



Decentralized Care for People Living with HIV in Koumpentoum (Senegal): Prevalence and Factors Associated with Unfavourables Outcomes from 2005 to 2022

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Abstract: *Background:* In a context of challenges to achieve the three (95), we studied the decentralized management of HIV infections in the health district of Koumpentoum. Our research focused on the prevalence and factors associated with unfavorable outcomes from (2005) to (2022). *Methodology:* This was a retrospective, descriptive and analytical study. The dependent variable was unfavorable outcomes, which included deaths and dropouts. The independent variables were related to socio-demographic, clinical, para-clinical, therapeutic and outcome characteristics. In the multi variate analysis, multiple logistic regression was used. *Results:* A total of (782) patients were included. There was a clear female predominance with (66.5%). More than half (56.26%) of the patients were under (45) years of age. Two thirds of them were living in a couple (65.98%). Almost three quarters (73.15%) had no income-generating activity. At inclusion, co-infection with tuberculosis was (2.56%). Viral load was not performed in more than three quarters (76.6%). Of those who had a viral load test (42.07%), the level was undetectable. Almost all (95.03%) were put on first line antiretroviral and less than half of them (43.86%) were on Dolutegravir. In terms of outcomes, (36.83%) of the patients were lost to follow-up, (20.08%) died and (43.09%) were still on follow-up. Factors statistically and significantly associated with an unfavorable outcomes were age less than (45) years (ORa = 2.15 [1.16-3.97]; p=0.014), not living with a partner (OR = 3.35 [2.7-4.7]; p<0.001), not having an income-generating activity (OR = 2.08 [1.51-2.87]; p=0.008), presenting tuberculosis at inclusion (OR = 5.78 [1.32-25.21]; p<0.008) and no treatment with Dolutegravir (ORa = 23.74 [11.97-47.1]; p<0.001). *Conclusion:* Improving the management of HIV patients in Koumpentoum health district will require an active search for those who have been lost to follow-up, awareness raising and financial protection for young people and vulnerable groups, systematic screening for tuberculosis and widespread use of Dolutegravir.

Keywords: Care, Decentralized, PLHIV, Unfavourables, Outcomes, Koumpentoum, Senegal

1. Introduction

Human immunodeficiency virus (HIV) infection targets the immune system and weakens the body's natural defenses. Untreated, it leads to acquired human immunodeficiency

syndrome (AIDS), characterized by the development of opportunistic infections (OIs) and certain cancers [1, 2].

The AIDS pandemic is one of the greatest known scourges in history. Since its discovery in the United States (EU) in (1981) by Dr Robert Gallo [3], this infectious disease has so

far claimed (33) million lives. In (2019), the World Health Organization (WHO) estimated that there were (38) million people living with HIV (PLHIV) worldwide. In (2020), United Nations Programme on AIDS (UNAIDS) estimated that there were (37.7) million PLHIV, (1.5) million new infections and (686) thousand new deaths. Sub-Saharan Africa accounts for (67%) of HIV infections and women account for (63%) of new infections [4].

In Senegal, thanks to the public initiative under the aegis of the National AIDS Council (CNLS) and the Division for the Fight against AIDS and Sexually Transmitted Infections (DLSI) of the Ministry of Health and Social Action (MSAS), considerable progress has been made in the fight against this disease, with inter-national assistance. Indeed, the prevalence of HIV/AIDS among (15-49) years old has fallen from (0.75%) in (2004) to (0.32%) in (2021) [5]. Nevertheless, despite the advent of highly active antiretroviral therapy (HAART) and the decentralization of care, there are still significant gaps in the achievement of the three (95) in most health districts [6].

In (2021), according to administrative data, Koumpentoum health district recorded a performance of (149%) for the first (95), (36.3%) for the second (95) and (10.2%) for the third (95). Our research focuses on the prevalence and associated factors with unfavorable outcomes from the start of care for PLHIV from (31st) October (2005) until 31st October (2022) [7].

