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Epidemiological, Clinical, Therapeutic and Evolutionary Profile of HIV-infected Patients Monitored at the Center of Excellence of the University of Lubumbashi

Philomène Lungu Anzwal[1,2], Dodo Manda Mukendi[2], Odon Panshi Wa Panshi[2], Athy Kalumba Kambote[1,3], Nathalie Mbuyamba Mutombo[2], Astrid Lokotshe Kanyama[2], Jirène Ndibu Ebondo[2], Salvatrice Masonga Madika[2], Franck Kasans Tshinyengo[2], Julie Ilunga[2], Mbelu Dina[2], Gloria Malitele Babile[2], Guy Kandja Lwamba[2], Eric Ngindu Mankoy[2], Odile Latshupanda Ampeng[2], Elie Kabika Yatambo[2], David Elo Lombe[2], Djo Banza Monga[2], Laurent Shamashanga Kwete[5], Jérôme Nyembo Lukamba[2], Tony Kayembe Kitenge[4]

[1]Department of Biomedical Sciences, Faculty of Medicine, University of Lubumbashi, Democratic Republic of Congo

[2]Center of Excellence for the Care of People Living with HIV/AIDS, Faculty of Medicine, University of Lubumbashi, Democratic Republic of Congo

[3]Laboratory of the University Clinics of Lubumbashi, Faculty of Medicine, University of Lubumbashi, Democratic Republic of Congo

[4]Biomedical Sciences, Higher Institute of Medical Techniques of Lubumbashi, Democratic Republic of Congo

[5]Faculty of Pharmaceutical Sciences, Department of Clinical Biology, University of Lubumbashi, Democratic Republic of Congo

***Corresponding Author**: Philomène Lungu Anzwal, lunguanzwal@gmail.com

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Abstract

Introduction: HIV infection is characterized by the progressive destruction of $CD4^+$ T lymphocytes, responsible for an immune deficiency, thus promoting the development of serious opportunistic infections and tumors.

Aim: The objective of this study was to describe the epidemiological, clinical, therapeutic, and disease progression of HIV-infected patients registered and monitored at the Center of Excellence at the University of Lubumbashi.

Methods: Retrospective descriptive study, carried out from 2006 to 2024 using patient records registered at the Center of Excellence. Data were collected using a previously established survey form. Variables collected: socio-demographic variables, opportunistic infections, stages of infection, antiretrovirals, treatment-related complications, mode of HIV transmission, and treatment progress. Data analysis was performed using SPSS 30.0 software. We calculated position and dispersion parameters.

Results: We collected 8,912 cases of HIV infection (24.95%) from a sample of 35,716 patients screened, including 5,271 women (59.1%) and 3,641 men (40.9%). The mean age was 35 ± 0.3 years. Opportunistic infections were dominated by pulmonary (31%) and extrapulmonary (8.8%) tuberculosis, digestive candidiasis (32.5%), cerebral toxoplasmosis (14.9%), isosporiasis (7.4%), herpes simplex (3.1%), cryptococcal meningitis (3.9%), vaginal candidiasis (3.7%), prurigo (3.3%), shingles (2.3%), Kaposi's sarcoma (2.2%), and diarrhea without isolated germs (2.1%). 99.6% of patients were receiving first-line treatment: tenofovir, lamivudine, and dolutegravir. The progression was marked by a death rate of 19.11%, significantly related to infections ($p<0.02$).

Conclusion: Despite awareness campaigns and the availability and free provision of antiretrovirals, the mortality rate and HIV prevalence remain high in Lubumbashi.

Keywords: Epidemiological, Clinical, therapeutic, and progression profile, PLHIV, Center of Excellence, Lubumbashi

Introduction

HIV infection is a chronic, manageable condition. It is characterized by the progressive destruction of CD4+ T lymphocytes, leading to immune deficiency, thus promoting the development of serious opportunistic infections and tumors. Thanks to antiretroviral treatment, people living with HIV can live long and healthy lives. According to a 2021 study by the World Bank on the total HIV prevalence among the population aged 15 to 49, HIV prevalence in this age group in the DRC is 0.6%, a low prevalence compared to neighboring countries such as Zambia (10.8%), Uganda (5.2%), Tanzania (4.5%), the Republic of Congo (3.8%), the Central African Republic (2.7%), Rwanda (2.3%), South Sudan (2.1%), Angola (1.6%), and Burundi (0.9%) [1]. Generally speaking, in Sub-Saharan Africa, it is 3.2% regardless of income [1].

The Democratic Republic of Congo is experiencing a generalized HIV epidemic with a prevalence rate of 1.1%, which is still low compared to neighboring countries and sub-Saharan Africa in general. This decline in HIV prevalence in the Democratic Republic of Congo and other countries reflects efforts in awareness campaigns for behavior change and voluntary HIV testing through the National Program to Fight HIV/AIDS (PNLS) [2]. However, some provinces in the Democratic Republic of Congo have relatively high prevalence compared to the overall prevalence of the country (1.1%). For example, the HIV prevalence is 6.9% in Haut-Uélé province, 3.9% in Maniema, 2.8%in Kasaï-Oriental, 2.6% in Haut-Katanga, 2.5% in the city of Lubumbashi, 2.4% in Bas-Uélé, 1.7% in Sankuru, 1.6% in the city of Kinshasa, and 1.4% in the province of Nord-Ubangi [UNAIDS 2018].

