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Opportunistic infections in HIV naive patients at a level IV hospital in Bogotá, Colombia

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Abstract

Introduction: Human immunodeficiency virus (HIV) infection remains a major public health challenge worldwide. HIV infection has a significant impact on morbidity and mortality due to associated complications such as opportunistic infections (OI). The objective of this study was to determine the prevalence and clinical characteristics of opportunistic infections in HIV-naive patients treated at a level IV hospital in Bogotá, Colombia.

Materials and Methods: This retrospective, cross-sectional, observational study was conducted between March 2020 and December 2021. Patients aged 18 years and older with Human inmunodeficiency virus who had not started antiretroviral therapy and presented with at least one opportunistic infection upon admission were included. Sociodemographic, clinical, and microbiological data were collected from the electronic medical records. Descriptive and bivariate analyses were performed using the chi-square test, Fisher's exact test, Mann-Whitney U test, and Kruskal-Wallis test ($p<0.05$).

Results: 99 patients were included, 78.79% of whom were men, with a median age of 34 years. Of the participants, 37.37% were migrants, and 60.5% had an irregular migratory status. The most common opportunistic infections are of fungal origin (59.23%), with *Candida* being the predominant pathogen (27.69%). The in-hospital mortality rate is 30%. Patients with CD4+ cell counts <50 cells/µL had a higher prevalence of fungal infections.

Discussion: Opportunistic infections remain a significant threat to HIV-naive patients. Migrants with irregular statuses are particularly vulnerable, highlighting the need for timely and equitable interventions to improve access to antiretroviral therapy.

Keywords: HIV infection; opportunistic infection; highly active antiretroviral therapy (HAART); Epidemiology; Colombia.

Infecciones oportunistas en pacientes sin diagnóstico previo de VIH en un hospital de nivel IV en Bogotá, Colombia

Resumen

Introducción: La infección por el virus de la inmunodeficiencia humana (VIH) sigue siendo un importante problema de salud pública a nivel mundial. La infección por VIH tiene un impacto significativo en la morbilidad y la mortalidad debido a complicaciones asociadas, como las infecciones oportunistas (IO). El objetivo de esta investigación fue determinar la prevalencia y las características clínicas de las infecciones oportunistas en pacientes sin infección por el virus de la inmunodeficiencia humana (VIH) tratados en un hospital de nivel IV en Bogotá, Colombia.

Materiales y Métodos: Se realizó un estudio retrospectivo, transversal y observacional entre marzo de 2020 y diciembre de 2021. Se incluyeron pacientes de 18 años o más con diagnóstico de VIH que no habían iniciado terapia antirretroviral y presentaron al menos una infección oportunista al momento de la admisión. Se recolectaron datos sociodemográficos, clínicos y microbiológicos de los registros médicos electrónicos. Se realizaron análisis descriptivos y bivariados utilizando las pruebas de Chi-cuadrado, exacta de Fisher, U de Mann-Whitney y Kruskal-Wallis ($p<0.05$).

Resultados: Se incluyeron 99 pacientes, el 78.79% de los cuales eran hombres, con una mediana de edad de 34 años. El 37.37% de los participantes eran migrantes, de los cuales el 60.5% tenían estatus migratorio irregular. Las infecciones oportunistas más comunes fueron de origen fúngico (59.23%), siendo Candida el patógeno predominante (27.69%). La tasa de mortalidad intrahospitalaria fue del 30%. Los pacientes con recuentos de CD4+ <50 células/µL presentaron una mayor prevalencia de infecciones fúngicas.

Discusión: Las infecciones oportunistas siguen siendo una amenaza significativa en pacientes sin diagnóstico previo de VIH. Los migrantes con estatus irregular son particularmente vulnerables, lo que resalta la necesidad de intervenciones oportunas y equitativas para mejorar el acceso a la terapia antirretroviral.

Palabras clave: Infecciones por VIH; Infecciones oportunistas; Terapia antirretroviral altamente activa (TAR); Epidemiología; Colombia.

