levels of bilirubin was lower in participants on TDF/FTC/EFV treatment regimen compared to those on TDF/3TC/EFV treatment regimen though this difference did not reach statistical significance.

Biomedical parameter	Total (n=155) Mean (SD)	TDF/3TC/EFV (n=92) Mean (SD)	TDF/FTC/EFV (n=63) Mean (SD)	t-value	p-value
Creatinine (mg/l)	8.75 (3.01)	8.33 (2.31)	9.37 (3.65)	-1.23	0.221
Transaminase ALT (IU/L)	28.24 (5.88)	25.88 (6.33)	31.67 (7.21)	-1.54	0.118
Transaminase AST (IU/L)	35.14 (6.12)	35.46 (6.05)	36.14 (6.34)	-0.12	0.898
BMI (Kg/m^2)	24.82 (5.03)	24.94 (5.11)	24.65 (4.99)	0.32	0.747

Table 9a: Baseline estimates of biomedical parameters in participants on first line ART, at the ITAVILSO study; July 2019

9a = for continuous variables.

Biomedical parameter	Total (n=155) n (%)	TDF/3TC/EFV (n=92) n (%)	TDF/FTC/EFV (n=63) n (%)	Chi square	p-value
High levels of creatinine	8 (5.2)	3 (3.3)	5 (7.9)	1.670	0.192
High levels of transaminase ALT	25 (16.1)	13 (14.1)	12 (19.0)	0.668	0.414
High levels of transaminase AST	43 (27.7)	21 (22.8)	22 (34.9)	2.729	0.099
Overweight/Obesity	59 (38.1)	38 (41.3)	21 (33.3)	1.008	0.315
Proteinuria	14 (9.0)	10 (10.9)	4 (6.3)	0.930	0.335
High levels of bilirubin	1 (0.6)	1 (1.1)	0 (0.0)	0.689	0.406
High levels of Urobilinogen	1 (0.6)	0 (0.0)	1 (1.6)	1.470	0.225

Table 9b: Baseline estimates of biomedical parameters in participants on first line ART at the ITAVILSO study; July 2019.

9b = for categorical variables.

Estimates of biomedical parameters in participants 6 months after initiation to first line art

The mean estimates or levels of biomedical parameters of participants 6 months after initiation to first line treatment are summarized in Table 10a. The mean levels of creatinine, transaminase ALT, transaminase AST and BMI six months after initiation to first line ART were 10.80 (2.87) mg/l, 26.89 (6.04) IU/L, 35.33 (5.34) IU/L and 27.82 (5.03) kg/m^2 respectively. The mean creatinine level was significantly ($p<0.001$) higher in participants on TDF/3TC/EFV treatment regimen compared to those on TDF/FTC/EFV treatment. The mean transaminases (ALT/AST) levels were lower in participants on TDF/3TC/EFV treatment regimen compared to those on TDF/FTC/EFV treatment though this difference did not reach statistical significance. The mean BMI was lower in participants on TDF/FTC/EFV treatment regimen compared to those on TDF/3TC/EFV treatment regimen though this difference did not reach statistical significance.

The proportion of participants with high estimates of biomedical parameters 6 months after initiation to first line treatment is summarized in Table 10b. The proportion of participants with high levels of creatinine, transaminase ALT, transaminase AST 6 months after initiation to first line ART were 11.2% (95%CI: 9.9 – 14.3), 13.9% (95%CI: 11.8 – 19.6) and 33.3% (95%CI: 29.1 – 35.5) respectively. The proportion of participants with high levels of creatinine 6 months after initiation to first line ART was higher in participants on TDF/3TC/EFV treatment regimen compared to those on TDF/FTC/EFV treatment regimen though this difference did not reach statistical significance. The proportion of participants with high levels of transaminases (ALT and AST) 6 months after initiation to first line ART was lower in participants on TDF/3TC/EFV treatment regimen compared to those on TDF/FTC/EFV treat-

Parameters	TDF/3TC/EFV (n=25)			TDF/FTC/EFV (n=11)		
	Baseline Mean (SD)	Post-test Mean (SD)	Mean difference (p-value)	Baseline Mean (SD)	Post-test Mean (SD)	Mean difference (p-value)
Creatinine (mg/l)	8.19(2.23)	12.02(1.32)	3.82(<0.001*)	8.43(2.03)	8.02(1.05)	0.45(0.677)
Transaminase ALT (IU/L)	27.19(5.31)	23.96 (5.91)	3.21(0.434)	22.38(6.21)	33.54(6.21)	11.12(0.033*)
Transaminase AST (IU/L)	33.13(7.12)	33.72(8.01)	-0.59(0.905)	27.03(7.23)	39.00(8.32)	11.16(0.041*)
BMI (kg/m^2)	24.94(5.11)	27.99(5.31)	3.05(0.547)	24.65 (4.99)	27.60(4.89)	2.95(0.235)

Table 10a: Changes in biomedical parameters 6 months after initiation in both first line ART options, at the ITAVILSO study; July 2019

*= significant at 5% significance level.

Treatment outcome	Total n (%)	TDF/3TC/EFV n (%)	TDF/FTC/EFV n (%)	Chi-square	P value
High levels of creatinine	4 (11.1)	3 (12.0)	1 (9.1)	0.065	0.789
High levels of Transaminase ALT	5 (13.9)	3 (12.0)	2 (18.2)	0.244	0.521
High levels of Transaminase ALT	12 (33.3)	8 (32.0)	4 (36.4)	0.065	0.798
Overweight/Obesity	70 (45.2)	43 (46.7)	27 (42.8)	0.227	0.633

Table 10b: Estimates of biomedical parameters in participants 6 months after initiation to first line ART, at the ITAVILSO study; July 2019.

2b = for categorical variables.

ment regimen though this difference did not reach statistical significance. The proportion of overweight and obese participants 6 months after initiation to first line ART was 45.2% (95%CI: 39.8 – 50.2). The proportion of overweight and obese participants 6 months after initiation to first line ART was higher in participants on TDF/3TC/EFV treatment regimen compared to those on TDF/FTC/EFV treatment regimen though this difference did not reach statistical significance.

Changes in the mean levels of biomedical parameters between baseline and 6 months after initiation to first line art

The changes in mean estimates of biomedical parameters of participants 6 months after initiation to first line treatment are summarized in Table 11. Overall, the mean estimates of biomedical parameters of participants increased from baseline to 6 months after initiation to first line treatment (Figure 11). The mean levels of creatinine increased significantly (p<0.001) from 8.28 (2.19) mg/l at baseline to 10.80 (2.86) mg/l at six months after initiation to first line treatment with ART (Figure 12). The increase in the mean BMI and transaminases (ALT/AST) levels were not significant from baseline to 6 months after initiation to first line treatment.

Biomedical parameter	Baseline (n=36) Mean (SD)	Post-test (n=36) Mean (SD)	Mean difference	P value
Creatinine (mg/l)	8.28 (2.19)	10.80 (2.86)	-2.51	<0.001*
Transaminase ALT (IU/L)	25.73 (3.12)	26.89 (2.71)	-1.16	0.726
Transaminase AST (IU/L)	31.27 (3.12)	35.33 (2.66)	-4.06	0.316
BMI (kg/m^2)	24.82 (5.03)	27.82 (4.23)	-3.00	0.654

Table 11: Changes in biomedical parameters 6 months after initiation in both first line ART options, at the ITAVILSO study; July 2019.

*: Significant at 5% significance level.

Figure 11: Overall changes in the mean of biomedical parameters 6 months after initiation to first line ART, at the ITAVILSO study. July 2019; *: Significant at 5% significance level.

Figure 12: Overall changes in the mean level of creatinine 6 months after initiation to first line ART, at the ITAVILSO study. July 2019; *: Significant at 5% significance level.

The changes in mean estimates of biomedical parameters of participants from baseline to 6 months after initiation to the different regimens of the first line treatment with ART are summarized in Table 12. Overall, the mean estimates of biomedical parameters of participants increased from baseline to 6 months after initia-

Parameters	TDF/3TC/EFV (n=25)			TDF/FTC/EFV (n=11)		
	Baseline Mean (SD)	Post-test Mean (SD)	Mean difference (p-value)	Baseline Mean (SD)	Post-test Mean (SD)	Mean difference (p-value)
Creatinine (mg/l)	8.19(2.23)	12.02(1.32)	3.82(<0.001*)	8.43(2.03)	8.02(1.05)	0.45(0.677)
Transaminase ALT (IU/L)	27.19(5.31)	23.96 (5.91)	3.21(0.434)	22.38(6.21)	33.54(6.21)	11.12(0.033*)
Transaminase AST (IU/L)	33.13 (7.12)	33.72 (8.01)	-0.59(0.905)	27.03(7.23)	39.00(8.32)	11.16(0.041*)
BMI (kg/m^2)	24.94 (5.11)	27.99 (5.31)	3.05(0.547)	24.65 (4.99)	27.60 (4.89)	2.95 (0.235)

Table 12: Changes in biomedical parameters 6 months after initiation in both first line ART options at the ITAVISO study. July 2019

* : Significant at 5% significance level.

tion to first line treatment in both treatment regimens. The mean creatinine level increased significantly (p<0.001) from 8.19 (2.23) mg/l at baseline to 12.02 (1.32) mg/l at six months after initiation to first line treatment in participants on TDF/3TC/EFV treatment regimen but remained fairly constant in those on TDF/FTC/EFV treatment regimen (Figure 13). The mean levels of transaminases (ALT/AST) increased significantly from baseline to 6 months after initiation to first line treatment in participants on TDF/FTC/EFV treatment regimen but not in those on TDF/3TC/EFV treatment regimen. The mean BMI increased from baseline to 6 months after initiation to first line treatment in participants on both TDF/FTC/EFV and TDF/3TC/EFV treatment regimens but this increase this not reach statistically significant levels.