2. Methodology

2.1. Scope of the Study

Our study took place in the health district of Koumpentoum, which overlaps with the department of the same name. Its population is estimated in (2021) at (170,048) inhabitants on a surface area of (7,652) km², i.e. a density of (22.5) inhabitants per km². The capital of the department is located (365) km from Dakar [8]. The Fulani ethnic group, with (90%) of the population, is dominant, as well as the Mandingoes, the Serer of Terres Neuves and the Coniaguus of the town of Koumpentoum. The economic and social situation of the department is characterized by a low socio-economic level, low school enrolment, geographical and financial inaccessibility of the population to health care and services. There is a high rate of early marriage among young girls [9].

The health district has (01) a referral health centre which provides referral activities and also offers primary health care (PHC) and (22) health posts (which only offer PHC), the most distant of which is that of Loffè located (103) km from Koumpentoum. Care for people living with HIV, decentralized to (10) health posts since (2015), is being generalized in the district [7].

2.2. Type and Period of Study

This was a retrospective, descriptive and analytical study that was carried out over a period of (16) years, from the beginning of the decentralization of care in October (2005) to

October (2022).

2.3. Population Study

The study population consisted of HIV patients registered at the reference health centre and the (22) health posts.

2.4. Inclusion and Non-Inclusion Criteria

PLHIV followed up at the referral health center and at the health posts whose data was usable were included, whether they were on ARVs or not.

PLVHIV with incomplete or non-existent data and cases of blood or sex exposure accidents were not included.

2.5. Variables Definitions

Dependent variable was the treatment outcome, which included deaths and dropouts.

Independent variables were related to the following characteristics:

- 1) Socio-demographic: gender, age, age group, marital status, education level, income-generating activity (IGA);
- 2) Clinical: circumstances of discovery and WHO clinical stage;
- 3) Para-clinical: serological profile, co-infection at inclusion and viral load;
- 4) Therapeutics: put on (Isoniazid) INH and (Dolutegravir) DTG protocol;
- 5) And outcomes aspects.

2.6. Data Collection

Data were collected using the PLHIV survival rate model and included items relating to socio-demographic, clinical, para clinical, therapeutic and outcomes characteristics.

2.7. Data Analysis

Excel survival rate model data entry sheet was used as the database. The R software version (4.05) was used for the analysis.

In the descriptive analysis, quantitative variables were described using extremes, means and standard deviations. Categorical variables were described using frequencies surrounded by their confidence intervals (IC95%).

In bi variate analysis, Pearson's Chi2 statistical tests and Fisher's test under the conditions of applicability were used to test statistically significant relationships between independent variables and adverse outcomes.

In multi variate analysis, multiple logistic regression was used and included all independent variables associated with the adverse outcomes found in the bivariate analysis and those that the literature review revealed to be related to the dependent variable. The top-down stepwise method was used to retain variables associated with the treatment outcome at the $p < (5\%)$ threshold. These variables were then eliminated one by one by comparing the nested models according to their Aikake Information Criterion (AIC) [10]. The process was

continued until the maximum likelihood test found no improvement. The Hosmer-Lemeshow test [11] was used to check the fit of the final model. The strength of the relationship between the adverse outcomes and the independent variables was assessed by the OR in the bivariate analysis and the adjusted OR in the multivariate analysis surrounded by their 95% CI.

2.8. Ethical Considerations

Data was collected, stored and analyzed in strict anonymity and in respect of medical confidentiality. The results of the study will only be used for advocacy purposes to improve the care of PLHIV.

2.9. Study Limitation

Database initially designed for purely administrative and public health purposes did not contain all clinical and para-clinical data. However, most of the factors associated with adverse outcomes found in the literature review were tested in our sample and our results were consistent with those of other authors.

3. Results

3.1. Distribution According Demographic Aspects

A total of (782) PLVIH were included. There was a clear female predominance with (66.5%) women, i.e. a sex ratio of (0.5) (2 women for 1 man). The (30-44) age group was the most represented with (33.55%) of cases, followed by the (45-59) age group with (31.33%). More than half (56.26%) of the patients were under 45 years of age.