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Introduction

Human immunodeficiency virus (HIV) infection remains a major public health challenge worldwide. Although the incidence has decreased in recent years, by 2022, 1.3 million new cases were diagnosed globally, including 12,919 in Colombia, representing a 40% increase compared to the previous year[1,2]. HIV infection has a significant impact on morbidity and mortality due to associated complications such as opportunistic infections (OI), especially in individuals who have not received antiretroviral therapy (ART).

Several studies have described how the introduction of ART alters the course of the disease. Studies conducted in the United States, United Kingdom, and Spain have demonstrated a clear reduction in the incidence of OIs since the advent of ART[3-5]. However, a considerable proportion of people who, although diagnosed, do not initiate treatment remain vulnerable to severe OIs, which often represent the first clinical sign of acquired immunodeficiency syndrome (AIDS). Late diagnosis and lack of treatment impact not only individual clinical outcomes, but also global healthcare costs. Studies by Nesheim et al. have shown that highly active ART reduces the incidence of OIs and prolongs the time to the first opportunistic infection[6].

The CoRIS cohort in Spain reported that among newly diagnosed HIV patients, 19% had an AIDS-defining illness; Pneumocystis jirovecii pneumonia accounted for 6%, followed by esophageal candidiasis at 3%, and extrapulmonary tuberculosis at 3%. Of these events, 2% of patients died[7]. The identification of hematological abnormalities such as cytopenias and 23.9% of OIs identified in bone marrow samples most frequently corresponded to mycobacterial infection in the publication by Roque et al.[8]. Regarding mortality, opportunistic infections (OIs) remain the primary contributor to HIV-related mortality, especially in low- to middle-income countries where full coverage with antiretroviral therapy and effective prophylaxis has not yet been achieved[9-11]. Between 1990 and 2003, mortality in ART-naive HIV patients was dominated by opportunistic viral infections, such as cytomegalovirus (CMV), which caused 59.9% of deaths, followed by bacteremia due to Mycobacterium avium complex and Pneumocystis jirovecii pneumonia. In contrast, among patients treated with ART, the leading causes of death are cardiovascular or hepatic[12].

In Colombia, although few studies have been conducted, epidemiology does not differ from global trends. A descriptive study of 15,040 HIV/AIDS deaths between 1985 and 2001 found that OIs were the leading cause of death, primarily due to mycobacteria and P. jirovecii pneumonia, while CMV-related deaths accounted for only 0.07%[13]. Despite studies conducted in cities such as Neiva, Cúcuta, Bucaramanga, and Bogotá, the available information remains insufficient to fully understand the impact of this condition on the population and the most frequent clinical syndromes of OIs[10,14,15]. Therefore, this study aimed to determine the prevalence of OIs, clinical characteristics, and factors associated with opportunistic infections in the ART-naïve HIV population treated at a level IV hospital in Bogotá, Colombia.

Materials and Methods

This observational, analytical, cross-sectional study was conducted at a level IV hospital in Bogotá, Colombia, between March 2020 and December 2021. The study population consisted of adult patients over 18 years of age with a confirmed diagnosis of HIV who were treated at a medical center. Eligible patients were those who had not initiated antiretroviral therapy (ART-naive) and presented with at least one opportunistic infection at the time of hospital admission. Patients with other conditions causing immunosuppression, such as organ transplantation or autoimmune diseases, and those with severe SARS-CoV-2 infection during hospitalization were excluded.

A non-probabilistic convenience sampling method was used to select patients who met the inclusion criteria during the data-collection period. Data were collected retrospectively from the patients' electronic medical records using institutional electronic medical record systems and clinical laboratory databases.

The variables of interest included sociodemographic data, such as age, sex, educational level, socioeconomic status, and migration status. Clinical variables such as HIV transmission mechanism, CD4+ count, viral load, and clinical presentation of opportunistic infections, classified according to the CDC's clinical classification (categories A, B, or C), were also recorded. Microbiological data on the etiological diagnosis of opportunistic infections, including bacteria, viruses, fungi, and parasites, as well as clinical outcomes at discharge and in-hospital mortality, were collected.

