

Knowledge, Attitudes, and Practices of Medical and Paramedical Staff on the Biological Monitoring of People Living with HIV in the Dschang Health District

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Abstract

Context: Human Immunodeficiency Virus (HIV) remains a major global public health issue, with 39 million people living with the virus by the end of 2022, 67% of whom reside in sub Saharan Africa (UNAIDS). In Cameroon, the prevalence among adults was estimated at 2.7% in 2018 (DHS). Biological monitoring is a key component in the management of people living with HIV (PLHIV), requiring the active involvement of healthcare personnel. **Objective:** The overall objective of this study was to assess the knowledge, attitudes, and practices of medical and paramedical staff regarding the biological monitoring of PLHIV in hospitals within the Dschang Health District. **Methodology:** The study took place over 8 months, from December 2024 to July 2025, and the data was collected from February 2025 to May 2025. A quantitative descriptive cross-sectional design was conducted among 203 healthcare workers at the Dschang Regional Annex Hospital (DRAH) and Saint Vincent de Paul Hospital (SVPH) as well as from patient records of those followed between December 2024 and July 2025. Retrospective data from DAMA were collected from January 2020 to May 2025. Data collection took place using an exhaustive sampling method, a structured questionnaire, and individual interviews. Due to limited access to other biological tests, only viral load data, systematically recorded in the DAMA (Data Manager Software System) system, were used. Data were entered in Excel and imported into R software for analysis. Descriptive statistics (frequencies, percentages) were produced for all variables, and fac-

tors associated with insufficient knowledge levels were identified using binary logistic regression, with a significance level set at 0.05. **Results:** This study showing that the viral load (VL) testing coverage among people living with HIV (PLHIV) was generally high in both health facilities during the study period. At Dschang Regional Annex Hospital (DRAH), coverage was 97.8% in 2020, with 89 of the 91 expected tests performed, and decreased slightly to 93.1% in 2021, with 122 of 131 expected tests completed. At Saint Vincent de Paul Hospital (SVPH), coverage remained consistently high, reaching 99.8% in 2020 (1279/1282) and 98.9% in 2021 (2088/2111). Among the 203 respondents included in the study, 126 from DRAH and 77 from SVPH, 106 (52.2%) demonstrated a good level of knowledge regarding VL testing, while 119 (58.6%) had good attitudes and practices. **Conclusion:** Efforts are still needed to improve continuous training and strengthen the integration of biological monitoring in the follow-up of PLHIV.

Keywords

Knowledge, Attitudes, Practices, Healthcare Personnel, Biological Monitoring, PLHIV

1. Introduction

The Human Immunodeficiency Virus (HIV) remains a major public health problem worldwide. According to the latest data from UNAIDS, 39 million people were living with HIV worldwide at the end of 2022, of whom 67% were in sub-Saharan Africa. In Cameroon, HIV prevalence among young people aged 15 to 49 years decreased from 5.4% in 2014 to 2.7% in 2018 [1]. Significant efforts have been made by public authorities to improve the care and management of people living with HIV (PLHIV), through the adoption of national strategic plans and the progressive decentralization of HIV testing and treatment services [2].

HIV/AIDS represents a major public health problem. According to the UNAIDS report, 36.9 million people were living with HIV worldwide in 2023, including 35.1 million adults and 1.8 million children under 15 years of age. There were 1.8 million people newly infected with HIV and 940,000 deaths from AIDS-related illnesses worldwide. In total, approximately 35.4 million people have died from AIDS-related illnesses since the beginning of the epidemic [3]. According to the Centers for Disease Control and Prevention (CDC), the HIV prevalence rate among adults in the United States was 0.3% in 2019 [4]. According to Public Health England, the HIV prevalence rate among adults in England was 0.2% in 2019 [5]. According to the Public Health Agency, the HIV prevalence rate was approximately 0.2% in Canada in 2020 [6].

Regular biological monitoring of people living with HIV (PLHIV) is essential for assessing the effectiveness of antiretroviral (ARV) therapy, detecting HIV-re-

lated complications or adverse drug reactions at an early stage, and adjusting patient management accordingly [3]. In this process, the role of healthcare professionals, including physicians, nurses, laboratory technicians, and other healthcare workers, is crucial, as they directly influence the quality and continuity of care provided to patients. Therefore, their knowledge, attitudes, and practices regarding the biological monitoring of PLHIV may have a major impact on patients' clinical and immunological outcomes. Regular biological monitoring of patients receiving ARV therapy is essential for evaluating treatment effectiveness, identifying HIV-related complications or adverse drug effects at an early stage, and ensuring appropriate and high-quality patient care [3].

However, in many regions of Cameroon, particularly in the Dschang Health District, where HIV prevalence is relatively low, data on the biological monitoring practices of PLHIV remain limited. Few studies have been conducted to assess the knowledge, attitudes, and practices of healthcare professionals, including physicians, nurses, laboratory technicians, and other healthcare workers, regarding the biological monitoring of people living with HIV in this area. The role of medical and paramedical staff is essential in the biological monitoring process because they play a key role in ensuring the quality and continuity of care provided to patients.

Their knowledge, perceptions, and practices in this area may have a significant impact on the clinical and immunological outcomes of PLHIV. It is within this context that the present study was undertaken. The study aims to address this gap by assessing the knowledge, attitudes, and practices of healthcare professionals in the Dschang Health District regarding the biological monitoring of people living with HIV. The findings of this assessment will help identify the strengths and weaknesses of the biological monitoring system and inform the development of appropriate interventions to improve the quality of care provided to PLHIV in the region [2].

2. Methodology

2.1. Study Setting and Timeframe

The study was conducted over an eight-month period, from December 2024 to July 2025, while data collection took place from February 2025 to May 2025. Retrospective data from DAMA was collected from January 2020 to May 2025. The study was conducted at the Regional Annex Hospital (HRA) and Saint Vincent de Paul Hospital (HSVP) in Dschang, within the Dschang Health District, located in the Western Region of Cameroon. The Regional Annex Hospital (HRA) is located in the Fiala Health Area, while Saint Vincent de Paul Hospital (HSVP) is located in the Siteu Health Area. These two healthcare facilities play a central role in the management and care of people living with HIV in the city of Dschang. In 2024, 5843 people living with HIV were receiving care at HSVP, compared with 1600 at HRA.

2.2. Study Design and Study Population

This was a descriptive, analytical, retrospective study targeting healthcare professionals and aimed at assessing their knowledge regarding the biological monitoring of people living with HIV (PLHIV). The target population consisted of medical and paramedical staff working in healthcare facilities within the Dschang Health District and involved in the care and management of people living with HIV.

The inclusion criteria were as follows: being a healthcare professional (physician, nurse, midwife, or laboratory technician) working at the Regional Annex Hospital of Dschang (HRA) or Saint Vincent de Paul Hospital (HSVP); being involved in the care and management of people living with HIV; and voluntarily agreeing to participate in the study.

Healthcare professionals who were not involved in the care and management of PLHIV, as well as staff members who withdrew from the study, refused to participate, or were unable to provide informed consent, were excluded from the study.

2.3. Sample Size and Sampling Method

The minimum sample size was calculated using Cochran's formula:

$$n = \frac{Z^2 p(1-p)}{e^2}$$

where n represents the minimum required sample size, Z is the value from the standard normal distribution corresponding to a 95% confidence level (1.96), P is the expected prevalence of the variable of interest (67%, or 0.67), as reported in a previous study conducted based on the estimated population proportion from the 2018 Demographic and Health Survey (DHS) [4], $1 - P$ is the complementary proportion (0.33), and d is the desired margin of error, set at 5% (0.05). The calculation yielded a minimum required sample size of 339 participants.