Since the Center of Excellence cohort consists of children, adolescents, and adults, most of the children and adolescents (98.9%) acquired HIV vertically and a few through blood transfusions (1.1%). As for the adults, most were infected sexually and some through blood transfusions. At the end of 2024, the Center of Excellence cohort included 623 sex worker and homosexual patients. This relatively high proportion of sex workers and homosexuals poses a significant risk of HIV transmission, as many patients refuse to use condoms. The study conducted by Aho *et al.* in 2014 attests that homosexuals and men who have sex with men (MSM) are vulnerable to HIV and often do not have access to adequate services [19]. Some emerging opportunistic diseases have been identified in the Center of Excellence cohort, including cryptococcal meningitis, pulmonary tuberculosis, digestive candidiasis, and skin infections (prurigo).

From 2006 to 2016, patient care was still faltering because self-stigma and stigma were a barrier to treatment; patients were ashamed to come freely to the Center. Most went hiding as soon as they met someone, they knew at the treatment center and could even flee the center. During this period, between 2006 and 2016, viral load and $CD4^+$ count testing were paid for and very expensive, and 70% of the cohort were destitute and did not undergo these tests. And yet, these were mandatory before being put on treatment. Only patients whose $CD4^+$ count was less than 200 $CD4^+/mm^3$ were eligible for treatment. Patients whose $CD4^+$ count was higher than 200 were not eligible for treatment, but they did benefit from prophylactic treatment with cotrimoxazole. At that time, antiretroviral treatment consisted of several drugs, such as lamivudine, stavudine, nevirapine, efavirenz, abacavir, zidovudine, and sometimes lopinavir/ritonavir, with two doses per day [20].

Treatment failure was due to non-adherence due to treatment-related side effects for some, and also immunological failure for others. This immunological failure was due to the depression of $CD4^+$ counts caused by the ineffectiveness of antiretrovirals, such as nevirapine, stavudine, efavirenz, didanosine, and lopinavir, to which the virus was resistant. This resulted in the death of approximately 2% of patients.

Complications related to taking ARVs can occur in some patients. The following molecules cause side effects:

Stavudine causes peripheral neuropathy and lipodystrophy; zidovudine causes anemia, vomiting, skin rash, and sometimes gynecomastia and skin hyperpigmentation; nevirapine causes skin rash and sometimes nausea. Efavirenz is the cause of neuropsychiatric or behavioral disorders, dizziness and palpitations; tenofovir causes kidney failure; abacavir causes skin rash and headaches; lopinavir increases blood sugar levels and induces diarrhea; and finally, dolutegravir causes, above all, muscle pain at the beginning of treatment, sometimes pasty stools [22].

The objective of this study was to describe the epidemiological profile, identify the dominant and emerging opportunistic diseases, the different antiretroviral associations used, evaluate the evolution of patient care and determine the case fatality rate of HIV-infected patients registered and monitored at the center of excellence/UNILU.

Patients and Methods

This is a retrospective descriptive study, focusing on the cohort of the Center of Excellence of the University of Lubumbashi, in the Democratic Republic of Congo, based on patient records recorded from December 2006 to December 2024, a long period of 18 years. All patient records followed for the management of HIV infection were included. Data collection was done using a previously established survey form. The variables collected were frequency, age, sex, occupation, marital status, residence, opportunistic infections, stages of HIV infection according to WHO, antiretroviral combination used, treatment-related complications, and mode of HIV transmission. In this study, we considered all ages without distinction of sex. We calculated the mean and standard deviation for quantitative variables, numbers as well as proportions for qualitative variables. Data analysis was

performed with SPSS 30.0 software. The alpha threshold was considered significant when the p-value was less than 0.05 for the confidence interval of 0.95.

Results

We collected 8,912 cases of HIV infection (24.95%) from a sample of 35,716 patients screened between 2006 and 2024. These included 5,271 women (59.1%) and 3,641 men (40.9%), all infected with HIV. The mean age was 35 ± 0.3 years, with a range of 2 to 92 years. The oldest subjects, aged 50 and over, numbered 3,179 (35.6%), while 437 (4.45%) were children ranging in age from 2 to 15 years. Married couples were more affected (29.36%). 99.61% of patients were on first-line treatment: tenofovir, lamivudine, and dolutegravir and 0.39% on second-line treatment: abacavir, lamivudine, and dolutegravir due to renal complications (renal failure). 55.7% of patients had undetectable viral loads (VL > 1000 copies/ml). 35.7% of patients did not have viral load results and 8.6% of patients still had detectable viral loads. 75.11% had opportunistic infections. 46.1% had opportunistic infections before HIV testing (before knowing the HIV serological status), 28% at the time of diagnosis, and 25.9% after starting antiretroviral treatment. 48.7%, or 4,345 patients in our cohort are alive and active. 39.69% were lost to follow-up, 9.8% died and 1.8% were transferred.