Table 1. Distribution according demographic aspects.

Variables	Absolutes frequencies (n = 782)	Relatives frequencies (%)
Gender		
Men	262	33.5
Women	520	66.5
Age group		
15-29	162	20.72
30-44	278	35.55
45-59	245	31.33
Over 65	97	12.4
Less than 45	440	56.27
Matrimonial Status		
Married monogamous	259	33.12
Married polygamous	257	32.86
In couple	516	65.98
No in couple	266	34.02
School education		
No school education	726	92.84
Koranic or Arabic	33	4.22
French	23	2.94
Not French school	759	97.06
Practicing an IGA		
Yes	210	26.85
No	572	73.15

Two thirds of the patients lived in couple (65.98%), half of whom (49, 8%) of whom were in polygamous status. Almost

all (92.84%) patients were illiterate, (4.22%) of them had been to Koranic school and only (2.42%) to French school. Nearly three quarters (73.15%) of patients did not engage in any income-generating activity (IGA) (Table 1).

3.2. Distribution According Clinic, Para Clinic, Therapeutic and Evolutionary Aspects

Medical care with (70.46%) was the most frequent circumstance of discovery followed by pregnancy (13.17%). Counseling for voluntary testing accounted for only (7.16%). Almost half (36.96%) of the patients were WHO stage 3 (32.74%) at WHO stage 3 and 4.22% at WHO stage 4).

Serological status was dominated by HIV-1 in (90.53%), followed by HIV2 with (8.57%) and the HIV1+2 profile with (0.89%). At inclusion, co-infection with hepatitis B was found in (8.94) of the cases compared to (2.43%) for tuberculosis. Viral load was not performed in more than three quarters (76.6%) of the patients. Among the PLHIV who had received it (42.07%), the rate was undetectable. Almost all (95.03%) of the PLHIV were put on first-line ARVs.

Only (3.96%) of PLHIV had received INH chemoprophylaxis and less than half of them (43.86%) were on TLD.

In terms of outcomes, (36.83%) of patients were lost to follow-up, (20.08%) died (56.98% adverse outcomes) and (43.09%) were still being followed (Table 2).

Table 2. Distribution according clinic, para clinic, therapeutic and evolutionary aspects.

Variables	Absolutes frequencies (n = 782)	Relatives frequencies (%)
<i>Circumstances of discovery</i>		
Medical Care	551	70.46
Maternal to child transmission	103	13.17
Family	49	6.26
Voluntary Counselling for Testing	56	7.16
Auto oriented (AA)	11	1.41
Tuberculosis	11	1.41
Blood Exposure Accident	1	0.13
<i>WHO stages infection</i>		
-1	201	25.7
-2	292	37.34
-3	256	32.74
-4	33	4.22
-3 or 4	289	36.96
<i>Serological profile</i>		
HIV 1	708	90.53
HIV 2	67	8.58
HIV 1 + 2	7	0.89
<i>Type of co infection</i>		
Tuberculosis	19	2.43
Hepatitis B	70	8.95
<i>Viral load</i>		
Not achieve	599	76.6
Achieve	183	23.4
Detectable	106	57.92
Undetectable	77	42.08
<i>Therapeutic aspects</i>		
ARV	751	95.03
INH	31	3.96
TLD	343	43.86

Variables	Absolutes frequencies (n = 782)	Relatives frequencies (%)
<i>Evolutionary aspects</i>		
Follow up	337	43.09
Deceased	157	20.08
Lost to view	288	36.83

3.3. Bi Variate Analysis

In bi variate analysis factors statistically and significantly associated with an unfavorable outcome were no life in couple (OR = 3.35 [2.7-4.7]; $p < 0.001$), no IGA (OR = 2.08 [1.51-2.87]; $p < 0.001$), TB at inclusion (OR = 5.78 [1.32-25.21]; $p = 0.008$) and no Dolutegravir treatment (OR = 20.15 [10.97-37.01]; $p < 0.001$) (Table 3).