Figure 13: Changes in the proportion of the participants with high levels of biomedical parameters 6 months after initiation to first line ART, at the ITAVILSO study; July 2019. * = significant at 5% significance level.

Figure 14: The proportion of participants experiencing side effect 6 months after initiation to first line ART, at the ITAVILSO study; July 2019. *: Significant at 5% significance level.

Figure 15: The proportion of participants experiencing side effect 6 months after initiation to first line ART, at the ITAVILSO study; July 2019. *: Significant at 5% significance level.

The changes in the proportion of participants with high estimates of biomedical parameters 6 months after initiation to first line treatment are summarized in Table 13. The proportion of participants with high levels of creatinine, transaminase ALT and transaminase AST increased from baseline to 6 months after initiation to first line ART. The proportion of participants with high levels of creatinine increased significantly from 0% at baseline to 11.1% at six months after initiation to first line ART. The proportion of participants with high levels of transaminase ALT and transaminase AST increased but not significantly from baseline to 6 months after initiation to first line ART. The proportion of overweight/obese participants increased but not significantly from baseline to 6 months after initiation to first line ART.

Biomedical parameter	Baseline (n=36) n (%)	Post-test (n=36) n (%)	difference in proportion	P value
High levels of creatinine	0 (0.0)	4 (11.1)	11.1	0.031*
High levels of transaminase ALT	4 (11.1)	5 (13.9)	2.8	0.955
High levels of transaminase AST	9 (25.0)	12 (33.3)	8.3	0.549
Overweight/ Obesity	59 (38.1)	70 (45.2)	7.1	0.524

Table 13: Overall changes in the proportion of the participants with high levels of biomedical parameters 6 months after initiation to first line ART, at the ITAVILSO study; July 2019.

*: Significant at 5% significance level.

The changes in the proportion of participants with high levels of biomedical parameters from base line to 6 months after initiation to the different regimen of the first line treatment with ART are summarized in Table 14. Overall, the proportion of participants with high levels of biomedical parameters increased from baseline to 6 months after initiation to first line treatment in both treatment regimens. The proportion of participants with high levels of creatinine increased significantly (p=0.041) from 0 (0.0%) at baseline to 3 (12.0%) at six months after initiation to first line treatment in participants on TDF/3TC/EFV treatment regimen but did not increase significantly in those on TDF/FTC/EFV treatment regimen. The mean levels of transaminases ALT increased significantly (p=0.044) from 0 (0.0%) at baseline to 2 (18.2%) at 6 months after initiation to first line treatment in participants on TDF/FTC/EFV treatment regimen but not in those on TDF/3TC/EFV treatment regimen. The proportion of overweight and obese participants increased in both treatment regimens from baseline to 6 months after initiation to first line ART though this increase did not reach statistically significant levels.

Treatment outcome in participants 6 months after initiation to first line art

Table 15 summarizes the treatment outcome of participants 6 months after initiation to first line treatment. The proportion of participants measuring or testing their VL 6 months after initiation to first line ART was 20.0% (95%CI: 17.5 – 25.1). VL testing was significantly (p=0.022) higher in participants on TDF/3TC/EFV treatment regimen (26.1%) compared to those on TDF/FTC/EFV treatment regimen (11.1%). The proportion of participants adhering to ART 6 months after initiation to first line ART was 96.7% (95%CI: 94.5 – 98.1). Adherence was higher in participants on TDF/3TC/EFV treatment regimen compared to those on TDF/FTC/EFV treatment regimen though this difference did not reach statistically significant levels. The proportion of participants retained in care 6 months after initiation to first line ART was 23.2% (95%CI: 20.5 – 28.1). Retention in care was higher in participants on TDF/3TC/EFV treatment regimen (27.2%) compared to those on TDF/FTC/EFV treatment regimen (17.5%) though this difference did not reach statistically significant levels. The proportion of participants experiencing side effects 6 months after initiation to first line ART was 35.6% (95%CI: 30.2 – 41.2). Side effects were significantly (p=0.023) lower in participants on TDF/3TC/EFV treatment regimen (25.5%) compared to those on TDF/FTC/EFV treatment regimen (46.9%). The proportion of participants with a suppressed viral load 6 months after initiation to first line ART was 93.5% (95%CI: 90.4 – 98.01). VL suppression did not show any significant variation between ART regimes though VL suppression was lower in participants on TDF/3TC/EFV treatment regimen (91.7%) compared to those on TDF/FTC/EFV treatment regimen (100%). Mortality rate was 5.6% (95%CI: 3.1 – 9.1). Mortality did not show a significant variation between ART regimens though mortality was higher in participants on TDF/3TC/EFV treatment regimen (7.6%) compared to those on TDF/FTC/EFV treatment regimen (3.2%).

Parameters	TDF/3TC/EFV (n=25)			TDF/FTC/EFV (n=11)		
	Baseline n(%)	Post-test n (%)	p-value	Baseline n(%)	Post-test n(%)	p-value
High levels of creatinine	0 (0.0)	3 (12.0)	0.041*	0 (0.0)	1 (9.1)	0.912
High levels of transaminase ALT	4 (16.0)	3 (12.0)	0.942	0 (0.0)	2 (18.2)	0.044*
High levels of transaminase AST	6 (24.0)	8 (32.0)	0.771	3 (27.3)	4 (36.4)	0.457
Overweight/obesity	38 (41.3)	43 (46.7)	0.735	21 (33.3)	27 (42.8)	0.325

Table 14: Changes in the proportion of the participants with high levels of biomedical parameters 6 months after initiation to first line ART in both treatment regimens, at the ITAVILSO study; July 2019.

*: Significant at 5% significance level.

Treatment outcome	Total n (%)	TDF/3TC/EFV n (%)	TDF/FTC/EFV n (%)	Chi-square	P value
VL testing 6 after initiation	31 (20.0)	24 (26.1)	7 (11.1)	5.242	0.022*
Adherence to ART	150 (96.7)	90 (97.8)	60 (95.2)	1.33	0.456
Retention in care	36 (23.2)	25 (27.2)	11 (17.5)	1.979	0.160
Side effects	37 (35.6)	14 (25.5)	23 (46.9)	5.21	0.023*
Suppressed VL	29 (93.5)	22 (91.7)	7 (100)	0.624	0.430
Mortality	9 (5.8)	7 (7.6)	2 (3.2)	1.344	0.246

Table 15: Treatment outcomes in participants 6 months after initiation to first line ART, at the ITAVILSO study; July 2019.

*: Significant at 5% significance level.

Determinants of treatment outcomes and VL testing in participants 6 months after initiation to first line art

Binary logistic regression model showed that being a male (AOR=2.25, 95% CI: 1.36 – 5.17), being overweight or obese (AOR=5.30, 95% CI: 3.11 – 8.36), being on TDF/3TC/EFV regimen (AOR=1.67, 95% CI: 1.11 – 3.87) and receiving treatment in

District Hospital Cite Verte (AOR=5.50, 95% CI: 3.14 – 9.25) were significantly associated with high levels of creatinine. While, being a male (AOR=3.90, 95% CI: 1.98 – 5.66), being overweight or obese (AOR=4.41, 95% CI: 2.11 – 10.21) and being on TDF/FTC/EFV treatment regimen (AOR=1.55, 95%CI: 1.06 – 3.21) were significantly associated with high levels of transaminase ALAT. Being a male (AOR=3.25, 95% CI: 1.22 – 7.21) and being overweight or obese (AOR=5.10, 95% CI: 2.51 – 8.01) were significantly associated with high levels of transaminase AST. On the other hand, being aged more than 25 years old (AOR=1.60, 95% CI: 1.44 – 6.64) and being on TDF/3TC/EFV treatment regimen (AOR=1.51, 95% CI: 1.07 – 3.14) were significantly associated with overweight/obesity in participants on first line ART. Now in respect to VL testing, binary logistic regression showed that being a female (AOR=2.50, 95% CI: 1.21 – 4.24), being educated (AOR = 3.11, 95%CI: 1.11 – 5.97) and being on TDF/3TC/EFV regimen (AOR=2.50, 95% CI: 1.21 – 5.99) were significantly associated with VL testing 6 months after initiation to ART (Table 16, 17, 18, 19 and 20 respectively).

Variable	Categories	High levels of Creatinine			
		UOR	(95%CI)	AOR	(95%CI)
Age (in years)					
	18 – 24	1		1	
	25+	0.91	0.53 – 2.62	0.94	0.61 – 2.92
Gender					
	Female	1		1	
	Male	2.35	1.20 – 4.24	2.25	1.36– 5.17*
Level of Education					
	Tertiary	1		1	
	Primary/ Secondary	0.45	0.31 – 0.89	0.41	0.33 – 1.02
Nutritional status					
	Normal	1		1	
	Overweight /Obese	5.21	3.01 – 8.14	5.30	3.11– 8.36*
First line ART					
	TDF/FTC/ EFV	1		1	
	TDF/3TC/ EFV	1.53	1.06 – 3.98	1.67	1.11– 3.87*
Adherence to ART					
	No	1		1	
	Yes	1.11	0.71 – 2.57	1.22	0.62 – 2.01
Hospital					
	DH Biyemassi	1		1	
	DH Cite Verte	5.52	2.36 – 9.32	5.50	3.14– 9.25*
	DH Nkoldongo	1.04	0.66 – 2.03	1.14	0.53– 2.01

Table 16: Determinants of high levels of creatinine in participants 6 months after initiation to first line ART, at the ITAVILSO study; July 2019.