Opportunistic infections were dominated by tuberculosis, including 31% pulmonary tuberculosis and 8.8% extrapulmonary tuberculosis followed by digestive candidiasis (32.5%), cerebral toxoplasmosis (14.9%), isosporiasis (7.4%), herpes simplex (3.1%), cryptococcal meningitis (3.9%), vaginal candidiasis (3.7%), prurigo (3.3%), Kaposi's sarcoma (2.2%), shingles (2.3%), diarrhea without isolated germs (2.1%). 57.22% of patients were at WHO stage I, 12.77% at stage II, 26.72% at stage III, and 3.30% at stage IV. The evolution was marked by a death rate of 9.8% significantly linked to opportunistic infections (p< 0.02). Most patients in our cohort had at least one opportunistic infection.

The mean age was 35 ± 0.3 years, with a range of 2 to 92 years. Patients aged 50 and older represented 35.6% of patients. Married patients were the most commonly infected (29.36% with HIV). The sex ratio was 1.5 women to 1 man. Infected women were significantly younger (63.4%) than men (mean age 38 vs. 43 years, p<10). Most patients receiving antiretroviral therapy (99.61%) were on first-line therapy: tenofovir, lamivudine, and dolutegravir. The death rate was high among patients over 50 years, at 14.2%.

HIV status was most often discovered during the onset of an opportunistic infection in patients aged 41 to 50 years (p=0.07) **(Table 1)**. 75.11% of patients had at least one opportunistic

Table 1. Sociodemographic variables, opportunistic diseases and therapeutic protocol.

Variables	**≤ 15**		**16 – 40**		**41 - 50**		**> 50**		**Total**		p-value ‡
Gender	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**<10,5**
Female	229	**51.8**	1,766	**63.4**	1,520	**60.6**	1,756	**55.3**	5,271	**59.1**	
Male	213	**48.2**	1,019	**36.6**	988	**39.4**	1,421	**44.7**	3,641	**40.9**	
Marital Status											
Single	437	**100**	1,205	**43.24**	23	**0.92**	45	**1.42**	1,710	**19.19**	
Divorced	0	**0**	139	**4.99**	877	**34.95**	376	**11.83**	1,392	**15.62**	
Married	**0**	**0**	**823**	**29.53**	601	**23.95**	1,193	**37.53**	2,617	**29.36**	
Widowed	0	**0**	231	**8.29**	354	**14.11**	879	**27.65**	1,464	**16.43**	
Common-law	0	**0**	389	**13.96**	654	**26.07**	686	**21.58**	1,729	**19.4**	
Type of Therapeutic Protocol											**0.08**
Current First Line (TLD)	437	**100**	2,787	**139.84**	2,498	**99.56**	3,155	**99.25**	8,877	**99.61**	
Second Line (ABC)	0	**0**	0	**0**	11	**0.44**	24	**0.75**	35	**0.39**	
Viral load											
Patients Without Viral load	248	**56.1**	1,215	**43.6**	859	**34.3**	860	**27.0**	3181	**35.7**	
< 1,000 Copies	157	**35.5**	1,321	**47.4**	1,431	**57.1**	2,059	**64.8**	4,966	**55.7**	
≥ 1,000 Copies	37	**8.4**	249	**9.0**	218	**8.7**	261	**8.2**	765	**8.6**	
Presence of opportunistic infections											**0.02**
Yes	391	**89.47**	2391	**85.79**	1,550	**61.78**	2,362	**74.3**	6,694	**75.11**	
No	46	**10.53**	396	**14.21**	959	**38.22**	817	**25.7**	2,218	**24.89**	

Times of occurrence of the opportunistic infections											**0.7**
Before screening	109	**27.88**	1,589	**66.46**	1,243	**80.19**	145	**6.14**	3,086	**46.1**	
At diagnosis	45	**11.51**	456	**19.07**	17	**1.1**	1,356	**57.41**	1,874	**28**	
After starting ARVs	237	**60.61**	346	**14.47**	290	**18.71**	861	**36.45**	1,734	**25.9**	
Status at the time of study											
Actively alive	171	**38.7**	1,363	**48.9**	1,183	**47.2**	1623	**51.1**	4,340	**48.7**	
Deceased	27	**6.1**	201	**7.2**	195	**7.8**	450	**14.2**	873	**9.8**	
Lost from follow-up	239	**54.1**	1183	**42.5**	1,076	**42.8**	1,045	**32.9**	3,543	**39.7**	
Transfer	5	**1.1**	38	**1.4**	54	**2.2**	59	**1.8**	156	**1.8**	

infection. We did not find a statistically significant association between ARV adherence and age (p=0.08). One-third of those aged 50 and over (32.3%) had at least one associated condition. 39.7% of patients were lost to follow-up.