A total of 203 healthcare professionals were recruited. This number was close to the calculated minimum sample size and was considered sufficient to meet the objectives of the study. The sampled healthcare professionals included medical doctors, nurses, assistant nurses, midwives, and laboratory technicians.

Participants were recruited using a non-probability convenience sampling method. This technique involved including all healthcare professionals who met the inclusion criteria, were present at the selected health facilities in the l'HRAD et HSVP during the data collection period and freely agreed to participate in the study after signing an informed consent form.

2.4. Data Collection Methods and Tools

Data were collected through a survey conducted at the Regional Annex Hospital of Dschang (HRA) and Saint Vincent de Paul Hospital (HSVP), using a semi-structured questionnaire administered through face-to-face interviews. The ques-

tionnaire consisted of three main sections: Section I: sociodemographic characteristics of the participants; Section II: knowledge of medical and paramedical staff regarding the biological monitoring of people living with HIV (PLHIV); and Section III: attitudes and practices of medical and paramedical staff regarding the biological monitoring of PLHIV. The questionnaire was prepared in both English and French to accommodate the bilingual context of the Western Region of Cameroon.

The questionnaire was pretested among 20 healthcare professionals with characteristics similar to those of the target population in a health district that was not included in the study. Following the pretest, the participants' understanding of the questions, the clarity of the questions, and the average duration of the interviews were assessed. Based on the pretest results, several adjustments were made: ambiguous questions were rephrased, the order of certain sections was reorganized to improve the flow of the interview, and some response options were clarified. Most questions were structured and included both closed-ended and open-ended items, which were coded into standardized categories prior to statistical analysis.

2.5. Definition and Operationalization of Variables

The participants' knowledge level was assessed on a scale of 1 to 15, based on 15 questions from a questionnaire. At the end of this assessment, participants who scored between 1 and 8 were considered to have insufficient knowledge, and those who scored between 9 and 15 were considered to have good knowledge.

The participant's attitude and practice level was assessed on a scale of 1 to 9, based on 9 questions from the questionnaire. At the end of this assessment, participants who scored between 1 and 5 appropriate attitudes and practices. Finally, participants who scored between 6 and 9 were considered to have good attitudes and practices.

2.6. Statistical Analysis of the Data

The data were entered into Microsoft Excel 2016 and then exported to RStudio version 4.4.2 for statistical analysis. Descriptive statistics were used to describe the participants' characteristics and the various study variables in terms of frequencies and percentages. Variables showing a statistically significant association ($p < 0.05$) were selected for the interpretation of the results. The significance level was set at 5%, with a 95% confidence interval.

2.7. Ethical Considerations

The study on the knowledge, attitudes, and practices of medical and paramedical staff aimed to ensure and protect the confidentiality and privacy of PLHIV whose data were being collected. Initially, we obtained administrative authorizations and ethical clearance No.: 408/26/03/2025/CE/CRERSH-OU/VP. Strict measures were put in place to anonymize the information and prevent any identification of pa-

tients. In addition, we obtained the informed consent of all medical staff and par-medical staff, clearly explaining to them the objectives of the study and the methods of data collection and use. This allowed us to respect the principle of autonomy and to make sure that participation was voluntary. Finally, the results of the study were shared with the participants and the relevant health authorities, in order to help improve the follow-up practices for PLHIV in the Dschang Health District from January to July 2025.

3. Results

3.1. Assess the Coverage of Viral Load (VL) Testing among People Living with HIV (PLHIV)

Table 1 below shows the coverage of viral load testing among people living with HIV at the Dschang Regional Annex Hospital from May 2020 to May 2025. From this table, it appears that the coverage rate was particularly high in 2020, with 89 tests conducted out of 91 expected (89/91), which is a rate of 97.80%. In 2021, there was a slight decrease, with 122 tests out of 131 expected (122/131), or 93.13%. In 2022, the coverage rate went back up to 97.70%, corresponding to 85 tests out of 87 expected (85/87).

In 2023, a slight drop was noted with 81 samples out of 86 (81/86), or 94.19%. The year 2024 recorded the lowest coverage, with 84 samples out of 96 (84/96), or 87.50%. Finally, in 2025, an improvement was observed with 28 samples carried out of 29 expected (28/29), corresponding to 96.55%.

Table 1. Coverage of CV implementation for PLHIV at the Dschang Regional Annex Hospital.

Indicators	Years					
	2020	2021	2022	2023	2024	2025
Expected	91	131	87	86	96	29
Sample T.	89	122	85	81	84	28
Cv < 1000 copies	86	119	84	77	83	28
Cv > 1000 copies	3	3	1	4	1	0
Coverage rate (%)	97.80	93.13	97.70	94.19	87.50	96.55

Source: Researcher.

Table 2 below shows the coverage of viral load (VL) testing among people living with HIV (PLHIV) at Saint Vincent de Paul Hospital over the period from 2020 to 2025. It turns out that the coverage rate was particularly impressive in 2020, with 1279 tests conducted out of 1282 expected (1279/1282), or 99.77%. In 2021, coverage remained very high, with 2088 tests out of 2111 (2088/2111), or 98.91%. The year 2022 showed a similar performance, with 2188 tests conducted out of 2212 expected (2188/2212), representing 98.92% coverage. In 2023, there was a slight improvement with 2114 samples out of 2126 (2114/2126), or 99.44%. In 2024, the rate dropped very slightly to 99.07%, corresponding to 2142 samples

taken out of 2162 expected (2142/2162). Finally, in 2025, there was a rebound with 1011 samples out of 1014 expected (1011/1014), or 99.70%.

Table 2. Achievement coverage of PLHIV medical records at Saint Vincent de Paul Hospital.

Indicators	Years					
	2020	2021	2022	2023	2024	2025
Expected	1282	2111	2212	2126	2162	1014
Sample T.	1279	2088	2188	2114	2142	1011
Cv < 1000 copies	1237	1994	2150	2093	2081	1004
Cv > 1000 copies	42	34	38	31	61	7
Coverage rate (%)	99.77	98.91	98.92	99.44	99.07	99.7

Source: Researcher.

3.2. Social and Demographic Characteristics of Healthcare Professionals

Table 3 shows that the majority of participants were between 31 and 40 years old (32.51%, or 66 people), followed by those aged 26 to 30 (23.15%, or 47 people).

Regarding gender, 65.52% were women (133 people) compared to 34.48% men (70 people).

For work experience, the 5 to 8 years category was the most common (46.80%, or 95 people).

Regarding marital status, 48.28% were married (98 people) and 7.39% widowed (15 people).

Finally, 62.07% of participants worked at the Dschang Regional Hospital Annex (126 people) and 42.86% were nurses (87 people).

Table 3. Distribution of participants according to their socio-demographic characteristics.

Variables	Effective (Number)	Frequency (%)
Age		
20 - 25	11	5.42
26 - 30	47	23.15
31 - 40	66	32.51
41 - 50	44	21.67
51 - 60	32	15.76
Plus 60	3	1.48
Sex		
Female	133	65.52
Male	70	34.48
Work experience (in years)		
13 - 16	9	4.43
17 - 20	7	3.45
2 - 4	48	23.65

Continued

5 - 8	95	46.80
9 - 12	44	21.67
Healthcare Facility (FOSA)		
Hôpital de saint Vincent de Paul	77	37.93
Hôpital régional annexe de Dschang	126	62.03
Marital status		
Single	68	33.50
Divorced	22	10.84
Married	98	48.28
Widower/Widow	15	7.39
Socio-professional categories		
Nursing Assistant	57	28.08
APS	10	4.9
Nurse	87	42.86
Doctor	07	3.45
Specialist Doctor	2	0.99
Midwife	4	1.97
Lab Technician	36	17.73
Do you work in the HIV care service?		
Yes	149	73.40
No	54	26.60

Source: Researcher.