UOR: Unadjusted Odds Ratio; AOR; Adjusted Odds Ratio; CI: Confidence Interval; *: Significant at 95% confidence interval.

Variable	Categories	High levels of transaminases ALT			
		UOR	(95%CI)	AOR	(95%CI)
Age (in years)					
	18 – 24	1		1	
	25+	0.13	0.09 - 1.36	0.11	0.07 – 1.35
Gender					
	Female	1		1	
	Male	3.94	2.01 – 6.32	3.90	1.98 – 5.66*
Level of Education					
	Tertiary	1		1	
	Secondary	0.34	0.10 – 0.88	0.33	0.23 – 1.04
	Primary	3.01	1.11 – 6.89	3.00	0.99 – 5.36
Nutritional status					
	Normal	1		1	
	Overweight/ Obese	4.44	2.01 – 9.21	4.41	2.11-10.21*
First line ART					
	TDF/3TC/ EFV	1		1	
	TDF/FTC/ EFV	1.51	1.02 – 2.36	1.55	1.06– 3.21*
Adherence to ART					
	No	1		1	
	Yes	1.21	0.61 – 2.07	1.25	0.52 – 2.11
Hospital					
	DH Biyemassi	1		1	
	DH Cite Verte	0.88	0.54 – 1.36	0.74	0.32 – 1.25
	DH Nkoldongo	1.25	0.50 – 2.55	1.23	0.38 – 2.44

Table 17: Determinants of high levels of transaminases ALT in participants 6 months after initiation to first line ART, at the ITAVILSO study; July 2019.

UOR: Unadjusted Odds Ratio; AOR; Adjusted Odds Ratio; CI:Confidence Interval; *: Significant at 95% confidence interval.

Determinants of adhernce, retention, side effects, suppressed VL and mortality of participants 6 months after initiation to first line art

Binary logistic regression model showed that being a female (AOR=2.18, 95% CI: 1.20 – 5.36) and not experiencing side effects (AOR=2.30, 95% CI: 1.50 - 4.30) were significantly associated with the adherence to ART 6 months after initiation to first line ART. On the other hand, being a male (AOR=2.15, 95% CI: 1.12 – 4.36), being educated (AOR = 3.10, 95%CI: 1.24 – 5.34), not experiencing side effects (AOR=2.10, 95% CI: 1.10 - 4.50) and receiving treatment in District Hospital Biyemassi (AOR=2.00, 95% CI: 1.10 – 4.94) were significantly associated with retention in care of participants 6 months after initiation to first line ART.

Variable	Categories	High levels of transaminases AST			
		UOR	(95%CI)	AOR	(95%CI)
Age (in years)					
	18 – 24	1		1	
	25+	1.05	0.52 – 2.01	1.02	0.44 – 2.64
Gender					
	Female	1		1	
	Male	3.30	1.25 – 6.12	3.25	1.22 – 7.21*
Level of Education					
	Tertiary	1			
	Secondary	0.94	0.55 – 1.66	1.05	0.47 – 1.65
Nutritional status					
	Normal	1		1	
	Overweight/Obese	5.02	2.36 – 8.32	5.10	2.51 – 8.01*
First line ART					
	TDF/3TC/EFV	1		1	
	TDF/FTC/EFV	1.40	0.69 – 2.14	1.12	0.87 – 2.14
Hospital					
	DH Biyemassi	1		1	
	DH Cite Verte	1.32	0.25 – 2.01	1.31	0.54 – 3.11
	DH Nkoldongo	1.51	0.98 – 3.01	1.50	0.88 – 3.01

Table 18: Determinants of high levels of transaminases AST in participants 6 months after initiation to first line ART, at the ITAVILSO study; July 2019.

UOR: Unadjusted Odds Ratio; AOR; Adjusted Odds Ratio; CI: Confidence Interval; *: Significant at 95% confidence interval.

Variable	Categories	Overweight/Obesity			
		UOR	(95%CI)	AOR	(95%CI)
Age (in years)					
	18 – 24	1		1	
	25+	1.59	1.02 – 5.01	1.60	1.04 – 6.64*
Gender					
	Female	1		1	
	Male	0.82	0.54 – 6.12	0.80	0.56 – 5.21
Level of Education					
	Primary	1		1	
	Secondary	0.94	0.55 – 1.66	1.05	0.47 – 1.65
	Tertiary	0.82	0.43 – 2.51	0.80	0.51 – 2.65
First line ART					
	TDF/FTC/EFV	1		1	
	TDF/3TC/EFV	1.40	1.09 – 2.14	1.51	1.07 – 3.14*
Hospital					
	DH Nkoldongo	1		1	
	DH Cite Verte	1.02	0.24 – 2.03	1.03	0.34 – 3.19
	DH Biyemassi	1.54	0.68 – 3.21	1.52	0.38 – 3.91

Table 19: Determinants of overweight/obesity in participants 6 months after initiation to first line ART, at the ITAVILSO study; July 2019.

UOR: Unadjusted Odds Ratio; AOR; Adjusted Odds Ratio; CI: Confidence Interval; *: Significant at 95% confidence interval.

Variable	Categories	VL testing 6 months after initiation to ART			
		UOR	(95%CI)	AOR	(95%CI)
Age (in years)					
	18 – 24	1		1	
	25+	0.71	0.41 – 1.02	0.94	0.55 – 1.13
Gender					
	Male	1		1	
	Female	2.61	1.10 – 4.32	2.50	1.21 – 4.24*
Level of Education					
	Primary	1		1	
	Secondary	0.75	0.51 – 1.12	0.84	0.75 – 1.33
	Tertiary	2.91	1.01 – 4.78	3.11	1.11 – 5.97*
Nutritional status					
	Normal	1		1	
	Underweight	0.52	0.12 – 1.04	0.66	0.14 – 1.36
	Overweight/obese	1.81	1.23 – 3.01	1.52	0.92 – 6.25
First line ART					
	TDF/FTC/EFV	1		1	
	TDF/3TC/EFV	2.30	1.19 – 4.78	2.50	1.21 – 5.99*
Hospital					
	DH Biyemassi	1		1	
	DH Cite Verte	0.94	0.24 – 1.02	0.92	0.31 – 1.52
	DH Nkoldongo	0.81	0.12 – 1.32	0.80	0.25 – 1.35

Table 20: Determinants of VL testing in participants 6 months after initiation to first line ART, at the ITAVILSO study; July 2019

UOR: Unadjusted Odds Ratio; AOR; Adjusted Odds Ratio; CI: Confidence Interval; *: Significant at 95% confidence interval.

Likewise, being a female (AOR = 2.30, 95%CI: 1.92 – 4.98), being overweight or obese (AOR=2.10, 95% CI: 1.02 – 3.99), being on TDF/FTC/EFV treatment regimen (AOR = 3.31, 95%CI: 1.54 – 6.02) and having abnormally high levels of transaminases (AOR=2.97, 95% CI: 1.24 – 6.02) were significantly associated with side effect in participants 6 months after initiation to first line ART. In the same vein, being a female (AOR = 3.05, 95%CI: 1.65 – 7.36), adhering to ART (AOR=2.05, 95% CI: 1.21 – 5.24) and not experiencing any side effects (AOR = 2.15, 95%CI: 1.25 – 5.66) were significantly associated with suppressed VL in participants 6 months after initiation to first line ART. Binary logistic regression model also showed that being a male (AOR = 3.01, 95%CI: 1.25 – 6.34), having high levels of creatinine at initiation (AOR=2.01, 95% CI: 1.69 – 6.32), not adhering to ART (AOR=3.50, 95% CI: 1.98 - 7.01) and receiving treatment in District Hospital Biyemassi (AOR = 2.21, 95%CI: 1.69 – 7.36) were significantly associated with mortality in participants 6 months after initiation to first line ART (Table 21, 22, 23,24 and 25 respectively).

Qualitative data

Under the qualitative component of the study, a total of four (4) focus group discussions (FGD) were organized in three (3) district hospitals (Biyemassi, Cite Verte and Nkoldongo) in which 24 individuals participated, six (6) in each group. Participants at the focus group discussions (FGD) were selected as being part of the ITAVILSO study and therefore were HIV-positive and were receiving ARV treatment.

Characteristics of participants at FGD sessions

As we have already described above, a total of 24 individuals participated at FGD sessions (12 women and 12 men), with a mean age of 27.4 years for female; and 29.5 in male. Details of the composition of the FGDs sessions are shown in Table 26.

Considering that majority of participants at the ITAVILSO study had as higher level of study the Secondary School level (64.5%), we therefore chose to select those with this same high level of school, for participants at the FGD sessions. For data analysis, Atlas ti 6.2 software was used with open-coding techniques. The outcomes of data collection led to 76 codes, leading to 16 subthemes and 07 themes. The seven themes identified were: Limiting factors/Enabling Environment, Overall perceptions, Skills Development, Denial, Missed appointments. Other considerations in relation to PLHIV and ARVs, and Side effects.

Theme 1: Limiting factors/Enabling environment

The limiting factors and enabling environment theme related to the access to treatment of PLHIV were furthermore disaggregated into four subthemes as follows: Financial constraints - Difficulties related to the health system and service providers - Better family environment - Health system improvement (Table 27).