Table 2 shows that pulmonary (31%) and extra-pulmonary (8.8%) tuberculosis dominate, followed by digestive (32.5%) and vaginal (3.7%) candidiasis, cerebral toxoplasmosis (14.9%), meningeal cryptococcosis (3.9%) and prurigo (3.3%).

The results of this **Table 3** reveal that 100% of women were infected with vaginal candidiasis and 94.6% had cryptococcal meningitis. On the other hand, 64.8% of men had pulmonary tuberculosis, 63.5% had extrapulmonary tuberculosis, and 61.0% had generalized Kaposi's sarcoma.

Table 4 shows that the age group >50 years had 81.2% cases of diarrhea without isolated germs, 60.4% of prurigo, 54.4% of generalized Kaposi's disease and 60.2% of cases of extra-pulmonary tuberculosis and that of 41-50 years had 84.4% cases of vaginal candidiasis, 35.5% of Herpes, and 31.5% of pulmonary tuberculosis.

Results from **Table 5** show that 41.13% of patients had physical asthenia due to antiretrovirals Zidovudine, Efavirenz, Lopinavir/ritonavir and Tenofovir, followed by 27.5% of patients who had nausea and vomiting due to antiretrovirals Zidovudine and Nevirapine.

Table 6 results reveal that 79.31% of adults were infected through blood and sexual transmission and 13.57% of children and adolescents were infected with HIV through vertical transmission.

Table 7 demonstrates a very good evolution of treatment in children, of whom 210/283 children are still alive, or 74.2%. 48.7% of patients in the cohort of the Center of Excellence are alive.

The results of **Table 8** show that emerging opportunistic diseases were dominated by digestive candidiasis 32.5%, followed by pulmonary tuberculosis 31%.

Table 2. Frequency of opportunistic infections in the cohort.

Opportunistic infections	N=8912	%
Digestive candidiasis	**2,897**	**32.5**
Pulmonary tuberculosis	**2,765**	**31**
Extrapulmonary tuberculosis	**781**	**8.8**
Isosporosis	**658**	**7.4**
Cerebral toxoplasmosis	**1,329**	**14.9**
Cryptococcal meningitis	**345**	**3.9**
Vaginal candidiasis	**333**	**3.7**
Generalized Kaposi's sarcoma	**195**	**2.2**
Shingles	**205**	**2.3**
Diarrhea without isolated germs	**191**	**2.1**
Herpes	**276**	**3.1**
Prurigo	**293**	**3.3**
Pneumocystosis	**59**	**0.7**

Table 3. Frequency of opportunistic diseases according to sex.

	Female		Male		Total	
Opportunistic infections	**N**	**%**	**N**	**%**	**N**	**%**
Digestive candidiasis	1,982	**68.4**	915	**31.6**	2,897	100
Pulmonary tuberculosis	973	**35.2**	1,792	**64.8**	2,765	100
Extrapulmonary tuberculosis	285	**36.5**	496	**63.5**	781	100
Isosporosis	658	**100**	0	**0.0**	658	100
Cerebral toxoplasmosis	959	**72.2**	370	**27.8**	1,329	100
Cryptococcal meningitis	180	**52.2**	165	**47.8**	345	100
Vaginal candidiasis	333	**100**	0	**0**	333	100
Generalized Kaposi's sarcoma	76	**39**	119	**61**	195	100
Shingles	128	**62.4**	77	**37.6**	205	100
Diarrhea without isolated germs	122	**63.9**	69	**36.1**	191	100
Herpes	261	**94.6**	15	**5.4**	276	100
Prurigo	179	**61.1**	114	**38.9**	293	100
Pneumocystosis	38	**64.4**	21	**35.6**	59	100

Table 4. Frequency of opportunistic diseases according to age groups.

	≤ 15		16 – 40		41 - 50		> 50		Total	
Opportunistic infections	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Digestive candidiasis	69	**2.4**	815	**28.1**	900	**31.1**	1113	**38.4**	2,897	100
Pulmonary tuberculosis	70	**2.5**	658	**23.8**	870	**31.5**	1167	**42.2**	2,765	100
Extrapulmonary tuberculosis	6	**0.8**	100	**12.8**	205	**26.2**	470	**60.2**	781	100
Isosporosis	0	**0**	94	**14.3**	237	**36**	327	**49.7**	658	100
Cerebral toxoplasmosis	47	**3.5**	375	**28.2**	362	**27.3**	545	**41**	1,329	100
Cryptococcal meningitis	23	**6.7**	96	**27.8**	66	**19.1**	160	**46.4**	345	100
Vaginal candidiasis	0	**0.0**	52	**15.6**	281	**84.4**	0	**0**	333	100
Generalized Kaposi's sarcoma	1	**0.5**	42	**21.5**	46	**23.6**	106	**54.4**	195	100
Zona	1	**0.5**	74	**36.1**	58	**28.3**	72	**35.1**	205	100
Diarrhea without isolated germs	0	**0**	18	**9.4**	18	**9.4**	155	**81.2**	191	100
Herpes	0	**0**	66	**23.9**	98	**35.5**	112	**40.6**	276	100
Prurigo	10	**3.4**	64	**21.8**	42	**14.4**	177	**60.4**	293	100
Pneumocystosis	0	**0**	11	**18.6**	24	**40.7**	24	**40.7**	59	100

Table 5. Frequency of complications related to ARV treatment.