3.3. Describe the Level of Knowledge of Medical and Paramedical Staff about the Lab Tests Needed to Monitor People Living with HIV

Table 4 shows the results of the assessment of medical and paramedical staff's knowledge on the follow-up of people living with HIV (PLHIV). It turns out that 196 staff members (96.55%) had heard about the biological follow-up of PLHIV. In terms of understanding, 178 participants (87.68%) considered that biological follow-up involved regular monitoring of biological parameters, such as viral load and CD4 count. Regarding the check-up before starting treatment, 182 respondents (89.66%) said they did not perform a prior assessment, while 171 participants (84.24%) stated that they carried out all the necessary assessments at this stage.

After 6 months of treatment, 143 people (70.44%) said they were doing a viral load test. If creatinine levels went up, 182 staff members (89.66%) changed the antiretroviral treatment. When the viral load exceeded 1000 copies/ml, 146 participants (71.92%) said they repeated the test within three months. Also, 164 respondents (80.79%) did a resistance test if the viral load stayed high. In terms of perception, 168 participants (82.76%) considered biological monitoring very important, and 140 people (68.97%) said they had received initial HIV training at university.

Table 4. Assessment of medical and paramedical staff knowledge.

Variables	Effective	Frequency (%)
Have you heard about the biological monitoring of people living with HIV?		
No	7	3.45
Yes	196	96.55
Meaning of biological monitoring for people living with HIV		
It just involves prescribing antiretroviral drugs without any testing.	25	12.32
It's about regularly monitoring biological parameters, like viral load and CD4 count, to check on the patient's health.	178	87.68
Version of the national HIV care guide you're using		
None	165	81.28
Electronics	33	16.26
Physics	05	2.46
Check-up before starting		
None	182	89.66
CD4	3	1.48
CD4, Creatinine	2	0.99
Viral load	12	5.91
Viral load, Fasting blood sugar	1	0.49
Fasting blood sugar	3	1.48
Check-up at M1 after starting treatment		
Viral load	11	5.42
Viral load, Pregnancy test	2	0.99
Creatinine, CD4 if advanced stage disease	1	0.49
Creatinine, Fasting blood sugar, CD4 if advanced stage disease, Viral load	3	1.48
FBC, Viral load	3	1.48
FBC, Viral load, Lipid profile	4	1.97
FBC, Creatinine	1	0.49
FBC, Creatinine, HBsAg	4	1.97
FBC, Creatinine, Fasting blood sugar	3	1.48
All these tests	171	84.24
Reports done every month		
CD4	4	1.97
CD4, Viral load	1	0.49
Viral load	8	3.94
Fasting blood sugar	171	84.24
Fasting blood sugar, CD4	3	1.48
Fasting blood sugar, Viral load	1	0.49
Fasting blood sugar, Creatinine	7	3.45
FBC	4	1.97
FBC, Creatinine	4	1.97

Continued

Review done at 6 months		
CD4	40	19.70
CD4, Viral load	1	0.49
Viral load	143	70.44
Viral load, Pregnancy test	9	4.43
Fasting blood sugar	1	0.49
Fasting blood sugar, CD4	4	1.97
Fasting blood sugar, Viral load	5	2.46
Check-up done at 1 year and every 12 months		
CD4	7	3.45
CD4, FBC, Creatinine	7	3.45
CD4, FBC, Fasting blood sugar	2	0.99
Viral load	75	36.95
Viral load, CD4	6	2.96
Viral load, CD4, Fasting blood sugar	3	1.48
Viral load, CD4, FBC	2	0.99
Viral load, CD4, FBC, Fasting blood sugar	1	0.49
Viral load, CD4, Lipid profile	1	0.49
Viral load, Creatinine, Fasting blood sugar	3	1.48
Viral load, Fasting blood sugar	17	8.37
Viral load, FBC, Lipid profile	1	0.49
Viral load, FBC, Lipid profile, Creatinine	1	0.49
Viral load, Lipid profile, Creatinine	3	1.48
Viral load, Lipid profile, Urinary protein	1	0.49
Viral load, The whole assessment	1	0.49
Creatinine, Fasting blood sugar	2	0.99
Fasting blood sugar	18	8.87
FBC, Fasting blood sugar	3	1.48
FBC, Lipid profile, Creatinine	2	0.99
The whole assessment	47	23.15
Creatinine levels are high		
We stop the treatment	21	10.34
We switch from TDF to ABC or AZT	182	89.66
Viral load is over 1000 copies/ml		
We'll do it again in 1 month	33	16.26
We'll do it again in 3 months	146	71.92
We'll do it again in 6 month	24	11.82
Additional tests done if the viral load remains above 1000 before switching treatment to second-line		
None	123	60.59
CD4	13	6.40

Continued

Viral load	45	22.17
FBC	8	3.94
Lipid profile	14	6.90
Assessment done if the patient was on second-line treatment and the viral load is still above 1000 copies/m		
We're doing the stress test	164	80.79
We're doing a tolerance test	39	19.21
Type of patient for whom syphilis testing is allowed		
At initiation and every year if risk exists for all patients	95	46.80
Routinely for women of childbearing age	65	32.02
Key populations	8	3.94
All answers are correct	35	17.24
From how many copies can a person be considered undetectable		
≤200 copies/ml	45	22.17
≤50 copies/ml	158	77.83
The importance of biological monitoring		
Important	35	17.24
Very important	168	82.76
Training received on HIV		
No training	47	23.15
Initial University training	140	68.97
Seminar on monitoring people living with HIV	16	7.88

Source: Researcher.

Table 5 below shows the result of participants' knowledge level on the follow-up of people living with HIV. It appears that 52.2%, or 106 participants, had good knowledge, while 47.8%, or 97 people, and had insufficient knowledge.

Table 5. Participants' knowledge level about following up on people living with HIV.

Variables	Effective	Frequency (%)
Good	106	52.2%
Insufficient	97	47.8%

Source: Researcher.

3.4. Describe the Attitudes and Practices of Medical and Paramedical Staff Regarding the Biological Follow-Up of People Living with HIV

Table 6 showed the evaluation of attitudes and practices of medical and paramedical staff regarding the follow-up of people living with HIV (PLHIV). It appears that 100% of the participants, that is 203 out of 203, carried out the medical history and physical examination as well as the viral load at each clinical visit.

Similarly, 203 participants (100%) reported systematically providing adherence

support and tuberculosis screening at every consultation. All respondents, again 203 participants (100%), also performed the HBsAg test at the start of treatment or when there were suggestive clinical signs. On the other hand, regarding syphilis testing, 166 participants (81, 77%) did it at initiation and each year if a risk was identified, while 31 participants (15, 3%) did not perform any testing at this level.

For biological monitoring of hemoglobin and creatinine levels, 165 participants (81, 28%) reported doing it as part of follow-up for people living with HIV. Regarding the HIV resistance test in case of third-line therapy failure, 192 participants (94, 58%) said they did not perform it. Finally, it's important to note that all 203 participants (100%) did not screen for cervical cancer every two years in women of childbearing age living with HIV, even though this practice is highly recommended.

Table 6. Assessment of the attitudes/practices of medical and paramedical staff.