Variable	Categories	Adherence to ART			
		UOR	(95%CI)	AOR	(95%CI)
Age (in years)					
	18 – 24	1		1	
	25+	1.13	0.35 – 2.36	1.15	0.45 – 2.65
Gender					
	Male	1		1	
	Female	2.17	1.03 – 4.54	2.18	1.20 – 5.36*
Level of Education					
	Primary	1		1	
	Secondary	0.95	0.35 – 1.31	1.02	0.59 – 2.31
	Tertiary	1.12	0.25 – 5.61	1.10	0.24 – 5.34
Nutritional status					
	Normal	1		1	
	Overweight/obese	1.39	1.11 – 4.11	1.30	0.89 – 5.14
First line ART					
	TDF/3TC/EFV	1		1	
	TDF/FTC/EFV	0.75	0.54 – 1.98	0.84	0.74 – 2.01
Side effect					
	Yes	1		1	
	No	2.32	1.45 – 4.26	2.30	1.50 - 4.30*
Hospital					
	DH Cite Verte	1		1	
	DH Biyemassi	1.08	0.61 – 5.68	1.20	0.60 – 4.94
	DH Nkoldongo	1.01	0.47 – 3.61	1.10	0.57 – 3.64

Table 21: Determinants of adherence of participants 6 months after initiation to first line ART, at the ITAVILSO study; July 2019.

UOR: Unadjusted Odds Ratio; AOR: Adjusted Odds Ratio; CI: Confidence Interval.

Variable	Categories	Retention in care			
		UOR	(95%CI)	AOR	(95%CI)
Age (in years)					
	18 – 24	1		1	
	25+	1.03	0.55 – 2.36	1.05	0.65 – 2.65
Gender					
	Female	1		1	
	Male	2.07	1.05 – 3.54	2.15	1.12 – 4.36*
Level of Education					
	Primary	1		1	
	Secondary	0.95	0.25 – 1.51	1.01	0.69 – 2.31
	Tertiary	3.12	1.35 – 5.61	3.10	1.24 – 5.34*
Nutritional status					
	Normal	1		1	
	Overweight/obese	1.99	1.01 – 3.11	1.50	0.99 – 3.14
First line ART					
	TDF/3TC/EFV	1		1	
	TDF/FTC/EFV	0.75	0.54 – 1.98	0.84	0.74 – 2.01
Side effect					
	Yes	1		1	
	No	2.01	1.05 – 4.36	2.10	1.10 - 4.50*
Hospital					
	DH Cite Verte	1		1	
	DH Biyemassi	2.08	1.31 – 5.98	2.00	1.10 – 4.94*
	DH Nkoldongo	1.01	0.47 – 5.61	1.10	0.57 – 3.64

Table 22: Determinants of retention in care of participants 6 months after initiation to first line ART, at the ITAVILSO study; July 2019.

UOR: Unadjusted Odds Ratio; AOR: Adjusted Odds Ratio; CI: Confidence Interval.

Variable	Categories	Side effect of ART			
		UOR	(95%CI)	AOR	(95%CI)
Age (in years)					
	18 – 24	1		1	
	25+	1.03	0.65 – 1.65	1.01	0.54 – 2.36
Gender					
	Male	1		1	
	Female	2.34	1.24 – 5.01	2.30	1.92 – 4.98
Level of Education					
	Tertiary	1		1	
	Secondary	1.10	0.14 – 2.58	1.11	0.78 – 3.12
	Primary	0.97	0.41 – 2.36	0.90	0.35 – 2.36
Nutritional status					
	Normal	1		1	
	Overweight/obese	2.14	1.01 – 4.35	2.10	1.02 – 3.99*
First line ART					
	TDF/3TC/EFV	1		1	
	TDF/FTC/EFV	3.32	1.65 – 5.24	3.31	1.54 – 6.02*
Adherence to ART					
	No	1		1	
	Yes	0.93	0.55 – 1.65	0.95	0.54 – 2.36
Creatinine level					
	Low - normal	1		1	
	High	1.21	0.51 – 3.25	1.20	0.71 – 4.23
Transaminase ALT/AST					
	Low – normal	1		1	
	High	2.95	1.02 – 5.36	2.97	1.24 – 6.02*
Hospital					
	DH Biyemassi	1		1	
	DH Cite Verte	1.11	0.14 – 2.58	1.21	0.78 – 3.12
	DH Nkoldongo	0.97	0.44 – 2.36	0.90	0.36 – 2.36

Table 23: Determinants of side effect in participants 6 months after initiation to first line ART, at the ITAVILSO study; July 2019.

UOR: Unadjusted Odds Ratio; AOR: Adjusted Odds Ratio; CI: Confidence Interval.

Variable	Categories	Suppressed Viral Load			
		UOR	(95%CI)	AOR	(95%CI)
Age (in years)					
	18 – 24	1		1	
	25+	1.12	0.25 – 1.59	1.01	0.46 – 2.35
Gender					
	Male	1		1	
	Female	3.03	1.32 – 6.98	3.05	1.65 – 7.36*
Nutritional status					
	Normal	1		1	
	Overweight/obese	0.74	0.36 – 2.01	0.71	0.54 – 2.30
First line ART					
	TDF/FTC/EFV	1		1	
	TDF/3TC/EFV	2.10	1.21 – 6.03	1.59	0.51 – 7.20
Adherence to ART					
	No	1		1	
	Yes	2.07	1.02 – 4.36	2.05	1.21 – 5.24*
Creatinine level					
	Low - normal	1		1	
	High	0.87	0.25 – 1.35	0.89	0.35 – 2.03
Transaminase ALT/AST					
	Low – normal	1		1	
	High	0.74	0.31 – 5.03	0.75	0.25 – 2.01
Side effect					
	Yes	1		1	
	No	2.14	1.45 – 5.36	2.15	1.25 – 5.66*
Hospital					
	DH Biyemassi	1		1	
	DH Nkoldongo	1.52	0.94 – 2.36	1.42	0.86 – 3.26

Table 24: Determinants of suppressed VL in participants 6 months after initiation to first line ART, at the ITAVILSO study; July 2019.

UOR: Unadjusted Odds Ratio; AOR: Adjusted Odds Ratio; CI: Confidence Interval.

Variable	Categories	Mortality			
		UOR	(95%CI)	AOR	(95%CI)
Age (in years)					
	18 – 24	1		1	
	25+	1.49	0.53 – 6.25	1.50	0.89 – 6.25
Gender					
	Female	1		1	
	Male	2.99	1.35 – 5.24	3.01	1.25 – 6.34*
Level of Education					
	Tertiary	1			
	Secondary	0.71	0.21 – 1.54	0.88	0.31 – 2.05
	Primary	1.12	0.89 – 3.69	1.11	0.58 – 6.54
Nutritional status					
	Normal	1		1	
	Overweight/obese	0.73	0.43 – 2.36	0.75	0.81 – 5.89
First line ART					
	TDF/3TC/EFV	1		1	
	TDF/FTC/EFV	0.95	0.53 – 3.96	0.91	0.45 – 6.34
Adherence to ART					
	Yes	1		1	
	No	3.61	1.36 – 6.47	3.50	1.98 - 7.01*
Creatinine level					
	Low - normal	1		1	
	High	2.02	1.59 – 5.36	2.01	1.69 – 6.32*
Transaminase ALT/AST					
	Low – normal	1		1	
	High	0.80	0.54 – 3.98	0.81	0.60 – 5.36
Side effect					
	No	1		1	
	Yes	1.14	0.14 – 3.69	1.02	0.2 – 5.19
Hospital					
	DH Nkoldongo	1		1	
	DH Cite Verte	1.02	0.65 – 2.36	1.11	0.68 – 5.36
	DH Biyemassi	2.20	1.25 – 4.96	2.21	1.69 – 7.36*

Table 25: Determinants of mortality in participants 6 months after initiation to first line ART, at the ITAVILSO study; July 2019. UOR: Unadjusted Odds Ratio; AOR: Adjusted Odds Ratio; CI: Confidence Interval.

	District Hospital Biyemassi				District Hospital Nkoldongo				
Age	Mean Age (years)	Sex	Higher level of study	Profession	Age	Mean Age (years)	Sex	Higher level of study	Profession
21	27.4	Female	Secondary	Without employment	24	29.5	Male	Secondary	Private sector
22		Female	Secondary	Student	25		Male	Secondary	Private sector
29		Female	Secondary	Other	20		Male	Secondary	Trader
20		Female	Secondary	Other	28		Male	Secondary	Trader
24		Female	Secondary	Other	36		Male	Secondary	Other
26		Female	Secondary	Student	26		Male	Secondary	Private sector employee
37		Female	Secondary	Private sector	35		Male	Secondary	Private sector employee
31		Female	Secondary	Without employment	24		Male	Secondary	Other
32		Female	Secondary	Without employment	37		Male	Secondary	Trader
18		Female	Secondary	Student	32		Male	Secondary	Other
34		Female	Secondary	Other	37		Male	Secondary	Other
35		Female	Secondary	Other	30		Male	Secondary	Other

Table 26: The composition of focus group discussions for participants of the ITAVILSO study at District Hospital Biyemassi and Nkoldongo. July 2019.

Themes	Subthemes	Codes
Limiting factors/Enabling Environment	Financial constraints	Financial means for transportation
		Distance to the treatment center
		Financial means for laboratory analyzes
		Financial means for medical consultations
		Financial means for nutrition
	Difficulties related to the health system and service providers	Poor reception
		Lack of information
		Poor care and support
	Better family environment	Family members better understand
		At times they express pity
	Health system improvement	Quality of reception
		Moral support and respect for PLHIV
		Dedication to work
		Service providers hospitable and available
		Staff don't consider PLHIV as sick
		Familiarity with the team
		Provision of good advise

Table 27: Limiting and enabling environment in relation to access to ARV treatment of PLHIV; ITAVILSO sty, July 2019.