For statistical analysis, categorical variables were described using absolute frequencies and percentages, whereas continuous variables were summarized using measures of central tendency and dispersion. The normality of continuous variables was assessed using the Shapiro-Wilk test. Bivariate analysis was conducted considering Colombian participants, classified as Colombians and migrants, with no distinction made regarding their migration status (regular or irregular). Additionally, an analysis was performed considering the clinical and microbiological characteristics of the CD4+ counts. Chi-square and Fisher's exact tests were used for categorical variables, while the Mann-Whitney U and Kruskal-Wallis tests were applied for continuous variables. Statistical significance was set at $P < 0.05$. Analyses were performed using the statistical software STATA 16.

Results

Of the 99 participants, 78.79% were men, with a median age of 34 years (range, 21–66 years). In terms of socioeconomic status, 45.2% of the patients were from socioeconomic low, followed by 22.22% from very low, 19.19% from lower middle, and 13.13% lacking socioeconomic classification data. Primary school education was the most common, observed in 40.4% of patients. The predominant health insurance co-

verage was subsidized, covering 68.7% of the participants. Additionally, 62.63% of the participants were Colombian while 37.37% were migrants. Of the migrants, 23.23% had an irregular immigration status and 14.14% had a regular status.

When comparing Colombians and migrants, a higher proportion of men was observed in both the groups. However, Colombians had a higher median age of 37.5, compared to 31 years for migrants, and this difference was statistically significant (p=0.008). Regarding education, most participants reported having a secondary school education, with 37.1% of Colombians and 45.95% of migrants having completed secondary education. Socioeconomic status ranged from very low to lower middle, with Colombians being more represented in the low and lower middle, while migrants were more represented in the low and very low. However, no statistically significant differences were observed between the groups. In terms of health insurance coverage, 83.87% of Colombians were covered under the subsidized system, whereas 54.05% of migrants were not affiliated with any social security system (Table 1).

In terms of immunological status, 37.34% of migrants did not have a CD4+ count compared to 8.06% of Colombians. Additionally, 62.9% of Colombians had a viral load lower than 50 cells/mL compared to 48.65% of migrants. Only one Colombian patient had a CD4+ cell count above 200 cells/mL, representing 1.61% of Colombian patients. The most common stage of HIV infection was stage C, present in 98.36% of Colombians and 100% of migrants. The median viral load for Colombians was 367,514 copies/mL, with a median log of 5.56, compared to 59,521 copies/mL with a median log of 4.77 in migrants, a statistically significant difference (p=0.007). Viral load data were unavailable for 37.84% of migrants (Table 1).

Regarding key population characteristics, 16.16% of participants identified as men who had sex with men (MSM), 6.06% were homeless, 4.04% were substance users, 3.03% were incarcerated, and 1.01% were transgender men. The remaining 69.7% did not belong to any of the aforementioned key population.

Considering that patients with this disease may present with different clinical manifestations, a total of 130 opportunistic infections were recorded among the 99 subjects, along with syndromic diagnoses and etiological agents. Among Colombian patients, 63.84% (n=83) were found, whereas among migrants, 36.15% (n=47) were reported.

Regarding syndromic diagnoses, meningeal syndrome and weight loss were the most common among Colombian participants, with frequencies of 31.33% and 30.12%, respectively. In contrast, among migrants, respiratory distress syndrome was the most prevalent (34.04 %), followed by weight loss (27.66 %, p = 0.204). In terms of clinical presentation, the predominant manifestation among Colombians was gastrointestinal involvement (33.73 %), followed by central nervous system involvement (21.69 %). This was similar to the findings in the migrant population, where gastrointestinal presentation occurred in 27.66% of cases, differing from the second most common cause, which was pulmonary at 29.79%, with a p-value of 0.321. In both groups, opportunistic infections were predominantly caused by fungi, with Candida being the primary etiological agent in both groups at 27.71% and 27.66%, respectively. The second most common etiological agent among Colombians was Cryptococcus spp., at 14.46%, whereas among migrants, it was Pneumocystis jirovecii at 23.40%. Notably, the latter was the third most common cause in the Colombian group, occurring in 12.05% of the cases (Table 2).