Variables	Effective	Frequency (%)
Medical history and physical exam		
Once a year	0	0
At every clinic visit	203	100
Viral Load Frequency		
Every 3 months for pregnant women and at 6 months and 12 months for both sexes	203	100
Every 3 months for everyone	0	0
Every 6 months for everyone	0	0
Assessment of adherence support		
At each visit	203	100
Once a year	0	0
TB screening		
At each clinical visit	203	100
Twice a year	0	0
Pregnancy test for women of childbearing age		
At each visit for women of childbearing age	203	100
For all women	0	0
HBsAg Test		
At the start or if clinical signs appear	203	100
In all patients without clinical signs	0	0
Syphilis Testing		
At the start and then every year if at risk	166	81.77
Only at one month	6	2.95
None	31	15.3
Biological monitoring of HG (or FBC), creatinine levels, and lipid profile		
1 month and 12 months	119	58.62
1 month and 6 months	84	41.38

Continued

HIV Resistance Test		
Resistance Test in case of second-line therapy failure	11	5.42
Resistance Test in case of third-line therapy failure	0	0
None	192	94.58
Cervical Cancer Screening in Women		
HPV screening done every two years for HIV-positive women of childbearing age	0	0
HPV screening not done every two years for HIV-positive women of childbearing age	203	100

Source: Researcher.

Table 7 below shows the results of the participants' attitude/practice levels regarding the follow-up of people living with HIV. It appears that 58.5%, or 119 participants, had good attitudes/practices, while 41.5%, or 84 participants had appropriate attitudes/practices.

Table 7. Level of participants' attitude/practice regarding the follow-up of people living with HIV.

Variables	Effective	Frequency (%)
Appropriate	84	41.5%
Good	119	58.5%

Source: Researcher.

Table 8 below shows the distribution of attitude and practice levels based on the type of health facility. The results show that all participants from Saint Vincent de Paul Hospital (100%) had what were considered good attitudes/practices, while none of them displayed appropriate attitudes. On the other hand, all participants from the Dschang Regional Annex Hospital (100%) had appropriate attitudes and practices, with no one having good attitudes ($p < 0.001$).

Table 8. Distribution of attitude/practice level according to type of health facility.

Variables	Attitude/pratique		P-value
	Appropriate (<i>n</i> = 203)	Good (<i>n</i> = 203)	
FOSA			
Saint Vincent de Paul Hospital	0 (0%)	203 (100%)	<0.001***
Dschang Regional Hospital Annex	203 (100%)	0 (0%)	

Source: Researcher.

4. Discussion

Table 1 presents the annual coverage of viral load (VL) testing among people living with HIV (PLHIV) at Dschang Regional Annex Hospital from 2020 to 2025. The results show that the coverage rate remained relatively high throughout the study period, ranging from 87.50% in 2024 to 97.70% in 2020. Coverage was

93.13% in 2021, increased to 97.70% in 2022, and subsequently declined to 94.19% in 2023 and 87.50% in 2024, before rising to 96.55% in 2025. This fluctuation suggests that although viral load monitoring was implemented for most patients expected to receive testing, complete coverage was not achieved consistently. The decline in coverage observed in 2024 deserves particular attention, as only 84 of the 96 expected patients had a sample recorded, corresponding to a coverage rate of 87.50%. This gap could reflect challenges related to patient attendance, specimen collection and transportation, laboratory capacity, or the availability and timely return of results. The subsequent increase to 96.55% in 2025 indicates an improvement in testing coverage, although three expected patients were still not represented among the samples tested. The importance of maintaining high viral load testing coverage is supported by World Health Organization (WHO) recommendations, which identify viral load testing as the preferred method for monitoring response to antiretroviral therapy (ART) and detecting potential treatment failure. Routine monitoring is recommended at six months after ART initiation, at 12 months, and annually thereafter for patients established on treatment monitoring [7]. Therefore, sustained coverage is essential to identify patients who may require enhanced adherence support or a reassessment of their treatment regimen. Regarding virological outcomes, the proportion of tested samples with viral loads below 1000 copies/mL was consistently high, ranging from 93.10% to 97.67% across the six years. In contrast, the proportion with viral loads above 1000 copies/mL remained low, ranging from 0% to 4.94%. These findings indicate that most tested patients had viral loads below the 1000 copies/mL threshold used by WHO to define viral suppression for programmatic monitoring. WHO guidance emphasizes that patients with viral loads above this threshold require appropriate clinical assessment, adherence support and follow-up viral load testing according to the applicable treatment-monitoring algorithm monitoring [7]. A study conducted in Cameroon examining access to viral load testing and virological outcomes following the introduction of the universal test-and-treat strategy provides a relevant national context for interpreting these findings. The study investigated changes in access to viral load testing, viral suppression and viral rebound, highlighting the importance of monitoring both access to testing and the subsequent virological outcomes of patients receiving ART. Its findings are particularly relevant because it addresses viral load monitoring within the Cameroonian HIV care system monitoring [8]. Overall, the findings at Dschang Regional Annex Hospital suggest relatively good implementation of viral load monitoring and a high proportion of tested patients with viral loads below 1000 copies/mL. Nevertheless, the persistent gap between the expected number of patients and the number of samples tested indicates that efforts should continue to ensure that all eligible patients receive routine monitoring. Strengthening appointment tracking, patient follow-up, specimen transport and result management may help maintain high coverage. In addition, patients with viral loads above 1000 copies/mL should receive adherence counselling and timely repeat testing or further clinical management, in accordance with national guidelines and WHO recommendations.

Table 2 presents the annual coverage of viral load (VL) testing among people living with HIV (PLHIV) at Saint Vincent de Paul Hospital from 2020 to 2025. The results show consistently high coverage throughout the study period, ranging from 98.91% in 2021 to 99.77% in 2020. Coverage was 98.92% in 2022, increased to 99.44% in 2023, decreased slightly to 99.07% in 2024, and reached 99.70% in 2025. These findings indicate that nearly all patients expected to undergo viral load testing were represented among the samples tested each year. The high coverage observed at this facility suggests effective implementation of routine viral load monitoring. The difference between the expected number of patients and the number of samples tested was relatively small, ranging from three patients in 2020 to 24 patients in 2022.

Regarding virological outcomes, the table indicates that most tested samples had viral loads below 1000 copies/mL throughout the study period. The number of samples with viral loads below this threshold increased from 1237 in 2020 to 2,093 in 2023, before decreasing slightly to 2,081 in 2024 and 1004 in 2025. The number of samples with viral loads above 1000 copies/mL was relatively low, although it increased from 31 in 2023 to 61 in 2024 before falling to seven in 2025. This pattern suggests that most tested patients had virological results consistent with suppression, while the elevated results in 2024 highlight the importance of continued monitoring and appropriate clinical follow-up. These findings can be discussed in relation to the study by Bekolo *et al.* (2024) monitoring [8] which investigated access to viral load testing, viral suppression and viral rebound following the introduction of the universal test-and-treat guidelines in Cameroon. The authors emphasized the importance of improving access to viral load monitoring and sustaining viral suppression among patients receiving antiretroviral therapy. Their findings provide a relevant national context for interpreting the high testing coverage observed at Saint Vincent de Paul Hospital, although direct comparisons require consideration of differences in study populations, periods and indicator definitions. Overall, the findings suggest that Saint Vincent de Paul Hospital maintained a high level of viral load testing coverage between 2020 and 2025. Continued efforts to ensure that all eligible patients undergo routine testing, coupled with timely management of elevated viral load results, remain essential for monitoring treatment effectiveness and identifying patients who may require adherence support or further clinical assessment.

The comparison of **Table 1** and **Table 2** shows that viral load testing coverage was consistently high at both Dschang Regional Annex Hospital and Saint Vincent de Paul Hospital between 2020 and 2025. At Dschang Regional Annex Hospital, coverage ranged from 87.50% in 2024 to 97.80% in 2020, whereas at Saint Vincent de Paul Hospital, it ranged from 98.91% in 2021 to 99.77% in 2020. These findings indicate that the proportion of expected patients represented among those tested was generally higher at Saint Vincent de Paul Hospital throughout the study period.