Table 3. Associated factors with unfavorable outcomes in bi variate analysis.

Variables	OR	IC _{95%}	P value
Male sexe	1.33	[0.97-1.81]	0.069
< 45 years	0.89	[0.67-1.19]	0.46
No in couple	3.35	[2.4-4.7]	<0.001
No education	2.01	[0.87-4.64]	0.095
No IGA	2.08	[1.51-2.87]	<0.001
No VCT or AA	0.95	[0.57-1.59]	0.86
In stage 3 or 4	1.22	[0.91-1.65]	0.176
TB in inclusion	5.78	[1.32-25.21]	0.008
VIH2 or VIH1+2	1.09	[0.66-1.78]	0.721
No TLD treatment	20.15	[10.97-37.01]	<0.001

3.4. Multi Variate Analysis

In multi variate analysis, factors statistically and significantly associated with an unfavorable outcome were age < 45 years (ORa = 2.15 [1.16-3.97]; $p = 0.014$) and no DTG treatment (ORa = 23.74 [11.97-47.1]; $p < 0.001$) (Table 4).

Table 4. Associated factors with unfavorable outcomes in multi variate analysis.

Variables	ORa	IC _{95%}	P value
Male sexe	0.95	[0.5-1.78]	0.878
< 45 years	2.15	[1.16-3.97]	0.014
No in couple	2.34	[1.25-4.65]	0.08
No education	0.697	[0.16-2.83]	0.618
No IGA	0.43	[0.27-0.82]	0.11
No VCT or AA	2.54	[0.91-7.07]	0.074
In stage 3 or 4	0.884	[0.48-1.61]	0.668
TB in inclusion	0.761	[0.04-9.12]	0.667
VIH2 or VIH1+2	1.38	[0.49-3.9]	0.54
No TLD treatment	23.74	[11.97-47.1]	<0.001

4. Discussion

4.1. According to Socio-Demographic, Clinical, Therapeutic and Evolutionary Characteristics

Almost all (92.84%) of the patients had no formal education, (4.22%) of them had been to Koranic school and only (2.42%) to French school. We noted a clear female predominance with (66.5%) women, i.e. a sex ratio of (0.5). This clear female predominance was found in the Ngom *et al.* in Dakar with a sex ratio of (0.7) [12] and in the African series notably by Bongonya *et al.* in Kinshasa with a sex ratio of (0.66) [13], by

Kwobah in Kenya (0.62) [14] and Sani K *et al.* in Niger (0.38) [15]. This can be explained by the biological, economic and cultural vulnerability of women. Indeed, the extensive and fragile female genital mucosa, the persistence of semen in the genital tract and menstruation expose women more than men to HIV/AIDS infection. Stephen Lewis said that "AIDS in the 21st century will have a woman's face, a poor and isolated woman, poorly educated, poorly nourished and unable to control her fertility" [16].

More than half (56.26%) of the patients were under (45) years of age. The age group (30-44 years) was the most represented with (33.555%) of cases, followed by the age group (45-59 years) with (31.33%). This result is constant in most national series notably that of Diop in Tambacounda [17], Ndiaye and *al.* in Kaolack [18], Ngom *et al.* in Dakar [12] and at national level [5]. Indeed, HIV/AIDS infection affects the adult population and reduces the active population, thus constituting an obstacle to economic and social development [19].

More than Two-thirds of the patients lived in couples (65.98%), half of whom (49.8%) were in polygamous relationships. Similar findings were noted in the same region in Tambacounda by Diop [17] and Sani K *et al.* in Niger (60.07) of married women, of whom (57.32%) were in polygamous unions [15]. Polygamy is an African and Muslim tradition, widely practiced throughout the Sahel. It is a potential factor in the spread of HIV/AIDS infection and makes it more difficult to share serological status [20].