Types of Complications	**Number of patients**	**Percentage**	**Antiretroviral treatment involve**
Neurological	336	11.2	Stavudine, Zidovudine, Efavirenz, Didanosine
Anemia	214	7.15	Zidovudine
Gynecomastia	13	0.43	Zidovudine, Efavirenz

Cutaneous and Mucous Membranes	69	2.31	Névirapine, Zidovudine, Efavirenz, Abacavir
Digestive	112	3.74	Zidovudine, Dolutégravir lopinavir/Ritonavir, Abacavir
Psychiatric	118	3.94	Efavirenz
Psychiatric	48	1.60	Ténofovir
Amenorrhea	29	1	Zidovidine, Efavirenz
Nausea, Vomiting	823	27.5	Zidovudine, Névirapine
Physical Asthenia	1,231	41.13	Zidovudine, Efavirenz, Lopinavir/Ritonavir, Ténofovir
Total	2,993	100	

Table 6. Modes of HIV transmission in patients in the cohort.

Patients	Effective	Percentage	Mode of transmission
Children and Adolescents	6	0.06	Blood stream (transfusion)
Children and Adolescents	1,211	13.57	Vertical track
Adolescents	4	0.04	Sexual way
Adults	7068	79.31	Blood stream and sexual
Sexually Impaired Men and Women (MSM)	623	6.98	Sexual way
Total	8,912	100	

Table 7. Age-related HIV progression and treatment evolution.

Patients	Effective	Age	Survivors	Lost Sight of	Transfer out	Death	Evolution of treatment
Children	283	2 -12	210 (74.2%)	90	5	17	Very good
Adolescents	938	13-17	445 (47.4%)	412	12	81	Pretty good
Adults	7,691	≥ 18	3,690 (48%)	3,035	140	775	Pretty good
Total	8,912		4,345 (48.7%)	3,537	157	873	Pretty good

Table 8. Frequency of emerging opportunistic diseases.

Emerging Opportunistic Diseases	Number	Percentage %
Digestive Candidiasis	**2,897**	32.5
Pulmonary Tuberculosis	**2,765**	**31**
Cryptococcosis Neuromeningitis	**345**	**3.9**
Prurigo	**293**	3.3

Discussion

The data collected from our patient registers could be extrapolated to the level of the city of Lubumbashi, particularly in the Democratic Republic of Congo, given the size of our sample and the size of our cohort, with over 4,000 active patients to date. From 2006 to 2024, we detected 8,912 cases of HIV infection out of 35,716 patients screened, representing a prevalence of 24.95%. The high and persistent HIV prevalence of 24.95%, despite awareness campaigns, can be justified by the fact that the data we have presented on HIV prevalence and persistence included those patients who registered at the opening of the Centre of Excellence (2006) and data up to the year 2024.

Retrospective studies over a long period are interesting because they allow for the rapid delineation of the results. At the same time, such a study can reveal a series of difficulties encountered in the patient care process. Retrospective studies over a long period also aim to analyze previous data to answer clinical questions.

The high HIV prevalence could also be justified, on one hand, by the proximity to the countries of southern Africa which still have fairly high HIV prevalence such as Zambia (10.8%) and Tanzania (4.5%), and on the other hand, by the movement of populations which interact through trade and tourism, the city of Lubumbashi being the gateway to and from the countries of southern Africa.

The back-and-forth traffic of truckers who do not monitor their HIV status, and who are high-risk individuals, only increases HIV transmission. This high HIV prevalence is further justified by the mining boom in Katanga, where the population engages in artisanal mining and prostitution without using condoms.

The HIV prevalence (24.95%) provides ample evidence that HIV infection is not yet under control in Lubumbashi, Democratic Republic of Congo. This rate is notably higher than that reported by Diallo et al. (2021) in Senegal (15.9%) [3] and by Mbopy-Kéou et al. (2012) in Cameroon (14.1%) [4], despite our study covering an extended period. The predominance of female prevalence (59.1%) noted in our study is comparable to that observed in many African studies and elsewhere in the world [3,5,10,16,17, and especially in the 16-40 age group (63.55%) [17,18].

This predominance of HIV prevalence in women is linked to the anatomical predispositions and socioeconomic factors such as poverty. During sexual intercourse, women are more vulnerable to HIV than men. Several biological factors explain this vulnerability of women to HIV; for example, women have a larger area of exposed mucous membranes, a large quantity of sexual fluid is transferred from men to women during sexual intercourse, the viral load in seminal fluid is greater than that of vaginal fluid. In addition, the micro-tears in vaginal tissue caused by sexual penetration serve as gateways for HIV/AIDS [10, 16, 17. The prevalence of HIV among married people was 29.36%, which contrasts sharply with the findings of Kaba Kourouma which shows a low prevalence of 0.6% among married people in monogamous unions and 0.3% in polygamous unions [18].