The virological results also indicate that the majority of tested samples at both

facilities had viral loads below 1000 copies/mL. At Dschang Regional Annex Hospital, the number of samples below this threshold represented a high proportion of the samples tested each year. Similar findings were observed at Saint Vincent de Paul Hospital, where the number of samples below 1000 copies/mL was substantially greater than the number above this threshold. These results are consistent with the importance of routine viral load monitoring as an indicator of response to antiretroviral therapy. The findings can be considered alongside those of Bekolo *et al.* (2024) [8] whose study in Cameroon assessed access to viral load testing and subsequent virological outcomes under the universal test-and-treat strategy. The authors highlighted the need to strengthen access to viral load monitoring and sustain viral suppression. This evidence supports the importance of evaluating both testing coverage and virological outcomes when assessing HIV treatment programs.

In this study, women represented 65.52% of participants, compared with 34.48% for men. This predominance of women may reflect the composition of the healthcare workforce, particularly in nursing and other patient-care professions. A study by Zang *et al.* (2015) examining Cameroon's public health workforce reported that women represented 55.74% of personnel, while men accounted for 44.26% [9]. The higher proportion of women in the present study is consistent with the female predominance reported in the national public health workforce, although differences in the populations and health facilities studied should be considered [9].

The most represented age group was 31 - 40 years (32.51%), followed by 26 - 30 years (23.15%) and 41 - 50 years (21.67%). Overall, 55.67% of respondents were aged between 26 and 40 years. This distribution indicates that the study predominantly involved healthcare workers in early to middle stages of their professional careers. However, age alone does not establish the level of knowledge or competence of healthcare workers in viral load monitoring. Professional training and continuing education are also important considerations when assessing the quality of healthcare delivery [10].

Nurses constituted the largest professional group (42.86%), followed by nursing assistants (28.08%) and laboratory technicians (17.73%). The predominance of nurses is relevant because nursing personnel constitute a major component of the healthcare workforce and contribute substantially to the delivery of health services [10]. In HIV care, healthcare professionals must work collaboratively to ensure continuity of treatment, patient follow-up and appropriate laboratory monitoring [11].

Laboratory technicians also play an important role in specimen processing and laboratory quality assurance, while clinical personnel contribute to interpreting viral load results and determining appropriate patient follow-up. The World Health Organization recommends routine viral load monitoring as the preferred method for assessing response to antiretroviral therapy and identifying potential treatment failure [12].

The inclusion of different professional categories in this study is therefore useful for examining how viral load monitoring is implemented across the participating facilities. Almost half of the respondents (46.80%) had between 5 and 8 years of professional experience. Those with 2 - 4 years represented 23.65%, while 21.67% had between 9 and 12 years of experience. Overall, most participants had between 2 and 12 years of professional experience. This distribution describes the professional background of the respondents; however, the number of years worked should not automatically be interpreted as evidence of better knowledge or clinical practice. Research among HIV-care physicians in Cameroon found that professional knowledge was associated with factors including training and collaboration with other practitioners, emphasizing the relevance of continuing professional development [11].

Most respondents (73.40%) reported working in HIV care services, whereas 26.60% did not. This finding indicates that most participants were working in services potentially associated with antiretroviral treatment and patient monitoring. The WHO recommends routine viral load testing to assess treatment response among people receiving antiretroviral therapy [12]. In Cameroon, Fouedjio Kafack *et al.* (2022) examined plasma viral load monitoring in three health facilities in the Littoral Region, illustrating the importance of evaluating viral load monitoring practices within the national healthcare context [13].

Awareness and understanding of biological monitoring

The results show that 196 participants (96.55%) had heard about the biological monitoring of people living with HIV (PLHIV), while only seven (3.45%) had never heard of it. Furthermore, 178 respondents (87.68%) correctly identified biological monitoring as the regular assessment of biological parameters, including viral load and CD4 count, to evaluate patients' health status. However, 25 respondents (12.32%) incorrectly associated monitoring with prescribing antiretroviral drugs without laboratory testing. These findings suggest that awareness of biological monitoring was high among the healthcare workers surveyed. Nevertheless, awareness does not necessarily imply comprehensive knowledge of the recommended monitoring procedures. The World Health Organization (WHO) identifies viral load testing as the preferred method for monitoring the response to antiretroviral therapy (ART), while CD4 testing remains important in assessing immune status, particularly in patients with advanced HIV disease [7]. Consequently, the proportion of respondents who misunderstood the purpose of biological monitoring highlights the need for continued professional education.

Knowledge and use of national HIV treatment guidelines

Regarding the national HIV care guide, 165 respondents (81.28%) reported that they did not use any version, while 33 (16.26%) reported using an electronic version and five (2.46%) selected the category labelled "Physics," which may represent a translation or data-entry error. The large proportion reporting no use of the guidelines raises concerns about access to, familiarity with, or implementation of standardized HIV monitoring recommendations. WHO guidance emphasizes

the importance of evidence-based protocols for monitoring ART, identifying treatment failure and determining appropriate clinical interventions [7]. In Cameroon, Rasson *et al.* examined factors associated with HIV-care knowledge among physicians and highlighted the relevance of professional training and collaboration in improving knowledge of HIV management [11]. These findings support the importance of ensuring that healthcare workers have access to updated national guidelines and opportunities for continuing education.

Knowledge of examinations before ART initiation

Before starting ART, 182 respondents (89.66%) selected none of the listed examinations. Only 12 (5.91%) identified viral load testing, while small proportions selected CD4 count, creatinine, fasting blood glucose or combinations of these investigations. This result may indicate inadequate knowledge of the baseline assessment required before ART initiation, although the interpretation depends on whether respondents were asked to identify all recommended tests or only one principal examination. WHO recommendations distinguish between baseline clinical assessment, tests required for specific treatment regimens and investigations indicated by a patient's clinical condition [7]. For example, renal function assessment is particularly relevant when tenofovir disoproxil fumarate (TDF) is being considered, while other tests are guided by the clinical context and treatment regimen. The low proportion identifying baseline investigations therefore suggests a need to strengthen staff knowledge of pretreatment assessment and the appropriate use of national protocols.

Knowledge of monitoring one months after ART initiation

For the assessment at one month after ART initiation, 171 respondents (84.24%) selected "all these tests," whereas the remaining respondents selected individual tests or combinations of examinations. This high proportion may reflect a broad understanding that patients require follow-up after starting treatment. However, it should not automatically be interpreted as correct knowledge of the recommended monitoring schedule, because not all the listed investigations are routinely required for every patient at one month. WHO guidance recommends monitoring treatment response through clinical follow-up and viral load testing according to the recommended schedule, with additional laboratory investigations determined by the regimen and the patient's clinical needs [7]. The findings therefore highlight the importance of distinguishing between tests routinely recommended for all patients and those indicated only in specific circumstances.

Knowledge of monthly monitoring

Regarding the tests reportedly required every month, 171 respondents (84.24%) selected fasting blood glucose, while only eight (3.94%) selected viral load testing alone. Other respondents selected CD4 count, full blood count, creatinine or combinations of these examinations. These responses suggest possible confusion about the frequency and purpose of different laboratory tests. Routine fasting blood glucose testing every month is not a universal requirement for all patients receiving ART, and viral load monitoring is not generally performed monthly in

clinically stable patients. WHO recommends viral load assessment at defined intervals, including six months after ART initiation, 12 months after initiation and annually thereafter for patients established on treatment [7]. The responses therefore indicate a need to reinforce knowledge of the appropriate frequency of biological investigations and to avoid unnecessary testing while ensuring that recommended monitoring is completed.