Financial constraints

One of the major difficulties that the PLHIV face in a country like Cameroon, is related to the lack of financial means, even though the ARV treatment has been made free of charge for patients. Still, apart from treatment costs, PLHIV continue to face other health-related costs, such as transportation costs (regular visits to health centers), consultation fees and laboratory tests, as well as nutritional costs for example. Participants of the FGD complained about various financial limitations, and particularly with regard to lack of money transport, as some participants said they were living far away from the treatment centres, but also different laboratory tests or consultation fees. These participants also complained about the overall financial burden of HIV infection. Although this load is not necessarily heavier than that of other diseases in the long term, it does not remain about it less than it handicaps even more the PLHIV.

"I sometime run out of money for transportation and sometime money for other medical expenses. (FGD1-Female)".

Difficulties related to the health system and service providers

The health system was perceived by the participants as a whole, but not only within the limited health facilities in which they were cared for. In this respect, some participants declared that the quality of the reception might be bad or even very bad in some health facilities. In addition, even when the quality of the reception at the health facility seems to be good or normal, the queues might be exorbitant and jeopardize the overall environment. And all of this could lead to the desertion of the treatment centers by PLHIV or even the abandonment of these. Participants pointed out the importance of the relationship between the PLHIV and the service provider, especially the quality of the reception, is very important for the continuation of the retention to the treatment process.

"Here at the hospital it is not always easy to bear the waiting time or even the presence of other patients, and their most frightful cases one over the other (FGD2-Male)".

Health system improvement

Although work conditions and infrastructure remain precarious in our health centers and health system, the fact remains that much has changed, especially on the part of service providers. Participants of the FGD sessions noted in particular the good reception, the user-friendliness of the service providers, and the quality of the information and advice given to the customers. This also includes, other positive traits such as the moral support and respect provided to PLHIV, dedication to work, hospitability and availability from service providers.

"They are hospitable, jokers, and available at any time. They do not consider us as a sick person, and they enable us to learn things here, such as tips and lessons on our infection and how to be healthy. In a nutshell, the service providers take good care of us here (FGD2-Female)".

Better family environment

Just as the environment in relation to the health system seems to have changed favorably, so does the environment in relation to families and family members. The perception of people, especially family members has evolved sufficiently to date. It must in fact be remembered that although the prevalence of HIV in the country has been steadily declining over the years, every family in the country has had, if not one case of infected individual, but even a case of death by AIDS. From the information gathered from the participants of FGD sessions, it is clear that the emotional approach of family members to HIV infected people has moved from one end to the other, from rejection to acceptation. The role of the family as a structure, or family members, friends remains important, not only as far as HIV case finding is concerned but also as far as acceptation of ARV treatment is concerned.

"When I was told that I had HIV I could not commit suicide because I have a family. At the level of families it depends. The PLHIV is not exposed most of the time. When you are in a position where

you count for your family, it gives you value again. My family encouraged me to take the HIV test when I was sick (FGD1-Female)".

Theme 2: Overall perceptions

The overall perceptions were on their part, was related to how people in general perceive not only PLHIV, but also how PLHIV perceive themselves, and how they perceive ARV treatment. What are the thoughts and beliefs of each other about these different topics? To better understand this, the theme was disaggregated into four subthemes as follows: Perception of PLHIV by others people - Self-Perception and relationships with other PLHIV - Perception and aptitude vis-à-vis the ARVs - Assessment of the ARV treatment by PLHIV (Table 28).

Themes	Subthemes	Codes
Overall perceptions	Perception of PLHIV by others people	PLHIV are about to die
		Former image has disappeared
		Different view from others
		Perception and environment
		Other diseases more dangerous
		Expression of pity
		Rejection from sexual partner
		Mockeries
		Destabilization of couples
		Important role in family
		Not a disease like any other
	Self-Perception and relationships with other PLHIV	Avoid long-term projects
		Frustration
		Not a sick person
		Dislike being viewed with pity
		Provision of advice PLHIV
		Publicity around AIDS
	Perception and aptitude vis-à-vis the ARVs	Live long time with ARVs
		I cannot stop ARVs
		Our lives depend on ARVs
		ARVs reduce evolution of HIV
		Cure for our health
		Taking ARVs is an obligation
		HIV, lifetime as any other
		ARVs limit disaster
		ARV is a fight against oneself
	Assessment of the ARV treatment by PLHIV	Fatigue as obstacle
		Job loss because of tiredness.
		Prohibited alcohol
		Discipline requirement
		Daily intake of ARV
		Embarrassment hiding
		Can lead to starvation
		I had hallucinations

Table 28: Perceptions of PLHIV by others, self-perception and ARV assessment by participants; ITAVILSO study, July 2019.

Perception of PLHIV by others and family members

Perceptions and beliefs of other members of the society concerning HIV and PLHIV as they were expressed by participants during FGD sessions, revealed that here too, the minds have evolved. In the past days, HIV/AIDS was considered was just considered as a deadly disease. Those who were infected were considered as those who about to die. However and whatever the case, majority of people continue to look at PLHIV differently. The situation depends on the environment in which the PLHIV lives, and also.

"Regarding the perception of those around us, I will say that HIV is not a disease like any other. Those who are not close to us cannot understand. People always think that those who are infected are those who do not control themselves sexually (men as women) [FGD1-Male]".

"The reality is that a person infected with HIV is considered as a person who will soon die (FGD2-Male)".

In most of the cases, families seem to have adapted themselves to the situation, in order to ensure better conditions and a better environment to those of their members who are HIV infected. The fact is that whatever the case, the mind-set of people concerning HIV/AIDS remains related to death. This will lead family members to be more caring for their relatives, and even showing commiseration for them at times.

"At the level of families it depends. The PLHIV are not exposed most of the time. In my family they look at me as someone for whom they feel some sort of pity, and family members are quick to do anything I want, they have become very kind with me. Me too on my side it's the same feeling. My family is aware and they are very kind (FGD1-Female)".

However, there are still cases where it is difficult for PLHIV to share their status with family members, as they think that this might be dangerous for them, because of some negative attitudes.

"In my family I have not spoken to anyone about my status, because there are mockeries (FGD1-Male)".

Self-Perception and relationships with other PLHIV

Self-erception is a very important factor for PLHIV, as it will determine their capacity to face their own situation and future, as well as the way they will handle them. The moral strength of PLHIV will therefore determine their decision-making in respect to various domains of their life, and in particular concerning their health. It should be noted that self-perception is directly related to self-esteem. How are PLHIV consider themselves? Do they feel themselves as faulty?

"At first I knew that I had to die soon. I avoid doing long-term projects. I felt frustrated, but now I consider myself as everyone else (FGD2-Male)".

In this respect, some PLHV have decided to involve themselves in various activities and campaigns in relation to HIV/AIDS control. For those of them who had already experienced the disease, it is easier for them to express the importance of this treatment.

Perception and aptitude vis-à-vis the ARVs/Assessment by PLHIV

ARVs are recognized by all and in particular by PLHIV as being an important pillar of the health of PLHIV, as well as for the overall control of HIV/AIDS throughout the World. Therefore, it was crucial that PLHIV who are the main consumers and main beneficiaries of ARVs provide their opinions and feelings about ARVs.

As a matter of fact ARVs were considered by participants at FGD as essential drugs for their life, a prerequisite for their wellbeing, and for their survival. Despite all the difficulties encountered in terms of side effects or in terms of requirements related to self-discipline, some do not imagine their life without ARVs. Some also just consider them as a duty, an obligation, irrespective to whether the results will be good or no.

"Taking ARVs can help a PLHIV to live a long time. I cannot stop ARVs. ARVs reduce the evolution of the disease in the blood. It's the cure for our health. I take ARVs as the drugs I was prescribed at the hospital. It's like I have a headache and I take the medicine. The fact that I started taking ARVs without having the disease meant that I have the perception that ARVs are a treatment like any other one (FGD1-Male)".

From the point of view of the participants at the FGD sessions, apart from being an efficient drug against HIV, ARVs are all the same related to fatigue, disturbances at job side, high requirement for discipline, particular measures when in public, and respect of prohibitions such as avoiding as much as possible taking alcohol.

"Even when you're outside, you always think about going home early to take your medicine. The main difficulty is to take the medicine every day and at the same time. It's embarrassing because you have to constantly hide to take the medicine or ask for the toilet all the time (FGD1-Female)".

Theme 3: Skills development

On the basis of what has been described here above, it appears that PLHIV will need some minor skills, or some level of self-organization, to be able to cope with their new situation. A situation by which they will be called upon to take their medicine every day, at a particular time of the day and for life. This theme was therefore divided into two subthemes, the change in mind-set and other necessaries readjustments (Table 29).

Themes	Subthemes	Codes
Skills Development	Change in mind-set	Importance of mind set change
		Avoid staying outside for long
		Change in meal times
		ARVs lead to more discipline
		High willingness to take ARV
	Other readjustments	Regular intake.
		Change in nutrition model
		Going along with its ARVs.
		Use of phone alarm

Table 29: Skills development characteristics by participants, in relation to ARV intake; ITAVILSO study, July 2019.

Change in mind-set

The notification of a HIV positive result to a client by a service provider, will incontestably lead to changes in the mind of the client. The individual will now understand that something has certainly change in his/her life. Many changes will certainly occur in his/her sexual, social, and may be professional life. At the beginning, it is just a passive change that will occur viz. he/she is only going through the impact of the information he has just received. Afterwards, he/she will now have to react, to take position, so as to be able to overcome and transcend the new situation. The PLHIV will now have to integrate in their minds that their lives depend on ARVs and therefore should develop a great willingness of taking them. Various or techniques are being used in this respect, such as phone alarm, or the fact of dispatching the medicines in different hand bags for women in particular.

"I changed my way of life. I do not stay outside for a long time. I changed the way I dwelled with some matters, since the time I knew I was infected. Taking ARVs helped me to be more orderly (FGD2_Male)".