The mean age of participants was 35 ± 0.3 years, with the extremes being 2 and 92 years, which is almost identical to the study findings by Gbangba-Ngai *et al.* (2014), who reported a mean age of 35 years with an age range of 18 to 69 years. However, it is slightly lower compared to the study carried out by Mbopy-Kérou *et al.* in 2012 and 2013 (mean age: 39 ± 0 years, extremes 17 and 88 years). The observed age gap can be justified by the fact that children are part of this cohort.

In this study, opportunistic infections were dominated by tuberculosis (pulmonary 31% and extra-pulmonary 8.8%), followed by digestive candidiasis (32.5%), cerebral toxoplasmosis (14.9%), meningeal cryptococcosis (3.9%) and prurigo (3.3%). These results align with the findings of Ouédraogo et al. (2007) in Mali, who reported a high prevalence of pulmonary and extrapulmonary tuberculosis at 28.9%, with pulmonary tuberculosis accounting for 73.1% of cases. Additionally, 27.3% of infections were fungal, including 11.7% neuro-meningeal cryptococcosis, while the remainder were primarily candidiasis. Other reported conditions included gastroenteritis (21.1%), toxoplasmosis (16%), and genital herpes (6.7%) [21]. Our results are similar to those reported by Apetse et al. (2011) in their study on opportunistic HIV/AIDS infections in adults in a hospital setting in Togo. They found a high prevalence of oral candidiasis at 49.7%, along with pulmonary tuberculosis at 11.3%, extrapulmonary tuberculosis at 2.9%, neuromeningeal cryptococcosis at 2.9%, and cerebral toxoplasmosis at 11.2%—all somewhat lower than the prevalence observed in our study [21].

Studies conducted in Senegal and Cameroon have indicated similar results. This is the case of the studies of Seydi *et al.* (2008) reported prevalences of 40% for oral candidiasis and 30% for pulmonary tuberculosis, while Mbopi *et al.* (2012 and 2013) [4- 8] also documented high prevalences, particularly of pulmonary tuberculosis. Mbopi et al. further noted that the frequency of comorbidities was significantly higher in patients aged 50 years and older ($p < 0.05$). The study by Roufik *et al.* (2022) reported that opportunistic infections were dominated by tuberculosis (54%), followed by pneumocystosis (10%), toxoplasmosis (8%), esophageal candidiasis (7%), cryptococcosis (6%), CMV infection and cryptosporidiosis (4% and 3% respectively) [9]. The prevalence of tuberculosis in their study exceeds (54%) that found in ours, while the prevalence of esophageal candidiasis is lower (7%) than in our study. This high prevalence of tuberculosis may be justified by the lower number of patients involved in the study (small sample). We found a prevalence of meningeal cryptococcosis of 3.9%, a lower prevalence than that of the study by Gbangba-Ngai *et al.* (6.5%) [11].

The study conducted by Okome-Nkoumou *et al.* confirmed that the prevalence of opportunistic infections classified as AIDS followed this order: prurigo (100%), cerebral toxoplasmosis (100%), oral candidiasis (88%), bacteremia (87.8%), shingles (84.6%), minor salmonellosis (72%), and tuberculosis (53%) [12]. These prevalence rates are much higher than those in our study but are supported by the findings of Zwang *et al.* (2004) and Domoua *et al.* (1997) [13,14]. The prevalence of cryptococcal meningitis (3.9%) in our study was identical to that found by El Mansouri *et al.* (1999), in their study conducted on ocular lesions during HIV infection in Casablanca, i.e. 3.7% of ocular cryptococcosis [15]. The delay in diagnosis explains the importance of opportunistic infections. We found that 57.41% of patients over 50 years of age knew they were infected with HIV when opportunistic infections occurred. These results are consistent with those found by Manga NM *et al.* (2009) [16].

The epidemiological, clinical, and therapeutic evolutionary characteristics described in our patients are close to those reported by most authors. In our study, a high prevalence of

the following opportunistic diseases was observed: pulmonary tuberculosis, cryptococcal neuromeningitis, digestive candidiasis, and prurigo **(Table 8)**. These opportunistic infections are qualified as emerging opportunistic infections because their incidence has increased recently. A total of 39.7% of patients were lost to follow-up (Table I). This high rate can be attributed to the eligibility criteria for antiretroviral (ARV) treatment that were in place at the time. All patients with a $CD4^+$ count less than 200 cells/mm^3 were eligible for antiretroviral treatment. However, patients with $CD4^+$ counts greater than 200 were not eligible for treatment, but they benefited from prophylactic treatment with cotrimoxazole. These patients with $CD4^+$ counts above 200 cells/mm^3 awaiting antiretroviral treatment should return to the center 6 months later to measure their $CD4^+$ count.

But unfortunately, most of them did not return for follow-up $CD4^+$ testing due to financial constraints. In addition, there were also other reasons such as religious beliefs that described HIV disease as a bad fate, and some believed traditional medicine provided better treatment than modern medicine. These factors contributed to the high rate of loss to follow-up. A total of 35.7% of patients did not have viral load results. This high percentage of missing viral load data is due to the fact that between 2006 and 2016, viral load testing was chargeable (US$40), was not an eligibility criterion for ARV treatment, and was also not accessible to all patients **(Table 1)**.