Knowledge of monitoring at six months after ART initiation

At six months after treatment initiation, 143 respondents (70.44%) selected viral load testing alone, while 40 (19.70%) selected CD4 count alone. The remaining respondents selected viral load testing combined with other examinations. This result indicates that a majority recognized viral load testing as an important component of the six-month assessment, although a substantial minority did not identify it as the principal test. The findings are consistent with WHO recommendations, which identify viral load testing at six months after ART initiation as an important measure of treatment response [7]. Viral load results help determine whether ART is suppressing viral replication and whether further adherence assessment or clinical evaluation is necessary. Strengthening knowledge of the six-month monitoring schedule may therefore help improve the consistency of treatment follow-up.

Knowledge of annual monitoring

For monitoring at one year and every 12 months thereafter, responses were widely distributed across different combinations of tests. Seventy-five respondents (36.95%) selected viral load testing alone, 47 (23.15%) selected the whole assessment, and 18 (8.87%) selected fasting blood glucose alone. Other respondents selected various combinations of viral load, CD4 count, full blood count, creatinine, lipid profile and urine protein testing. This variation suggests that respondents may have different understandings of annual monitoring requirements. WHO recommends annual viral load testing for patients established on ART, while additional investigations depend on the patient's clinical status, treatment regimen and specific risk factors [7]. The results emphasize the importance of clarifying which examinations are routinely required and which are indicated by individual clinical circumstances.

Management of elevated creatinine levels

When asked about management of elevated creatinine levels, 182 respondents (89.66%) indicated that they would switch from TDF to abacavir (ABC) or zidovudine (AZT), while 21 (10.34%) indicated that they would stop treatment. These responses suggest that most participants recognized the possibility of changing the treatment regimen when renal toxicity is suspected. However, an elevated creatinine concentration does not automatically require switching treatment, and ART should not be discontinued without appropriate clinical assessment. Management depends on renal function, the degree and cause of impairment, the patient's treatment regimen and the availability of suitable alternatives. WHO guidance emphasizes appropriate assessment and management of treatment-related

adverse effects [7]. Training should therefore focus on assessing renal function and selecting an appropriate regimen rather than making treatment decisions based on an isolated laboratory value.

Management of viral load above 1000 copies/ml

When asked when to repeat viral load testing after a result above 1000 copies/mL, 146 respondents (71.92%) selected three months, 33 (16.26%) selected one month and 24 (11.82%) selected six months. The three-month interval was the most frequently selected response. WHO guidance recommends adherence assessment and support when an elevated viral load is detected, followed by repeat viral load testing according to the applicable treatment-monitoring algorithm, commonly after approximately three months of enhanced adherence support [7]. The responses therefore suggest that many participants were familiar with the recommended interval, although almost 28% selected a different time frame.

Additional investigations before switching to second-line ART

When asked which additional tests should be performed if viral load remains above 1000 copies/mL before switching to second-line treatment, 123 respondents (60.59%) selected none of the listed options, while 45 (22.17%) selected another viral load test. Smaller proportions selected CD4 count, full blood count or lipid profile. Persistent virological failure requires assessment of adherence, confirmation of the viral load result according to national guidance, review of the current regimen and consideration of available treatment options. Additional laboratory investigations may be required depending on the proposed regimen and the patient's clinical condition [7]. The high proportion selecting none of the listed investigations suggests a potential gap in knowledge of the clinical assessment required before changing treatment. However, because the answer choices may not have included all the relevant elements of the recommended algorithm, the result should be interpreted cautiously.

Management of persistent viraemia on second line treatment

When asked about management of a patient receiving second-line ART whose viral load remained above 1000 copies/mL, 164 respondents (80.79%) selected "stress test," while 39 (19.21%) selected "tolerance test." These labels are unclear and may reflect translation or questionnaire-coding problems. They should be checked against the original questionnaire before drawing conclusions about participants' knowledge. Clinical management of persistent viraemia requires assessment of adherence, tolerability, drug interactions and possible treatment failure, followed by appropriate specialist evaluation when indicated [7]. The responses cannot be reliably classified as correct or incorrect until the intended meaning of "stress test" and "tolerance test" has been established.

Knowledge of syphilis testing

Regarding syphilis screening, 95 respondents (46.80%) selected testing at ART initiation and annually when risk exists, 65 (32.02%) selected routine testing for women of childbearing age, eight (3.94%) selected key populations, and 35 (17.24%) selected all the answers. These results indicate variation in respondents'

understanding of the populations and circumstances for which syphilis screening is appropriate. WHO guidance recommends syphilis screening for relevant populations and clinical circumstances, including pregnant women and individuals with increased risk of sexually transmitted infections [14]. Screening policies should be applied according to national guidelines and the patient's clinical context rather than assuming that one testing schedule is appropriate for everyone.

Understand of undetectable viral load

A total of 158 respondents (77.83%) considered a viral load of 50 copies/mL or lower to be undetectable, while 45 (22.17%) selected 200 copies/mL or lower. These responses show that most participants associated undetectability with the lower threshold. However, the precise definition of an undetectable viral load depends on the sensitivity and reporting threshold of the assay used. A viral load below 200 copies/mL is commonly used in the U=U evidence base concerning sexual transmission, whereas WHO uses a viral load below 1,000 copies/mL as the threshold for programmatic viral suppression [7] [15]. These thresholds serve different purposes and should not be treated as interchangeable.

Perceived importance of biological monitoring

All respondents considered biological monitoring important: 168 (82.76%) described it as very important, while 35 (17.24%) described it as important. This finding suggests strong recognition of the value of biological monitoring among the surveyed healthcare workers. Routine viral load monitoring is essential for assessing response to ART, identifying possible treatment failure and informing appropriate follow-up [7]. Nevertheless, the positive attitudes reported by participants should be distinguished from their technical knowledge, since the responses to questions about monitoring schedules and clinical management showed considerable variation.

Training received on HIV

Regarding HIV-related training, 140 respondents (68.97%) reported that their training came from initial university education, 16 (7.88%) reported attending seminars on monitoring PLHIV, and 47 (23.15%) reported no training. The proportion reporting no training is particularly important because current recommendations and treatment protocols may change over time. The findings of Rasson *et al.* in Cameroon highlight the relevance of training and professional collaboration to HIV-care knowledge [11]. The results support strengthening continuing professional development, particularly practical training on viral load interpretation, monitoring intervals, management of elevated viral load and appropriate decisions about treatment failure.