Other readjustments

In addition to the overall change in mind-set, some other readjustments will also occur, in relation to the capacity of PLHIV to adapt themselves to their new situation and new challenges. This adaptation will certainly induce new ways of doing things, new orientations and new directives, likely to guide their life and their future. Still in this respect, adjustments such as no longer staying out of the house for a long time, or those related to new ways of eating have been reported, confirming that the individual has taken full measure of his new situation, that he has accepted it and that he has complied with it.

"A PLHIV should develop a great willingness to take medicine and integrate the fact of returning home when the time of taking his medicines comes, or then to walk along with the medicines if one thinks to return late. I usually put the drugs in all my bags so as not to forget my treatment (FGD2-female)".

Theme 4: Denial

In a community whereby the stigmatization of PLHIV (Table 30), and self-stigma remain creeping, although it has decreased as we have already described above, it is understandable that denial is one of the main results of this state of fact. Those who are HIV-positive are more likely to reject their serological status, citing various reasons such as unreliable tests, unreliable devices, bad luck, witchcraft, the impossibility of this happening to them, etc. And this will certainly have consequences for their management, as well as their ability to comply with their treatment and other prescriptions relating to it.

Themes	Sub themes	Codes
Denial		I do not believe in my status
		My blood is dirty
		Traditional scarifications
		Status will become negative

Table 30: Expressions of HIV status denial by participants of the FGD sessions. ITAVILSO study, July 2019.

"I will tell you: I do not believe in my status. For me, I think my blood is dirty. Do you see this foot? This foot began to swell alone, I went to see a traditional practitioner I tell myself that it is the multiple scarifications that he made to my foot that have stained my blood. By the end of the year I will do a verification test and I hope that this test will be negative (FGD1-Male)".

Theme 5: Missed appointments

Missed appointments from the patients end, represent a real issue as far as care and support of PLHIV is concerned (Table 31). PLHIV who are already initiated into ARV treatment must abide and be regular and consistent to their appointments and treatment. Unfortunately, this is not always the case. For multiple reasons, a lot of PLHIV miss their appointments and therefore also miss the opportunity to observant to their treatment and jeopardize their capacity of being protected against the damages caused by the HIV. On the other hand, missed appointments will also be like a factor demonstrating the inability of the health system to correctly follow-up, those for whom it is supposed to care of. In this respect, participants at the FGD sessions revealed missed appointments were most of the time due to the fact that monthly appointments provided by the service providers represent a high frequency of appointments which is not easy to bear by everybody.

Themes	Subthemes	Codes
Missed appointments	Frequency	Monthly appointments
	Lack of skills	Forgetfulness
	Mobility	When I travel

Table 31: Description of the foundation of missed appointments in the care of PLHIV by participants of the FGD sessions. ITAVILSO study, July 2019.

Secondly, a PLHIV who is not properly organized, who has not developed appropriate skills in relation to ARV intake, may be exposed to forgetfulness, and will not be consistent to his/her appointments dates.

Finally, there is the issue of mobility, whereby when PLHIV travel, they will either forget to bring along their medication, or they might travel for a long time and will miss opportunity to show up for their medicines pick-up.

"I interrupted the treatment for two weeks because I had traveled but I did not get sick even though I was disturbed to miss taking the treatment. I had traveled and failed to take my treatment for two (2) days (FGD2-Male)".

Theme 6: Other considerations in relation to PLHIV and ARVs

As regard to other considerations expressed by participants at the FGD sessions still in relation to ARVs (Table 32), they revealed that what they hate most concerning ARVs is the respect of hour, as well as the fact of drinking medicine every day. As a matter of fact, PLHIV do feel uncomfortable with certain practices related to antiretroviral treatment, not only the respect of hours, but also the daily intake, and in addition, the fact that ARVs do not completely cure AIDS. These are also things that can affect the morale of PLHIV as part of their follow-up, and have an impact on their health and survival. It should be added, however, that for some, the prohibition on the consumption of alcohol is a real obstacle to the proper observance of treatment.

Themes	Subthemes	Codes
Other considerations in relation to PLHIV and ARVs	What matters most with ARVs	Respect of the hour.
		Drinking medicine
		ARV cannot cure AIDS
		Respect of the interdicts

Table 32: Other considerations in relation to PLHIV and ARVs. ITAVILSO study, July 2019.

Theme 7: Side Effects

The side effects of a treatment can also greatly influence treatment adherence by the person who is forced to do so. This is all the more acute when these side effects affect certain vital organs such as the heart or the nervous system. And this was particularly the case in our sample, where participants also complained of effects such as fatigue, hallucinations, vertigo, dizziness, or heart palpitations (Table 33). This will be all the more damaging for the infected person, if it has not been sufficiently prepared in advance of the likely occurrence of these side effects, or if the infected person is not followed up under the best conditions possible.

Themes	Subthemes	Codes
Side Effects	Cardiovascular events	I had palpitations
	Central Nervous System Effects	Vertigo
		Dizziness, tiredness
		ARVs cause insomnia
		Nightmares
		I had hallucinations

Table 33: Other considerations in relation to PLHIV and ARVs. ITAVILSO study, July 2019.

"As a side effect I had hallucinations. ARVs cause insomnia, hallucinations (at the beginning of treatment) and vertigo. I had dizziness and tiredness for more than three (3) months. I had palpitations and insomnia for more than two weeks (FGD-Male). When I started taking ARVs my body was heating up for more than five minutes. But I did not stop taking the treatment and gradually the hot flashes disappeared. During the first few weeks I had hallucinations, nightmares and I felt stunned (FGD2-female)".

Discussion

Various studies have so far addressed the concept of Test and Treat and antiretroviral therapy. This has always been done either in terms of adherence to treatment, long term engagement in HIV care [4] or in terms of the toxicity of ARVs, in relation to the liver, kidneys or other effects [10]. While taking into account some of the above-mentioned aspects, our particular focus was on observational facts related not only to participants' adherence to antiretroviral therapy, the limits to good adherence, but also to the outcome, and the impact of the antiretroviral treatment on PLHIV at the earlier stage of their treatment. Our concern also particularly focused on the perception that PLHIV have in respect to the antiretroviral treatment and the difficulties encountered with this treatment, as well as the blockages that this could have on the success of the global Test and Treat strategy. Knowing, moreover, that the test and treat strategy as it has been designed and applied until now, is based primarily on the search for cases and therefore on HIV testing, as well as mentioned by Wagner., *et al.* [28]. Case finding (1st 90) which concerns in fact all layers of society, as well as infants, children and adolescents, not just adults. However, it appears that the population strata of infants, children and adolescents are not always correctly taken into account by the health system, despite a greater tendency to join the services (testing, linkage to treatment). It is in this context that Penda and team in a study conducted in Cameroon, noted the importance of an active search for cases in these groups, because of the feasibility of this activity, and its usefulness [16]. As in most cases, PLHIV involved in the test and treat strategy, participants in this study were all HIV-infected individuals who had never been initiated into antiretroviral treatment. They were naïve to the antiretroviral treatment. In Cameroon, the first line of antiretroviral regimen consists of Tenofovir, Lamivudine, and Efavirenz (TDF/3TC/EFV). Still in respect to the antiretroviral first line regimen, it is also possible to use Tenofovir, Emtriotabine, Efavirenz (TDF/FTC/EFV). These are made of two nucleoside reverse transcriptase inhibitors (NRTIs – Tenofovir; Lamivudine or Emtriotabine) and one nonnucleoside reverse transcriptase inhibitor (NNRTI - Efavirenz) [13]. Therefore, all the participants in our study were initiated to either TDF/3TC/EFV [63 participants; 40.6%] or to TDF/FTC/EFV [92 participants; 59.4%]. However, the difference between those on TDF/3TC/EFV and those on TDF/FTC/EFV was statistically different (p = 0.2144). Among all these participants, and in relation to the body mass index (BMI) of participants at inclusion, it was observed that more participants had a normal BMI (56.1%), while few were either underweight (5.8%), overweight (21.3%), or obese (6.8%). In respect to other health issues, majority of participants (88.4%) reported not being aware that they had any condition related to liver, kidney, weight loss, overweight, or diabetes. This again demonstrates that most people who are tested HIV positive and are put on treatment as part of the test-and-treat strategy, initiation of antiretroviral therapy occurs without the person having any suspicion of a health issue. This might be an important factor that could have an impact on the subsequent management of this type of patient, both on the clinical aspect, and the psychosocial end. Indeed, a person who does not feel sick and who is called upon to follow a treatment as heavy as that of antiretroviral, will not always be ready to accept it easily, especially when relationships with service providers are not very friendly, as described by Stern and his team in a study in South Africa [19]. This is all the more true since this is a treatment for life. Hence the need for a good therapeutic education for these people.

Therapeutic education that is supposed to provide them with capacity building on the importance of antiretroviral treatment on their situation, the conditions under which this treatment must be taken, the impact of treatment on their future and that of their loved ones, as well as the challenges of this treatment. It will indeed be a question of better preparing these people to take this treatment, in terms of adherence and compliance. And in this case, instead of just talking about "Test and Treat", or Find and Treat" [27], we should rather talk about "Prepare, Test and Treat." At the observation, many of those who are tested according to the testing approach initiated by the service provider (PITC: Provider Initiated Testing and Counseling) and who are subsequently immediately initiated into treatment, will then be more likely to abandon the treatment, and even affect the outcome of the treatment in terms of viral suppression, as explained by José and team, in a study conducted in the UK [9]. This will happen especially if these people

are neither prepared nor monitored individually. The health system thus intervenes as an essential link in the success of this strategy, both in the establishment of material, financial and human resources. By fulfilling these cardinal functions, the health system will promote better access for those infected, to screening services, treatment and holistic care of the people infected by HIV, as Shet and Adelekan with their respective team also described in their studies [1,18]. If such conditions are not met, especially by service providers and the health system in general, there is a great risk of continuing to observe the regrettable phenomenon of lost to follow up (LTFU), or poor adherence to treatment.