The results of our cohort on age-related HIV progression and treatment progress show that it is very good in children aged 2 to 12 years and very good in adolescents and adults **(Table 7)**. These results are contrary to those found by Tshikwej Ngwej *et al.* (2020) in their study on "Clinical and biological evolution of HIV-infected children under antiretroviral treatment in Lubumbashi, Democratic Republic of Congo" where they demonstrated a treatment failure significantly associated with age ≥ 10 years during the assessment of care [23].

Limitations of the study

Viral load testing represents a weakness of this study because the Center of Excellence does not have a molecular biology laboratory to perform viral load analysis and must therefore rely on the National Laboratory of the PNLS (National Program to Combat HIV/AIDS) to perform viral load testing. This results in delayed results, which do not meet the recommended two viral load tests per year. This situation sows doubt among patients, who refuse to repeat the test until they have received the first viral load result. Some patient records in our cohort were misplaced following the building renovation and reorganization of the workspace. The patient records in our cohort were not computerized for the first ten years of its existence, resulting in the loss of records for some patients who were lost to follow-up.

Conclusion

Improved access to antiretroviral treatment has extended the survival of people living with HIV and led to an aging population within the cohort. It has also reduced the occurrence of opportunistic HIV/AIDS infections. Regular health care for people living with HIV/AIDS improves the length and quality of life and helps prevent the onset of opportunistic infections and HIV-related illnesses. However, despite awareness campaigns and the availability and free provision of antiretrovirals, the hospital prevalence of HIV infection and mortality remain high. The continued high HIV prevalence in the cohort of the Center of Excellence at the University of Lubumbashi is believed to be linked to the socioeconomic conditions of the population and the refusal to undergo systematic HIV testing. The study revealed that most patients only receive information about their HIV status when opportunistic HIV/AIDS infections occur. Awareness and education of the population on HIV/AIDS are necessary for early consultation in hospital structures organizing voluntary screening.

Conflicts of Interest

The authors declare no conflicts of interest.

Author Contributions

All authors contributed to the writing of this article. They have read and approved the final version.

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References

1. Prévalence du VIH total de la population âgée de 15 à 49 ans, Données. Banquemondiale.org/indicateur/SH.DYN.AIDS.ZS 2021

2. Plan stratégique de lutte contre le VIH et le SIDA 2014 – 2017, Programme National Multisectoriel de Lutte contre le SIDA (PNMLS), juin 2014.

3. Diallo K, Wembulua BS, Sarr GD, Badiane A, Pudence BBN, Diatta A, et al. « Infection à VIH chez le sujet âgé : Profil épidémiologique et clinique dans la région de Ziguinchor au sud du Sénégal » Revue Africaine de Médecine interne (RAFMI). 2021;8(1):19-24.

4. Mbopi-Kéou FX, Djomassi LD, Monebenimp F. Aspects descriptifs du VIH/SIDA chez les sujets âgés de 50 ans et plus suivis au Centre de Traitement Agréé de Bafoussam - Cameroun [Descriptive aspects of HIV/AIDS in patients aged 50 years and over followed at the Treatment Center of Bafoussam - Cameroon]. Pan Afr Med J. 2012;12:107. French.

5. Mbopi-Keou FX, Nguefack-Tsague G, Kalla GC, Viche L, Noubom M. Profil épidémiologique de l'infection à VIH au cours d'une campagne de sensibilisation à Yaoundé au Cameroun [Epidemiological profile of HIV infection during an awareness campaign in Yaounde, Cameroon]. Pan Afr Med J. 2013 Aug 5;15:119.

6. Seydi M, Diop SA, Niang K, Sow A, Soumaré M, Diop M, et al. Aspects épidemio-cliniques et psychosociaux au cours du sida à Dakar : étude préliminaire prospective. Rev. CAMES - Série A. 2008;7:74-6.

7. Bassandja O, Yakusu I, Bongenya B, Kamangu E, Apalata T. Profil Epidemiologique, Clinique Et Therapeutique Des Patients Infectes Par Le VIH Sous Traitement Antiretroviral A Kisangani, Republique Democratique Du Congo [Epidemiological, Clinical And Therapeutic Profile Of Hiv-Infected Patients On Antiretroviral Treatment In Kisangani, Democratic Republic Of Congo]. Mali Med. 2023;38(2):6-9.

8. Kautako-Kiambi M, Aloni-Ntetani M, Pululu P, Luyinduladio L, Ezinga-Atshitsha F, Lema-Landu P, et al. Profil sociodémographique, biologique et clinique de patients suivis dans un Centre de conseil et dépistage volontaire du VIH en zone rurale dans la province du Bas-Congo (RDC) 2006-2011 [Socio-demographic, biological and clinical profile of patients living with HIV during screening in a voluntary counselling and screening centre in a rural area of Mbanza-Ngungu, Democratic Republic of Congo, in 2006-2011]. Bull Soc Pathol Exot. 2013 Aug;106(3):180-3.