Participant's knowledge level regarding the follow-up of PLHIV

Table 5 presents the overall level of knowledge among healthcare workers regarding the follow-up of people living with HIV. Of the 203 participants, 106 (52.2%) had a good level of knowledge, whereas 97 (47.8%) had an insufficient level of knowledge. Although slightly more than half of the participants demonstrated good knowledge, the difference between the two groups was relatively

small. This finding suggests that knowledge of HIV patient follow-up was not optimal across the study population and that substantial gaps may remain among healthcare workers. The proportion of participants with insufficient knowledge (47.8%) is particularly important because effective HIV care requires healthcare workers to understand treatment monitoring, interpretation of viral load results, adherence support and the identification of possible treatment failure. The World Health Organization (WHO) recommends routine viral load testing as the preferred approach for monitoring response to antiretroviral therapy (ART), with testing generally performed six months after treatment initiation, at 12 months and annually thereafter for patients established on treatment [7]. Inadequate knowledge of these recommendations may complicate the consistent implementation of follow-up procedures, although the present results alone do not establish a direct relationship between knowledge level and clinical practice. These findings can also be discussed in relation to the study by Rasson *et al.* (2011), conducted among physicians involved in HIV care in Cameroon. The authors examined factors associated with HIV-care knowledge and highlighted the relevance of training and collaboration between healthcare professionals [11]. Their work provides a useful national context for the present study and supports the importance of strengthening professional education to improve knowledge of HIV management. Furthermore, the fact that nearly half of the respondents had insufficient knowledge may be relevant to the training profile observed in the preceding table, where 23.15% reported no HIV-related training and only 7.88% reported attending seminars on the monitoring of PLHIV. However, the association between training and knowledge cannot be confirmed from these descriptive results alone; an appropriate statistical analysis would be required to determine whether participants' training backgrounds were associated with their knowledge levels. Overall, the findings indicate a need to strengthen the knowledge of healthcare workers regarding the follow-up of PLHIV. Targeted continuing professional development, regular dissemination of updated national HIV guidelines, case-based training and supervision may help improve understanding of viral load monitoring and treatment follow-up. These interventions should be evaluated to determine whether they lead to measurable improvements in healthcare workers' knowledge and the implementation of recommended practices.

Medical history and physical examination

All 203 participants (100%) selected that medical history and physical examination should be conducted at every clinic visit, while none selected once a year. This result indicates a unanimous response regarding regular clinical assessment. Routine clinical follow-up is an important component of HIV care because it allows healthcare workers to assess symptoms, identify opportunistic infections, evaluate treatment tolerance and identify other clinical problems. The World Health Organization (WHO) emphasizes the importance of ongoing clinical assessment as part of comprehensive HIV treatment and care [7]. However, the questionnaire responses alone do not establish whether these practices are con-

sistently implemented in daily clinical work.

Frequency of viral load testing

All 203 participants (100%) selected the option recommending viral load testing every three months for pregnant women and at six and 12 months for both sexes. This unanimous response suggests a common understanding of the importance of viral load monitoring. WHO recommends routine viral load testing by six months after ART initiation, at 12 months and annually thereafter for people established on treatment [7]. Pregnant and breastfeeding women may require additional monitoring according to national guidelines and the timing of ART initiation, because maintaining viral suppression is important for maternal health and prevention of vertical HIV transmission [16]. The exact answer should nevertheless be checked against the current Cameroonian national guideline, as monitoring schedules may differ according to pregnancy status, treatment history and clinical circumstances.

Tuberculosis screening

All 203 respondents (100%) selected tuberculosis (TB) screening at each clinical visit. This finding suggests strong awareness of the importance of TB screening among PLHIV. People living with HIV are at increased risk of developing active TB, and WHO recommends systematic screening for TB among people living with HIV, including symptom screening at clinical encounters [17]. Early identification of presumptive TB can facilitate timely diagnostic evaluation and treatment, thereby improving patient outcomes. However, a positive screening result should lead to appropriate diagnostic assessment rather than being interpreted as confirmation of TB.

Pregnancy testing among women of childbearing age

All respondents (100%) selected pregnancy testing at each visit for women of childbearing age, while none selected testing for all women. This unanimous response demonstrates agreement with the selected option. However, the frequency of pregnancy testing should be guided by clinical circumstances, the patient's reproductive intentions and national protocols; testing at every visit is not necessarily a universal requirement for all women of childbearing age. WHO guidance supports integrating sexual and reproductive health services into HIV care and providing appropriate assessment according to individual needs [7].

Hepatitis B surface antigen (HBsAg) testing

All participants (100%) selected HBsAg testing at treatment initiation or when clinical signs appear, rather than testing all patients without clinical signs. This result indicates agreement among respondents, but it should not automatically be interpreted as evidence of correct knowledge. Hepatitis B coinfection is clinically important in HIV care because it can influence ART regimen selection and the management of liver disease. WHO HIV treatment guidance recommends appropriate assessment for relevant coinfections and consideration of hepatitis B status when selecting treatment [7]. Whether testing should be performed universally at baseline or according to specific indications should be verified against current

Cameroonian national recommendations and local testing protocols.

Syphilis testing

For syphilis screening, 166 participants (81.77%) selected testing at treatment initiation and annually when risk exists. Six respondents (2.95%) selected testing only at one month, while 31 (15.27%) selected none of the proposed options. The predominance of the first response suggests that most participants recognized the importance of risk-based syphilis screening. WHO recommends syphilis screening for relevant populations and clinical circumstances, particularly during pregnancy, and emphasizes timely diagnosis and treatment to prevent complications [14]. The proportion of respondents who selected no screening option indicates a possible gap in knowledge that could be addressed through continuing education. The exact frequency of screening should follow national guidance and individual risk assessment.

Participants attitudes and practice regarding the follow-up of PLHIV

Table 7 presents the assessment of participants' attitudes and practices regarding the follow-up of people living with HIV (PLHIV). Of the 203 healthcare workers surveyed, 119 (58.5%) demonstrated a good level of attitude and practice, while 84 (41.5%) were classified as having an appropriate level. These findings indicate that more than half of the participants achieved the higher category reported in the table. However, the proportion in the other category remains substantial, suggesting that improvements in attitudes and practices related to HIV follow-up may still be needed. The importance of appropriate healthcare practices is supported by Kippen *et al.* (2024), whose systematic review of viral load monitoring programs in sub-Saharan Africa identified considerable variation in monitoring coverage and in subsequent management of patients with virological failure [18]. The authors highlighted the need to strengthen health systems and improve the continuity of viral load monitoring and follow-up. Their findings provide a useful regional context for understanding why healthcare workers' practices are important for effective HIV care.

Similarly, Kumwenda *et al.* (2024), in a study of healthcare workers' practices and challenges in monitoring adherence and follow-up in Malawi, examined factors affecting the delivery of HIV care and the implementation of patient follow-up activities [19]. This evidence reinforces the importance of supporting healthcare workers through appropriate training, clear protocols and effective service organization.

Association between healthcare facility and attitude/practice level

Table 8 examines the relationship between the type of healthcare facility and participants' attitude/practice level regarding the follow-up of people living with HIV (PLHIV). The table reports a statistically significant association between the two variables ($p < 0.001$). This result suggests that attitude/practice classification may differ according to the healthcare facility, provided that the data have been correctly entered and the statistical test appropriately applied. Differences in healthcare workers' practices between facilities may be related to organizational factors, ac-

cess to updated clinical guidelines, opportunities for professional training, supervision and the availability of resources. However, these factors were not directly measured in the presented table and should therefore be considered possible explanations rather than established causes. Warner (2013) explains that statistical tests of association are used to determine whether the distribution of a categorical outcome differs according to another categorical variable [20]. Similarly, Hess and Hess (2017) discuss the use of Pearson's chi-square test and Fisher's exact test to evaluate associations between categorical variables [21]. These methods support the statistical approach used to investigate whether attitude/practice level varies between the two facilities.

5. Study Limitations

This study has some limitations that should be considered when interpreting the findings. The use of convenience sampling and a relatively small sample size may have reduced the representativeness of the study population and limited the generalizability of the results to the broader Cameroonian population. Furthermore, as the study was conducted in only two health districts in the West Region of Cameroon, the perceived barriers and proposed strategies may differ in other sociocultural and geographical settings across the country.

The sample size calculated using Cochran's formula was 339 participants; however, only 203 participants were recruited for the study. This shortfall was primarily due to the limited time available for data collection. Consequently, the smaller sample size may have reduced the statistical power of the study and may limit the generalizability of the findings to the broader target population.