A total of 130 opportunistic infections were recorded among the 99 subjects, with distribution varying based on CD4 levels and the etiological agent (Table 3). The gastrointestinal system was the most frequently affected, accounting for 31.54%, followed by the central nervous system (CNS) at 26.15 (Table 3). In terms of the type of pathogen involved, it was found that in 59.2% of the 99 cases, there was fungal involvement, 16.2% viral, 13.1% parasitic, and 11.5% bacterial. When analyzing the groups by age, most patients were between 30 and 39 years old. A total of 47 opportunistic infections were recorded among 42 patients, accounting for 36% of the recorded infections. The age group contributing the most patients was 30-34 years, with a total of 21 patients representing 21% of the documented opportunistic infections (Figure 1).

Regarding the number of opportunistic infections involved, 75.8% of the analyzed individuals had one laboratory-confirmed opportunistic infection, 18.2% had two infections, and the remaining 6.0% had three or more opportunistic infections.Out of the 99 patients analyzed, 4 were infected with the Sars-Cov-2/COVID-19 virus, of which 100% had a CD4 count <50. Respiratory distress was the most common syndrome (83%). In addition, 50% of the patients died (Table 3).

Furthermore, a Pearson chi-square test was performed to assess the relationship with CD4+ counts and migratory status, yielding values of 0.01 and 0.0 for health insurance regime, indicating a significant relationship regarding the immunological status of the disease and the migratory status of the patients, as well as the health system they belong to. Finally, a total of 30 individuals (30%) died during hospitalization due to opportunistic infections, with these patients presenting a total of 43 opportunistic infections: 62% were fungal, 13% viral, 11% bacterial, and 11% parasitic. In six patients (6%) from the study, it could not be determined whether they had a fatal outcome because they were referred to other institutions.

Discussion

The results of our study indicate that regarding sociodemographic characteristics, male sex predominates, with a median age of 37 ± 11.4 years. It was observed that the migrant subgroup was younger and predominantly from lower so-

Table 1. Sociodemographic and clinical characteristics of the participants

Variable	Category	Colombians	Migrants	Total	p-value
Sex	Woman	12 (19.35)	9 (24.32)	21 (21.21)	0.558
	Man	50 (80.65)	28 (75.68)	78 (78.79)	
Age	Median (IQR)	37.5 (30-47)	31 (26-38)	34 (29-45)	**0.008**
Education	None	1 (1.61)	1 (2.7)	2 (2.02)	0.177
	Primary	22 (35.48)	10 (27.03)	32 (32.32)	
	Secondary	23 (37.1)	17 (45.95)	40 (40.4)	
	No data	7 (11.29)	4 (10.81)	11 (11.11)	
	Technical	8 (12.9)	1 (2.7)	9 (9.09)	
	University	1 (1.61)	4 (10.81)	5 (5.05)	
Socioeconomic status	Very low	12 (19.35)	10 (27.03)	22 (22.22)	0.361
	Low	28 (45.16)	17 (45.95)	45 (45.45)	
	Lower middle	15 (24.19)	4 (10.81)	19 (19.19)	
	Sin dato	7 (11.29)	6 (16.22)	13 (13.13)	
Social security system	Contributory	8 (12.9)	0 (0)	8 (8.08)	**<0.001**
	Special	2 (3.23)	1 (2.7)	3 (3.03)	
	Uninsured	0 (0)	20 (54.05)	20 (20.2)	
	Subsidized	52 (83.87)	16 (43.24)	68 (68.69)	
Key population	Substance users (non-injection route)	2 (3.23)	2 (5.41)	4 (4.04)	0.531
	MSM	9 (14.52)	7 (18.92)	16 (16.16)	
	Homeless individual	5 (8.06)	1 (2.7)	6 (6.06)	
	Transgender man	1 (1.61)	0 (0)	1 (1.01)	
	Not part of any of these groups	42 (67.74)	27 (72.97)	69 (69.7)	
	Incarcerated	3 (4.84)	0 (0)	3 (3.03)	
Mode of Transmission	Unknown	43 (69.35)	26 (70.27)	69 (69.7)	0.538
	Sexual transmission	17 (27.42)	11 (29.73)	28 (28.28)	
	Use of needles or sharp objects	2 (3.23)	0 (0)	2 (2.02)	
CDC Classification	B	1 (1.61)	0 (0)	1 (1.01)	0.437
	C	61 (98.39)	37 (100)	98 (98.99)	
CD4 Count	200-499	1 (1.61)	0 (0)	1 (1.01)	**0.007**
	50- 100	13 (20.97)	4 (10.81)	17 (17.17)	
	100- 200	4 (6.45)	1 (2.7)	5 (5.05)	
	< 50	39 (62.9)	18 (48.65)	57 (57.58)	
	It was not performed	5 (8.06)	14 (37.84)	19 (19.19)	
CD4/CD8 Ratio	Median (IQR)	0.06(0.03-0.13)	0.01 (0-0.06)	0.05 (0-0.1)	**<0.001**
Viral Load Values	Median (IQR)	367514.5(46963 - 1015630)	59521(0 - 321209)	216101 (22341-769387)	**<0.001**
Viral load test performed	No	6 (9.68)	14 (37.84)	20 (20.2)	**0.001**
	Yes	56 (90.32)	23 (62.16)	79 (79.8)	
Mortality	No	38 (61.29)	25 (67.57)	63 (63.64)	0.536
	No/referred	5 (8.06)	1 (2.7)	6 (6.06)	
	Yes	19 (30.65)	11 (29.73)	30 (30.3)	