Nearly three quarters (73, 15%) of the patients did not carry out any income-generating activity (IGA). The same observation was made in the series by Ndiaye *et al.* in Kaolack [18], with greater vulnerability among women. This situation could largely explain the late recourse to care and the difficult social and professional reintegration of HIV patients.

Medical care with (70, 46%) was the most frequent circumstance of discovery, followed by pregnancy (13, 17%). More than a third (36, 96%) of patients was at WHO stage (3) or (4). This late recourse to care was also found by Ngom N. FN. *et al.* [12] at the Dakar CTA and by BA S. *et al.* [21] at Roi Baudoin with respectively (52.7%) and (56.5%) of patients at WHO stages (3) or (4). This difference could be explained by the fact that the health centre refers severe cases to the regional hospital in Tambacounda. Overall, there is a delay in the diagnosis and management of HIV infections in developing countries, particularly in Senegal. In fact, various factors of vulnerability such as lack of education and the geographical and financial inaccessibility of health structures are all explanatory factors [19] for delays in the care of HIV patients.

Serological status was dominated by HIV-1 in (90, 53%), followed by HIV2 with (8, 57%) and the HIV1+2 profile with (0.89%). This clear predominance of HIV1 was found in Senegalese series, notably by Ngom NF *et al.* [12] with (87.6%) and BA S. *et al.* [21] with (89%). Indeed, HIV1 is ubiquitous and more widespread in the world, while HIV2 is mainly found in West Africa [22, 23].

At inclusion, co-infection with hepatitis B was found in (8,

95%) of PLHIV. BA S. et al. in Dakar [21] noted similar prevalence with (5%) for hepatitis B, as did Sani K. and al. in Niger with (5.53%) [15] and Mirambo et al. with (10.7%) in Tanzania [24].

The frequency of TB-HIV co-infection was (2,43%) comparable to that found by BA S. et al. in Senegal with (5%) [21] pulmonary disease at inclusion, and Rogers K et al. with (5.9%) pulmonary TB in Kenya [25]. On the other hand, Hassan et al. noted a frequency of TB-HIV co-infection of (52%) in Nigeria [26] while Gezae K. E. et al. found (14.8%) in Ethiopia [27]. The unavailability of diagnostic facilities, including sputum examination at health posts and a Gen Xpert machine at the health centre, is probably one of the causes of under-diagnosis of TB-HIV co-infection.

Only (3, 96%) of the PLHIV had received INH-based chemoprophylaxis and less than half of them (43, 86%) were on DTG. The INH-based chemoprophylaxis for tuberculosis in HIV patients every (2) years for (6) months, although recommended [28], is not effective because of frequent discontinuations. Also, as of (2019), the WHO recommends Dolutegravir as the preferred treatment option for HIV in all populations [29]. The substitution of treatment regimens is slow because of the many people who have been lost to follow-up (36.83%) and deaths that have occurred (20.08%) [7].

4.2. Level of Achievement of the Three (95) in the District

In (2021), according to administrative data, the Koumpentoum health district recorded a performance of (149%) for the first (95). This poses the problem of the availability of survey data, particularly the prevalence of HIV/AIDS infection disaggregated by district. The country surveys provide national [7] and regional data [8] that do not take into account local specificities.

Almost all (95.03%) of HIV patients were put on ARVs, including (100%) in the first line. Thus the second (95), which consists of putting (95%) of the patients tested on treatment, has been achieved due to the decentralization of ARV treatment to the (22) health posts in the district.

The viral load was not carried out in more than three quarters (76.6%) of the patients. Of the HIV patients who had received it, 42.07% had an undetectable level. This illustrates the difficulties in achieving the third target (95) of having an undetectable viral load for (95%) of patients on treatment. The only viral load machine in the region is located in Tambacounda (100 km from the health centre) and there are frequent shortages of reagents. Catch-up viral load campaigns are organized, but these are hampered by problems of reimbursement for the transport of HIV tests.