In fact, to be in a situation of lost to follow up (LTFU), a person infected with HIV, will begin to miss his/her clinical appointments, for his/her drug supply. Appointments that are initially monthly, and may subsequently become quarterly, in case of good adherence and good compliance to treatment. Now, it has been observed in our study that out of the 930 expected monthly rendezvous for their drug pick up (155 participants included at the beginning of the study), only 346 visits up were actually respected. This represents an achievement rate of 37.2% for follow up visits, with a level of defaulters of 62.8%. More than half of the participants missed their appointments, thus jeopardizing their medical follow-up and survival in one way or another. Some authors have indeed described a certain correlation between the high level of lost to follow up (LTFU), and the mortality of people living with HIV [9,26].

From the point of view of people infected with HIV themselves, various reasons were put forward to justify this phenomenon of lost to follow up (LTFU), that we were able to collect through the group discussions. In this regard, we have notably noted in terms of justifications, reasons related to the mobility of PLHIV, the monthly frequency of appointments that can be difficult to bear for some peoples, and finally the lack of skills and adaptation of some PLHIV, who continue to forget their dates of appointment, thus showing a weak level of organization. Apart from the purely social and behavioral aspects of infected persons, a new element appears here, that of the overall cost of care, not only in terms of medical care and laboratory, but also in terms of transport costs, for monthly appointments for example [1].

The phenomenon of lost to follow up (LTFU) therefore appears as the main threat not only in relation to the survival of persons infected with HIV, but also in general with the success of the overall implementation of the "Test and Treat strategy." There is thus a combination of two essential elements here, those relating to the organization of the health system and those relating to the intrinsic capacities of each PLHIV in relation to his new situation. For those related to the organization of the health system, service providers and the way services are organized remain the crucial point. Medical care of patients do not only include appointments with medical doctors, but also all other needs of clients, such as lab exams, counselling or even enhanced adherence counselling (EAC), social services, refill of medication. Under these conditions, service providers will play the role of navigators, facilitators, helping clients find themselves in the labyrinths of these different services. Services which are not always easy to understand, to master, for the lay man, people living with HIV, who for the most part are of modest social status. The quality of these services will also play a greater role as a barrier to retention (if of poor quality) or a facilitator to retention (if of good quality). This is in other words, the clinical commitment or more precisely the level of this commitment as was also indicated in a study that was conducted in Rwanda, in which "less clinical engagement was identified as one of the key factor associated with defaulting" and in the other hand, another study described that "Clinic services and ancillary services (like mental health) may facilitate retention in care [14,31].

The routine activities from service providers are in fact part of the enabling environment that each health facility is supposed to put in place, to make sure that clients are received, followed up and their cases managed in a conducive environment. This in fact is known as the "Andersen Model of Health Services Use," which is "composed of domains of predisposing, enabling, and need characteristics that influence health behavior and use of health services [7]. The enabling environment, which consists of everything that the health system puts in place in terms of material resources, human resources (technical skills, attitudes, practices...) and even logistics (work tools, registers, standard procedures, implementation guides...) is the starting point and even the central point in the hope of keeping patients under treatment. In this respect and talking about tools, registers and other methods of monitoring, some studies have shown that one can go as far as the use of smartphones for example. One of these applications is the "Smart Link, a health app for Android smartphones providing HIV-related laboratory results, information, support, and appointment reminders to engage and link patients to care [31]. These are tools, applications that we do not use yet that we could use as well, in the context of improving retention in treatment, and even other components of monitoring people on treatment. It is nevertheless true that we also use new information and communication technologies for calls and reminders to clients who have forgotten their appointments. It will therefore be of paramount importance that special care be taken to ensure that all these conditions are met so that the clients of the different health centers feel ready to come back, ready to listen and put into practice the advice and instructions they receive from the medical team.

All these arguments show the importance once again of the quality of the relationship between the service provider and the client/patient, in view of a good retention process to treatment, but also that of the quality of reception and information provided to the client/patient, still by the service provider, and still in view of good retention. We can however observe that many limiting factors or barriers to retention were identified, by participants, namely:

- The financial barrier (transportation; consultation fees; costs of displacement;
- Stigma/Auto stigmatisation;
- Denial;
- Beliefs;
- Fear to lose job because of absenteeism to work;
- Fear of being recognized by someone in the hospital milieu;
- Preference given to traditional doctors;
- Hope for HIV status change, therefore leading some patients to migrate from health facilities to other;
- Poor documentation;

Most of these factors or barriers to retention were also identified during a study targeting Latino immigrants and migrants in the USA, as well as in another study still carried out in the USA. Using the "Andersen Model of Healthcare Utilization", the two studies came out with major barriers to retention such as: "Psychosocial and cultural barriers (like inability to share HIV status with others), mistaken beliefs, Structural/environmental barriers (difficulties to reach clinic due to transportation fees), Transportation/ challenges getting to provider, Inconsistent housing, No or inadequate insurance, High cost of medications, Long pharmacy wait times and discourteous staff, Competing life activities [7,11]. However, we can already observe that although some barriers seem to be universal (financial barriers, transportation, stigmatization, discrimination, beliefs, etc.), others seem to be particular in the Cameroonian context. And these can be barriers such as: - Fear of being recognized by someone in the hospital milieu - Preference given to traditional doctors - Hope for HIV status change, therefore leading some patients to migrate from health facilities to other.

As a matter of fact, several PLHIV continue to cherish the hope that their serological status will change or has already changed, thus continuing to migrate from health facility to health facility, continuing to be screened, and hoping that the status will change. And this can surely impact figures related to retention. This attitude of continuing to be tested in different health facilities, to continue to be initiated each time under treatment, is harmful to the health system, in the sense that it certainly leads to duplicates, in the country's active file. The other local socio-cultural characteristic is related to the use of traditional healers. Indeed, many resort to medical or paramedical care regardless of their social status, simply because of their beliefs and cultural values. The tradition for many Cameroonians continues to be an important factor in the scale of values. Apart from cultural considerations with emphasis on traditional medicine, financial barrier considerations should also be highlighted. Indeed, many believe that this medicine is less expensive than modern medicine, which is not always the case. Just such as religion, traditional practitioners are most of the times, a source of hope for PLHIV, who continue to believe that either by their faith, or by the effect of a treatment taken from a traditional practitioner, their serological status will change. Religion, in particular, has been indexed in a study on the retention of Latino immigrants and migrants in the United States [11]. Financial barriers, lack of transportation means, denial, fear of being infected, effects of medicine, stigmatization, poor relationships with service providers, and lack of social support were all underlined as being the roots of treatment discontinuation. These same explanations were also provided by the authors of the study called "Mapping Patient–Identified Barriers and Facilitators to Retention in HIV Care and Antiretroviral Therapy Adherence to Andersen's Behavioral Model [7]. The main points highlighted here are the good relationship with service providers, and the fear of getting sick, which were also highlighted in "Mapping Patient–Identified Barriers and Facilitators to Retention in HIV Care and Antiretroviral Therapy Adherence to Andersen's Behavioral Model [7]. The first concern, the one related to the willingness of participants to continue taking medications in the current site. Once again, and although many participants answered this question, the opinions converged on the quality of the reception, the relation with the clients, the moral support on the part of the service providers. Once again, these are the arguments that are in perfect agreement with those developed in the study related to retention in HIV care in Latino Immigrants and Migrants [11].

Speaking now of the intrinsic capacities of each PLWH, this should include the skills that each infected person will develop on an organizational and psychosocial level, in order to cope with the challenges of the announcement of a positive result, and those related to the follow up of the treatment. This aspect, which is related to the development of individual capacities, is indeed of great importance on the part of the HIV infected person as he or she will be called upon to be accompanied by the service provider, be it a psychosocial worker, a nurse or a medical doctor. The individual development of capacities was as well recognized as a good practice by Palfai and team [15]. However, people infected with HIV have the responsibility themselves to be able to develop their own tricks and mechanisms, allowing them to overcome the difficulties encountered, once they have integrated that their survival depends essentially on this treatment. In this respect, the majority of PLHIV are implementing small tips such as reminder methods of taking ARVs, telephone alarms, the distribution of ARV boxes in various bags (especially for women), so as to ensure that Whatever the bag she has with her, she always has her ARVs available. Horter described this as the way each PLHIV process a positive result [8]. The fact is that, obviously and as soon as the result is announced, most, if not all, of the HIV infected people have questions about their future, as expressed by the authors of a study conducted among young people in Uganda [12]. And the first step for this is the change in mind-set, as they described themselves, during group discussions.