cioeconomic strata (stratum 1 and 2). These findings align with the report by Agudelo et al. from the Hospital Universitario de Neiva, Colombia, which reported similar results[14]. In contrast, the Colombian National Institute of Health reported a higher affiliation to the contributory regime of the General System of Health Social Security (SGSSS) in 2020, which contrasts with our population, where the subsidized regime predominated. This difference may be partly explained by the type of state contracting and economic barriers[2]. The concentration of patients from low socioeconomic strata underscores inequalities in access to health services, particularly among migrants who also face significant administrative hurdles. This situation is especially evident in the southwestern area of Bogotá, a region characterized by a lower cost of living, where economic constraints further limit access to healthcare.

In Colombia the High-Cost Account (CAC) for HIV in 2022 showed a higher incidence of the disease among men who have sex with men (MSM) (53.94%), users of psychoactive substances (7.31%), homeless individuals (0.75%), transgender men (0.33%), and prisoners (0.31%)[2]. However, in our study, despite focusing on the same key population, it is noteworthy that a larger proportion (69.7%) of patients did not belong to any of these groups. This suggests the presence of other vulnerability factors that were not adequately captured by standard categories. Notably, one key population that is often overlooked despite its distinct sociocultural and healthcare challenges is migrants. Given their different national origins, migrants may face unique barriers that influence their HIV risk and access to health care. Further research is needed to better understand the social and structural determinants of HIV in Colombia, particularly in this underserved population.

Table 2. Clinical and microbiological characteristics of the patients.