6. Conclusion

At the end of this study on the knowledge, attitudes, and practices of medical and paramedical staff regarding the biological monitoring of people living with HIV in the Dschang health district, several key findings emerge. Viral load coverage is generally satisfactory, with rates above 95% in both hospitals assessed. However, a notable weakness is observed regarding additional tests such as CD4 counts, creatinine, and cervical cancer screening, whose integration remains insufficient. Overall, the staff's level of knowledge appears good in 52.2% of respondents, reflecting a relatively adequate but improvable theoretical foundation. Attitudes and practices are considered good in 58.5% of cases, showing a promising professional commitment, although certain aspects of care still need to be strengthened. Finally, the analysis of influencing factors revealed that young caregivers, especially those aged 20 to 30, are significantly more exposed to a lack of knowledge, which highlights the importance of strengthening skills from the early years of practice.

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Consent for Publication

All respondents gave their consent to the publication of anonymized information.

Availability of Data and Materials

All data generated or analyzed during this study are included in this published article and its supplementary information files, and additional data are available from the corresponding author upon reasonable request.

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Author Contributions

Stephanie Dzene ^{1*} conceived and designed the study, developed the research protocol, collected and analyzed the data, interpreted the findings, and drafted the initial manuscript. Bienvenu Nkissi KAMLA.G. contributed to the study design, provided scientific supervision, guided the research process, and critically reviewed the manuscript. Charles Kouanfack supervised the overall research process, contributed to the methodological approach, provided scientific guidance, and reviewed the manuscript critically. All authors read and approved the final manuscript.

Conflicts of Interest

The authors declare that they have no personal or financial interests to disclose in connection with this research. None of the authors has any financial or personal relationships with other individuals or organizations that could inappropriately influence or bias their work.

References

- [1] Organisation mondiale de la Santé (OMS), Bureau régional pour l'Afrique (2024) VIH/Sida: 3 220 nouveaux cas en 2024. <https://www.afro.who.int/fr/countries/cameroon/news/vih-sida-3-220-nouveaux-cas-en-2024>
- [2] Ministère de la Santé Publique (2021) Plan stratégique national de lutte contre le VIH/SIDA 2021-2025. MINSANTE.
- [3] World Health Organisation (2017) Directives consolidées sur la prise en charge du VIH: Recommandations pour un système de santé axé sur les populations. WHO/HIV/

- 2017.15, OMS.
<https://iris.who.int/bitstream/handle/10665/260136/WHO-HIV-2017.15-fre.pdf>
- [4] Institut National de la Statistique (INS) (2018) Enquête Démographique et de Santé (EDS) 2018. INS.
 - [5] Miguez-Burbano, M.J., Burbano, X., Rodriguez, A., Lecusay, R., Rodriguez, N. and Shor-Posner, G. (2002) Development of Thrombocytosis in HIV+ Drug Users: Impact of Antiretroviral Therapy. *Platelets*, **13**, 183-185.
<https://doi.org/10.1080/0953371027984>
 - [6] Sissoko, G. (2024) Suivi biologique des personnes vivant avec le VIH/SIDA sous traitement ARV au CSRef de la commune V du district de Bamako. These, Université des Sciences, des Techniques et des Technologies de Bamako.
<https://www.bibliosante.ml/handle/123456789/13501>
 - [7] World Health Organization (2021) Consolidated Guidelines on HIV Prevention, Testing, Treatment, Service Delivery and Monitoring: Recommendations for a Public Health Approach. World Health Organization.
<https://www.who.int/publications/i/item/9789240031593>
 - [8] Bekolo, C.E., Ndeso, S.A., Moifo, L.L., Mangala, N., Ateudjieu, J., Kouanfack, C., *et al.* (2024) Changes in Access to Viral Load Testing, Incidence Rates of Viral Load Suppression and Rebound Following the Introduction of the “Universal Test and Treat” Guidelines in Cameroon: A Retrospective Follow-Up Analysis. *PLOS Global Public Health*, **4**, e0003042. <https://doi.org/10.1371/journal.pgph.0003042>
 - [9] Andi, T.E., Cho, Y., Akam, A.J.C., Afoh, C.O., Ryu, S.H., Choi, M.S., Kim, K. and Choi, J.W. (2015) Cameroon Public Health Sector: Shortage and Inequalities in Geographic Distribution of Health Personnel. *International Journal for Equity in Health*, **14**, Article No. 43.
 - [10] World Health Organization (2020) State of the World’s Nursing 2020: Investing in Education, Jobs and Leadership. WHO.
 - [11] Rasson, S., Boyer, S., Fugon, L., Protopopescu, C., Marcellin, F., Koulla-Shiro, S., *et al.* (2011) Decentralization of Access to Antiretroviral Therapy in Cameroon: Correlates of HIV Physicians’ Knowledge in HIV Care. *Antiviral Therapy*, **16**, 423-428. <https://doi.org/10.3851/imp1773>
 - [12] World Health Organization (2021) Consolidated Guidelines on HIV Prevention, Testing, Treatment, Service Delivery and Monitoring: Recommendations for a Public Health Approach. WHO.
 - [13] Kafack, E.V.F., Fokam, J., Nana, T.N., Saniotis, A. and Halle-Ekane, G.E. (2022) Evaluation of Plasma Viral-Load Monitoring and the Prevention of Mother-to-Child Transmission of HIV-1 in Three Health Facilities of the Littoral Region of Cameroon. *PLOS ONE*, **17**, e0277271. <https://doi.org/10.1371/journal.pone.0277271>
 - [14] World Health Organization (2017) WHO Guideline on Syphilis Screening and Treatment for Pregnant Women. WHO.
<https://www.who.int/publications-detail-redirect/9789241550093>
 - [15] World Health Organization (2018) Viral Suppression for HIV Treatment Success and Prevention of Sexual Transmission of HIV.
<https://www.who.int/news/item/20-07-2018-viral-suppression-for-hiv-treatment-success-and-prevention-of-sexual-transmission-of-hiv>
 - [16] World Health Organization (2021) Updated Recommendations on HIV Prevention, Infant Diagnosis, Antiretroviral Initiation and Monitoring. WHO.
<https://www.who.int/publications/i/item/9789240022232>

- [17] World Health Organization (2021) WHO Consolidated Guidelines on Tuberculosis. Module 2: Screening-Systematic Screening for Tuberculosis Disease. WHO. <https://www.who.int/publications/i/item/9789240022676>
- [18] Kippen, A., Nzimande, L., Gareta, D. and Iwuji, C. (2024) The Viral Load Monitoring Cascade in HIV Treatment Programmes in Sub-Saharan Africa: A Systematic Review. *BMC Public Health*, **24**, Article No. 2603. <https://doi.org/10.1186/s12889-024-20013-x>
- [19] Kumwenda, W., Bengtson, A.M., Wallie, S., Bula, A.K., Villiera, J.B., Ngoma, E., *et al* (2024) Monitoring Patient Adherence and Follow-Up in Option B+ Program: Understanding Healthcare Workers' Practices, Challenges, and Facilitators in Lilongwe, Malawi. *Journal of the International Association of Providers of AIDS Care*, **23**, 1-11. <https://doi.org/10.1177/23259582241299006>
- [20] Warner, P. (2013) Testing Association with Fisher's Exact Test. *Journal of Family Planning and Reproductive Health Care*, **39**, 281-284. <https://doi.org/10.1136/jfprhc-2013-100747>
- [21] Hess, A.S. and Hess, J.R. (2017) Understanding Tests of the Association of Categorical Variables: The Pearson Chi-Square Test and Fisher's Exact Test. *Transfusion*, **57**, 877-879. <https://doi.org/10.1111/trf.14057>