4.3. Prevalence and Associated Factors with Adverse Outcomes

In terms of outcome, (36, 83%) of the patients were lost to follow-up, (20, 08%) de-escalated (including 56, 98% adverse events) and (43, 09%) were still being followed. Factors statistically significantly associated with

unfavorable outcome were age < (45) years (ORa = 2.15 [1.16-3.97]; p=0.014), not living with a partner (OR = 3.35 [2.7-4.7]; p<0.001), lack of IGA (OR = 2.08 [1.51-2.87]; p=0.008), tuberculosis at inclusion (OR = 5.78 [1.32-25.21]; p<0.001), and no DTG treatment (ORa = 23.74 [11.97-47.1]; p<0.001).

Diop found a frequency of lost to follow-up of 19.88% and a case fatality of 13.04% in the regional hospital of Tambacounda, with the associated factors of living with a partner, the presence of digestive signs, and the presence of neurological signs, profound immunodepression, anemia and leucopenia [17].

BA S and al. recorded in Roi Baudouin (Dakar), (21%) of lost to follow-up and a case fatality of (7%) with the associated factors of female sex, late initiation of ARV, profound immunodepression and low level of knowledge about HIV [21].

Toure et al. in Conakry, Guinea, recorded (16.9%) of those lost to follow-up, with under nutrition and immunodepression as associated factors [30].

Bougnounou et al. in Ouagadougou, Burkina Faso, reported (7.9%) of lost to follow-up and (8.5%) of deaths, with non-education, residence outside the capital, HIV2 infection and lack of information as the main causes [31].

These differences could be explained by the different study sites. Indeed, we conducted our research in a rural health centre, unlike the other authors who did theirs in urban and hospital settings characterized by references to HIV-PV at more advanced WHO stages [17, 21, 30, 31].

Age < (45) years (ORa = 2.15 [1.16-3.97]; p=0.014) and not living with a partner (OR = 3.35 [2.7-4.7]; p<0.001) were predictive of an unfavorable outcome. This could be explained by the high financial vulnerability of young and single people. Indeed, young age is related to the period of genital activity (15) to (49) years and is an exposure factor [6, 8, 9].

The absence of IGA (OR = 2.08 [1.51-2.87]; p=0.008) was associated with an unfavorable outcome. Binkhof M. W. G et al. in a meta-analysis of mortality of HIV patients lost to follow-up in resource-limited countries noted transfer to another care site, clinical improvement, clinical deterioration and financial problems as predictive factors [32].

PLHIV with tuberculosis at inclusion (OR = 5.78 [1.32-25.21]; p<0.001) had a higher frequency of adverse outcome. Indeed, tuberculosis is the first opportunistic infection during the course of AIDS and is associated with increased mortality [33]. Kegoung B. and al. in a systematic review of the literature revealed the existence of numerous missed opportunities in the management of HIV/AIDS infection and/or tuberculosis in sub-Saharan Africa linked to patients, the community and poorly performing health systems [34].

Failure to start DTG (ORa = 23.74 [11.97-47.1]; p<0.001) is predictive of an adverse outcome. Indeed, the WHO recommends since (2019), the use of DTG as first therapeutic intention in all PLHIV due to its greater efficacy and better safety [28, 29].

5. Conclusion

Our study revealed a high prevalence of adverse outcomes in the follow-up of HIV patients, including a high frequency of lost to follow-up (36.8%) and a very high case fatality rate (20.8%), of which (56.98%) was related to ARV adverse events.

To improve the management of HIV patients, we recommend active search for those lost to follow-up, awareness raising and financial protection for young people and vulnerable groups, systematic screening for tuberculosis and the generalization of Dolutegravir.

The active search for people who have been lost to follow-up will require collaboration with the other health districts, particularly those with a border and the digitization of follow-up records. Pharmacovigilance through mandatory reporting of even minor adverse events must be strengthened and follow-up evaluation of PLHIV systematic.

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