Variable	Category	Colombians (83)	Migrants (47)	Total (130)	p-value
Clinical Presentation	Disseminated	6 (7.23)	5 (10.64)	11 (8.46)	0,321
	Gastrointestinal	28 (33.73)	13 (27.66)	41 (31.54)	
	Genitourinary	1 (1.2)	2 (4.26)	3 (2.31)	
	Ocular	2 (2.41)	1 (2.13)	3 (2.31)	
	Skin or Mucous Membranes	2 (2.41)	3 (6.38)	5 (3.85)	
	Pulmonary	18 (21.69)	14 (29.79)	32 (24.62)	
	CNS	26 (31.33)	8 (17.02)	34 (26.15)	
	Integumentary	-	1 (2.13)	1 (0.77)	
Syndromic Diagnosis	Respiratory Distress Syndrome	16 (19.28)	16 (34.04)	32 (24.62)	0,204
	Weight Loss Syndrome	25 (30.12)	13 (27.66)	38 (29.23)	
	Febrile Syndrome	14 (16.87)	7 (14.89)	21 (16.15)	
	Lymphadenopathy Syndrome	-	1 (2.13)	1 (0.77)	
	Meningeal Syndrome	26 (31.33)	8 (17.02)	34 (26.15)	
	Genital Ulcer Syndrome	2 (2.41)	2 (4.26)	4 (3.08)	
Opportunistic Infection	Bacterial	9 (10.84)	6 (12.77)	15 (11.54)	0,282
	Fungal	49 (59.04)	28 (59.57)	77 (59.23)	
	Parasitic	14 (16.87)	3 (6.38)	17 (13.08)	
	Viral	11 (13.25)	10 (21.28)	21 (16.15)	
Etiological Agent	Candida	23 (27.71)	13 (27.66)	36 (27.69)	0,309
	Cytomegalovirus	7 (8.43)	5 (10.64)	12 (9.23)	
	Cryptococcus spp	12 (14.46)	3 (6.38)	15 (11.54)	
	Herpes Simplex	2 (2.41)	2 (4.26)	4 (3.08)	
	Herpes Virus 8	2 (2.41)	3 (6.38)	5 (3.85)	
	Histoplasmosis	4 (4.82)	1 (2.13)	5 (3.85)	
	Tuberculosis Mycobacteria	8 (9.64)	5 (10.64)	13 (10)	
	Non-tuberculosis Mycobacteria	1 (1.2)	-	1 (0.77)	
	Pneumocystis jirovecii	10 (12.05)	11 (23.4)	21 (16.15)	
	Salmonella	-	1 (2.13)	1 (0.77)	
	Toxoplasmosis	14 (16.87)	3 (6.38)	17 (13.08)	

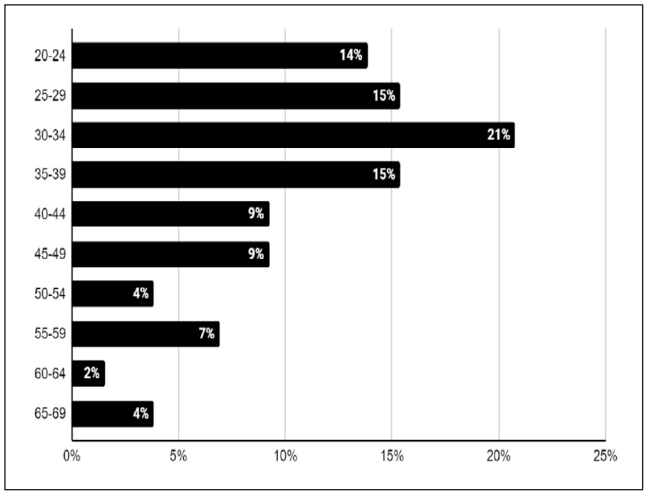

Figure 1. Proportion of opportunistic infections by age group.

Our study determined that the most common lymphocyte count was CD4+ <50 cells/µL, with an advanced stage of the disease (type C) in 99% of the cases, which does not align with the data from CAC, where an average CD4+ count of 337.18 cells/µL has been reported[2]. This finding suggests a late diagnosis in a significant proportion of patients in our cohort, particularly among migrants, which worsens their prognosis. The lack of CD4+ counts in many migrants reflects barriers to accessing specialized and preventive healthcare, highlighting the need for intervention strategies aimed at this population. Migrants showed a much lower CD4/CD8 ratio, which negatively affected their survival. A Colombian Study assessed the impact of migration on HIV case reporting in Venezuelan migrants, but did not evaluate other outcomes[15]. While two international studies evaluated socioeconomic aspects and factors associated with non-adherence to ART, they did not assess the frequency of OIs. This Highlights a gap in the literature regarding the interplay between socioeconomic determinants, ART adherence, and OI prevalence, particularly among migrant populations[16,17].

In our study, the most frequent OIs were of fungal etiology, which is consistent with the findings of Castro et al., where Candida spp. was the most common pathogen (27.67%)[18]. Gastrointestinal infection (31.54%) and central nervous system involvement (26.15%) were also observed. Among migrants, *Pneumocystis jirovecii* infections were more common than among Colombian patients, reflecting differences in the clinical presentation of OIs according to socioeconomic group and access to antiretroviral treatment. A study conducted in Latin America, which included 10,583 patients from six countries receiving ART, excluded those diagnosed with AIDS at the beginning of follow-up. During the observation period, 10.7% of patients discontinued ART, and OIs were recorded in 895 patients (8.4%), and the mortality rate was 5.4%. The most common OIs was Tuberculosis, present in 38.3% of cases, followed by esophageal candidiasis (10.4%), and *Pneumocystis jiroveccii* (10.4%). Notably, in our study, tuberculosis was not the most common OI despite being a country with a high prevalence of this disease[19]. Additionally, no significant differences were observed between Colombian and migrant patients in the distribution of OIs.