In terms of the adverse effects of taking ARVs, it was found that only one-fifth of participants at follow-up visits reported experiencing side effects or adverse treatment effects. Among other things, the side effects reported were, weakness and tiredness, dizziness, problems of concentration, stomach pain with nausea, discomfort, insomnia, blurred vision, diarrhea, and headache. This

was in stark contrast to the results of the study conducted by Raymond and his team in Ghana, which stated that the main side effect observed was anemia, while noting that it was a treatment with Zidovudine [23], which was not the case for our study. However, we must also mention here a study that was conducted in Italy and aimed at comparing first-line combination antiretroviral therapy (cART) with TDF/FTC in combination with RPV or EFV. The study demonstrated that after adjustment, patients treated with EFV were more likely to discontinue at least one drug for any cause, either for toxicity or intolerance [22]. However, considering that in our study, we had only 20.0% of participants who reported the occurrence of adverse effects on treatment, while 62.8% in the same cohort missed their appointments, it was difficult for us to correlate the occurrence of adverse effects and the phenomenon of defaulters or even those of lost to follow-up (LTFU). In reality, we are not here totally disqualifying the role and impact of the adverse effects linked to antiretroviral treatment on compliance and adherence. It must be admitted that this first-line antiretroviral treatment, as a matter of fact, and beyond the simple side effects such as fatigue, dizziness, nausea or other hallucinations, there are more important and long-term effects on certain organs such as the liver and kidneys. In a single-center cohort study conducted among Asian patients, it was revealed that TDF use was associated with the development of Chronic Kidney Disease (CKD) (OR, 1.8; 95% CI, 1.00–3.13; p = 0.052) [20]. Our study on its part revealed an association between participants with high levels of Creatinine at inclusion, and the occurrence of deaths during treatment (OR, 80.6; 95% CI, 11.8–548.9; p = 0.0001). This means, in particular, that there is a strong need for PLHIV initiated on ART as part of the Test and Treat strategy in Cameroon, to benefit from close monitoring of their renal function, as soon as they are initiated into treatment. Now in relation to the use of Tenofovir (as a nucleoside reverse transcriptase inhibitor), Young and his team have demonstrated some important facts, relative to renal function, with regard to the action of this molecule, in combination with others, such as Efavirenz, Lopinavir or Atazanavir. So this team has stipulated that patients starting Tenofovir with either Lopinavir or Atazanavir appeared to have the same rates of decline and recovery as those starting Tenofovir with Efavirenz [30]. In another study on Efavirenz in particular and non-nucleoside reverse transcriptase inhibitors (NNRTIs) in general, a team led by Segamwenge concluded that hepatotoxicity of Efavirenz is not as rare as previously described in the literature and does actually present with fatal outcomes [17]. In another study involving the use of Efavirenz on one hand, and that of Maraviroc on the other, and knowing that Maraviroc is rather an antagonist of the CCR5 receptor, data related to the occurrence of side effects were reported [5]. As a matter of fact, the implementation team focused, among other things, on the comparison of side effects occurring in each arm of the study (Maraviroc, otherwise designed as MVC, and Efavirenz, otherwise designed as EFV). The occurrence of side effects described in this study, was substantially the same as that described in ours, although the proportions of occurrence of these side effects were at times different. Thus, considering only the branch of this study which consisted of Efavirenz, we arrived at the following data, between ITAVILSO and the said study, that we will name here, EFVARM: nausea (ITAVILSO 1.4% vs. EFVARM 28.5%), headache (ITAVILSO 1.4% vs. EFVARM 18.0%), dizziness (ITAVILSO 20.0% vs. EFVARM 28.0%), fatigue (ITAVILSO 44.3% vs. EFVARM 9.1%), diarrhea (ITAVILSO 1.4% vs. EFVARM 14.7%). Nevertheless, it should be noted immediately that the comparisons made here between the ITAVILSO study and that of Gallant are only indicative, particularly as regards the proportions found, relative to the occurrence of the undesirable effects. In fact, while the Gallant study lasted 5 years and included 895 participants, ITAVILSO was supposed to observe 155 participants during the first 6 months of their medical follow-up, after initiation of antiretroviral treatment. It is therefore not really objective comparisons, but rather indicative data, allowing to have the trends between the 2 studies. What is important here is that in both studies the adverse effects are almost the same. And in fact, even if some side effects such as hallucinations and bad dreams that were not mentioned in the quantitative part of ITAVILSO, were nevertheless in its qualitative part, thus allowing to have the same side effects in the two studies.

However and beyond all this, it should not be overlooked that many of those infected with HIV are clearly satisfied by their treatment (84.1%), in terms of gain for their health. This is an important achievement on which the health system should build, in order to truly retain all those infected, who need to be kept under treatment. Good communication, as well as good public education, would not only make it easier to find new cases [21], but also better to keep infected ones under a treatment that already gives satisfaction to those who have already started. Tang and his team consider that an early diagnosis of HIV in infected people and a treatment as early as possible, would prevent early death in these people. Which is one of the pillars of the Test and Treat strategy.

In terms of the final results and concluding observations of our study, one of the first aspects to consider is the poor respect of the clinical appointments by participants in the study. At the observation, very few participants were able to respect the various clinical monthly appointments, for their ARV pick up. As a matter of fact, we observed during the ITAVILSO study that the level of defaulters in medication pick up was high (more than half of the participants were defaulting to their treatment appointments).

Retention remains the real weak point of the program of care for people infected with HIV, and in particular the implementation of the Test and Treat strategy in Cameroon. Retention represents a real challenge that the program of care for people infected with HIV is to overcome, in case its ambition is to succeed in its ambition to eliminate HIV in Cameroon. While Tsague and his team observed an association between low retention and some biological factors related to the disease [24], our study instead showed an association between the gender of the individual (male), absence of side effects, and receiving treatment in a particular treatment

center and retention to care. In fact, and in order to improve retention, some proposals have been made, such as community involvement, or better follow-up by service providers, as Constance and his team also pointed out [2]. However, antiretroviral therapy continues to demonstrate its effectiveness, for viral suppression (93.5% of individuals virally suppressed at the ITAVILSO study). For those who normally follow their treatment (compliance and adherence) the results are felt to be good in terms of viral suppression. Nevertheless, it appears that other factors such as denial, stigmatization, trust in various denominations, financial constraints, are more likely to be triggers for low retention. This is the same scheme that Tetteh and team also described in their paper related to ART adverse events [23]. Denial in itself is a veritable pitfall, in that it profoundly alters all the objective resources of the individual, both psychologically and psychosocially. Denial is at the root of any counterproductive decision that may lead to decisions that go against any form of compliance and adherence to antiretroviral treatment.

When to this is added the secondary effects of the treatment, there is a real rejection of the said treatment

Indeed, our study has shown that the presence or absence of treatment-related effects could influence both retention and other phenomena such as viral suppression.

Another important finding of our study was the association between mortality, gender (male), elevated level of creatinine before initiation of treatment Ultimately, and with the aim of achieving a positive outcome of the Test and Treat strategy in Cameroon, a number of important elements need to be reviewed and corrected, including:

- Good preparation of clients before screening and before initiation into treatment, through therapeutic education, in order to improve linkage and retention to treatment of PLHIV initiated into treatment. This will increase patients' understanding of the concepts and challenges related to antiretroviral therapy, and would significantly reduce the number of patients lost to follow up, therefore increase retention.
- Better follow-up of people already initiated into treatment, through better communication with all available means, including home visits.
- Better biological monitoring of people initiated into treatment, with more active monitoring of liver and more particularly renal function from the first months of treatment initiation.

Conclusion

As we have already pointed out, the overall goal of our study was to explore how the biomedical and side effects of first-line antiretroviral therapy for HIV could affect adherence to antiretroviral therapy, perception of antiretroviral therapy, and viral load suppression in patients infected with HIV. Biological parameters based on baseline values (naive to ART) of serum creatinine showed changes beyond normal values in 22 participants, 7 of whom had a high value and 15 participants whose values were below normal value. An increase in hepatic activity was observed in the 19 patients (SGPT) and 43 participants in the SGOT values. Viral suppression was obtained in 93.5% of participants despite the adverse effects reported in some participants and a slight increase in transaminase and creatinine averages compared to those obtained at the initiation of treatment. Despite some financial and social difficulties, we observed a change in attitudes and an improvement in society's view of people living with HIV in this study, which contributes to improving adherence and in general, HIV care and control in Cameroon. The number of persons accessing the viral load test is still abnormally low. This has the effect of negatively impacting the overall care and support of these people.

Furthermore, the strategy of the Test and Treat, has this fundamental characteristic that the individual who is tested HIV positive is called to be put immediately under treatment, without the individual concerned having to wait for any phase of assimilation or preparation before being put on treatment. This new procedure is nevertheless likely to disturb the people who are subject to it, resulting in a greater propensity to the phenomenon of lost to follow up (LTFU). Moreover, the appearance of treatment-related side effects, no matter how small, is likely to aggravate this situation. Aggravation that could itself negatively impact the entire program. And in terms of the effects of the drugs, the results of the study seem to show a rapid adverse effect (6 months of treatment) on the renal function, compared to the hepatic function which seems not to be affected in the same way.

Finally, with regard to viral suppression, it has been found that, apart from retention, this other component is also one of the Achilles' heel of the program. Yet the program appears to be doing well in terms of viral suppression, although the volume of people who benefit from it is below expectations. Thus, and considering a number of variables not related to the management of PLHIV and the test and treat strategy, our study revealed the following elements:

- **Antiretroviral side effects:** Being a female, being overweight or obese, being on TDF/FTC/EFV treatment regimen and having abnormally high levels of transaminases at inclusion, were significantly associated with side effects.
- **Retention to ART and care:** Being a male, being educated, not experiencing side effects and receiving treatment in District Hospital Biyemassi were significantly associated with retention in care.
- Being a female and not experiencing side effects were significantly associated with the adherence to ART.
- **Viral Load Suppression:** Being a female, being educated and being on TDF/3TC/EFV regimen were significantly associated with VL testing.

- Being a female, adhering to ART and not experiencing any side effects were significantly associated with suppressed VL
- **Mortality:** Being a male, having high levels of creatinine at initiation, not adhering to ART and receiving treatment in District Hospital Biyemassi were significantly associated with mortality

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Conflict of Interest

This study was initiated and conducted with the authors' own funds and as such, the authors declare that they have no conflict of interest with any structure or organization for this purpose.

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