9. Roufik I, Maamar M, Nissrine J, Hajar K, El FFZ, Harmouch H, et al. Profil épidémiologique, clinique, thérapeutique, et évolutif de l'infection à VIH : à propos d'une série de 163 patients vivant avec le VIH. Revue Médecine interne. 2022 Dec;43(Supplément 2):A464.

10. Mbopi-Keou FX, Nkala IV, Kalla GC, Nguefack-Tsague G, Kamga HG, Noubom M, et al. Séroprévalence et facteurs associés au VIH et aux hépatites virales B et C dans la ville de Bafoussam au Cameroun [Prevalence and factors associated with HIV and viral hepatitis B and C in the city of Bafoussam in Cameroon]. Pan Afr Med J. 2015 Feb 19;20:156.

11. Gbangba-Ngai E, Fikouma V, Mossoro-Kpinde CD, Tekpa G, Ouavene JO, Yangba Mongba DS, et al. La cryptococcose neuroméningée au cours de l'infection à VIH à Bangui, à l'ère du traitement antirétroviral [Cryptococcal neuromeningitidis in HIV-infected patients in Bangui, in the era of antiretroviral treatment]. Bull Soc Pathol Exot. 2014 May;107(2):106-9.

12. Okome-Nkoumou M, Boguikouma JB, Kombila M. Les maladies opportunistes de l'infection par le VIH a l'hôpital Fondation Jeanne Ebori de Libreville, Gabon [Opportunistic diseases in HIV-infected patients at the Jeanne Ebori Foundation in Libreville, Gabon]. Med Trop (Mars). 2006 Apr;66(2):167-71.

13. Zwang J, garenne M - Emergence de la co-infection tuberculose VIH-sida en milieu rural Sud Africain (Agincourt). Sidanet 2004. www.sidanet.info

14. Domoua K, N'Dhatz M, Coulibaly G, Traoré F, Koffi J, Achi V, et al. Complications pulmonaires de l'infection par le virus de l'immunodéficience humaine en Afrique sub-saharienne [Pulmonary complications of human immunodeficiency virus infection in sub-Saharan Africa]. Rev Pneumol Clin. 1997;53(2):79-84.

15. el Mansouri Y, Zaghloul K, Himmich H, Amraoui A. Les atteintes oculaires au cours de l'infection par le VIH au CHU de Casablanca. (A propos de 400 cas) [Ocular damage during HIV infection at the University Hospital Center of Casablanca. (Apropos of 400 cases)]. Bull Soc Pathol Exot. 2000 Feb;93(1):14-6.

16. Manga NM, Diop SA, Ndour CT, Dia NM, Mendy A, Coudec M, et al. Dépistage tardif de l'infection à VIH à la clinique des maladies infectieuses de Fann, Dakar: circonstances de diagnostic, itinéraire thérapeutique des patients et facteurs déterminants [Late diagnosis of HIV infection in the Fann, Dakar clinic of infectious diseases: testing circumstances, therapeutic course of patients, and determining factors]. Med Mal Infect. 2009 Feb;39(2):95-100.

17. Lot F. Epidémiologie du VIH/sida et des autres infections sexuellement transmissibles chez les femmes [Epidemiology of HIV/AIDS and other sexually transmitted diseases in women]. Med Sci (Paris). 2008 Mar;24 Spec No 2:7-19.

18. Kabakourouma:https://dhsprogram.com/pubs/pdf/FR162/16Chapter16.pdf

19. Aho J, Hakim A, Vuylsteke B, Semde G, Gbais HG, Diarrassouba M, et al. Exploring risk behaviors and vulnerability for HIV among men who have sex with men in Abidjan, Cote d'Ivoire: poor knowledge, homophobia and sexual violence. PLoS One. 2014 Jun 24;9(6):e99591.

20. Ouedraogo SM, Ouedraogo M, Dagnan NS, Adom AH. Infections opportunistes au cours du Sida au CHU de Treichville [Side infection during HIV/AIDS at Trechville university health center (CHU)]. Mali Med. 2007;22(1):26-8.

21. Apetse K, Assogba K, Kevi K, Balogou AA, Pitche P, Grunitzky E. Infections opportunistes du VIH/sida chez les adultes en milieu hospitalier au Togo [Opportunistic infections of the HIV/AIDS in adults in hospital settings in Togo]. Bull Soc Pathol Exot. 2011 Dec;104(5):352-4.

22. Cissoko M. Badara Aliou, « Notification des effets secondaires des ARV à l'USAC du CSREF de la CIV » Thèse de médecine, Université des Sciences des Techniques et des Technologies de Bamako, 2015.

23. Tshikwej ND, Mukuku O, Malonga KF, Luboya NO, Kakoma SJB, Wembonyama OS. Évolution clinique et biologique des enfants infectés par le VIH sous traitement antirétroviral à Lubumbashi, République Démocratique du Congo. HIV Epidemiology, Infectious disease, Pediatrics (General). 2020;2:21.