In 2020, the Joint United Nations Programme on HIV/AIDS (UNAIDS) estimated a global mortality of 690,000 deaths related to AIDS[20]. In Colombia, 2, 098 deaths were reported among people diagnosed with HIV in 2022, with 30% attributed to AIDS-defining illnesses[2]. Our results reflect a significant mortality rate of 30%, which, while in line with national estimates, remains alarming, particularly among migrants. In our study, 38% of patients were migrants, of whom 60.5% had irregular migration status. This group exhibited poorer health indicators, with 47% of migrants having CD4+ cell counts below 50 cells/µL. This finding aligns with previous studies indicating that irregular migrants often have less access to healthcare services, directly impacting their immune status and increasing the prevalence of OIs[20].

Regarding prognosis, key factors such as access to and adherence to ART, comorbidities, clinical stage, self-care, age, and socioeconomic status were identified. Early diagnosis plays a crucial role in improving survival[21]. However, our findings suggest that a late diagnosis remains a significant challenge in Colombia. Interventions to improve screening and early diagnosis such as Resolution No. 1314 of 2020, which introduced rapid HIV testing, are steps in the right direction. Nevertheless, implementation must be strengthened, particularly among marginalized populations, such as migrants. Despite these initiatives, Colombia has yet to meet the World Health Organization's "90-90-90" targets, which state that 90% of the population living with HIV should be diagnosed, 90% should receive treatment, and 90% should achieve an undetectable viral load. The CAC for 2022 indicated that several key indicators will fall below 90%, suggesting the need for more aggressive public health interventions to close these gaps[2].

Among the limitations of our study, the small sample size and incomplete clinical or sociodemographic information in some cases are noteworthy, as they may have affected the analysis of certain variables. Additionally, the lack of long-term follow-up precluded assessment of the impact of OIs on post-hospitalization survival and the effectiveness of clinical interventions. Another limiting factor was the absence of measurements of undetectable viral load, which is a key parameter for evaluating HIV transmission control in patients.

Finally, the results of our study suggest the need for more comprehensive interventions that address the structural and social barriers faced by treatment-naive patients with HIV, particularly migrants. Implementing support programs to ensure adherence to treatment and expanding rapid HIV testing are essential to improve long-term outcomes. Future studies should explore the differences in the clinical presentations of OIs between migrant and Colombian patient groups to develop more targeted and effective public health policies.

Table 3. Etiological Agents According to CD4+ Count, by Group.

Variable	Category	< 50	50- 100	100- 200	200-499	It was not performed	Total	P-value
Clinical Presentation	Disseminated	5 (6.41)	2 (9.09)	2 (28.57)	-	2 (9.09)	11 (8.46)	0,019
	Gastrointestinal	23 (29.49)	7 (31.82)	1 (14.29)	-	10 (45.45)	41 (31.54)	
	Genitourinary	1 (1.28)	-	-	-	2 (9.09)	3 (2.31)	
	Ocular	1 (1.28)	-	2 (28.57)	-	-	3 (2.31)	
	Skin or mucous membranes	4 (5.13)	-	-	-	1 (4.55)	5 (3.85)	
	Pulmonary	21 (26.92)	4 (18.18)	1 (14.29)	-	6 (27.27)	32 (24.62)	
	Central Nervous System (CNS)	22 (28.21)	9 (40.91)	1 (14.29)	1 (100)	1 (4.55)	34 (26.15)	
	Integumentary	1 (1.28)	-	-	-	-	1 (0.77)	
	Total	78 (100)	22 (100)	7 (100)	1 (100)	22 (100)	130 (100)	
Syndromic Diagnosis	Respiratory distress syndrome	21 (26.92)	3 (13.64)	2 (28.57)	-	6 (27.27)	32 (24.62)	0,345
	Weight loss syndrome	24 (30.77)	3 (13.64)	3 (42.86)	-	8 (36.36)	38 (29.23)	
	Febrile syndrome	10 (12.82)	5 (22.73)	1 (14.29)	-	5 (22.73)	21 (16.15)	
	Lymphadenopathy syndrome	1 (1.28)	-	-	-	-	1 (0.77)	
	Meningeal syndrome	20 (25.64)	11 (50)	1 (14.29)	1 (100)	1 (4.55)	34 (26.15)	
	Genital ulcer	2 (2.56)	-	-	-	2 (9.09)	4 (3.08)	
	Total	78 (100)	22 (100)	7 (100)	1 (100)	22 (100)	130 (100)	
Opportunistic Infection	Bacterial	10 (12.82)	2 (9.09)	-	-	3 (13.64)	15 (11.54)	0,003
	Fungal	47 (60.26)	13 (59.09)	1 (14.29)	-	16 (72.73)	77 (59.23)	
	Parasitic	10 (12.82)	5 (22.73)	1 (14.29)	1 (100)	-	17 (13.08)	
	Viral	11 (14.1)	2 (9.09)	5 (71.43)	-	3 (13.64)	21 (16.15)	
	Total	78 (100)	22 (100)	7 (100)	1 (100)	22 (100)	130 (100)	
Etiological Agent	Candida	-	7 (31.82)	-	21 (26.92)	8 (36.36)	36 (27.69)	0,037
	Cytomegalovirus	-	1 (4.55)	4 (57.14)	6 (7.69)	1 (4.55)	12 (9.23)	
	Cryptococcus spp	-	4 (18.18)	-	10 (12.82)	1 (4.55)	15 (11.54)	
	Herpes Simplex	-	-	1 (14.29)	3 (3.85)	-	4 (3.08)	
	Herpes Virus 8	-	1 (4.55)	-	2 (2.56)	2 (9.09)	5 (3.85)	
	Histoplasmosis	-	-	-	4 (5.13)	1 (4.55)	5 (3.85)	
	Mycobacterium tuberculosis	-	2 (9.09)	-	10 (12.82)	1 (4.55)	13 (10)	
	Non-tuberculous mycobacteria	-	-	-	-	1 (4.55)	1 (0.77)	
	Pneumocystis jirovecii	-	2 (9.09)	1 (14.29)	12 (15.38)	6 (27.27)	21 (16.15)	
	Salmonella	-	-	-	-	1 (4.55)	1 (0.77)	
	Toxoplasmosis	1 (100)	5 (22.73)	1 (14.29)	10 (12.82)	-	17 (13.08)	
	Total	1 (100)	22 (100)	7 (100)	78 (100)	22 (100)	130 (100)	

Ethical considerations

This study was classified as minimal risk in accordance with Resolution 8430 of 1993 by the Ministry of Health of Colombia. As this was a retrospective analysis of medical records, confidentiality was ensured through the use of anonymized databases that were only accessible to the investigators. This research was approved by the Ethics Committee of the Subred SurOccidente on December 12, 2022, under Act No. 14 of 2022.

Protection of persons. All the procedures were conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Patients were not exposed to any additional risks owing to the retrospective nature of the study and anonymization of the data.

Protection of vulnerable populations. The dignity, rights, and well-being of potentially vulnerable populations are fully respected. No direct interventions were performed, and potential risks were minimized.

Confidentiality. Data confidentiality was maintained strictly. The databases were fully anonymized to prevent the identification of individual participants.

Privacy. Patient privacy was safeguarded at all stages of data collection, analysis, and publication to ensure that no personal or identifiable information was disclosed.

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Conflicts of interest. The authors have no conflict of interest to declare.

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Statement on the use of artificial intelligence. No artificial intelligence was used.

Authors´ contribution. CAS, GM, ELL, ECS, JC, DGR, SPR, SCE, EFMH: contributed to the conceptualization of the research, performed the data analysis, and wrote the final manuscript. All authors contributed to read and approved the version of the submitted manuscript.

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