BMC Infectious Diseases

RESEARCH

Open Access

Clinical characteristics and treatment outcomes of opportunistic infections in advanced HIV disease patients among men who have sex with men in Vietnam: A prospective cross-sectional study

Ly Trieu Vo[1,2], Dung Quoc Phan[3], Phi Hoang Nguyen[4], Araba Gyan[5], Nhut Minh Vuong[2], Tung Nhu Le Nguyen[1], Lan Y Vo[4] and Giao Huynh[4,6*]

Abstract

Background Opportunistic infections (OIs) in patients with advanced HIV disease remain a serious health issue, particularly in low-and middle-income countries.

Objectives This study aims to describe the clinical characteristics and factors associated with mortality among hospitalized advanced HIV-infected men who have sex with men (MSM).

Methods A prospective cross-sectional study was conducted at the Hospital for Tropical Diseases in Ho Chi Minh City between March and June 2023. Data was collected through interviews and medical record reviews. A multivariate logistic regression model was employed to assess factors associated with hospitalization outcomes, with statistical significance set at $p < 0.05$.

Results The study included 121 participants, with 61.3% aged 25–34 years and 42.2% classified as underweight. Only 35.5% of patients received OI preventive treatment. Comorbidities were noted as follows: hepatitis B (12.4%), hepatitis C (2.5%), and syphilis (43.8%). A total of 41.3% of patients had at least one OI, with *Mycobacterium tuberculosis* being the most common (46.3%), followed by *Pneumocystis jirovecii* pneumonia (44.6%) and *Cryptococcus neoformans* (19%). Sepsis was present in 20.7% of patients. The in-hospital mortality rate was 19%. Factors significantly associated with mortality included being underweight, HBV coinfection, *C. neoformans* infection, lack of OI preventive treatment, and sepsis.

Conclusion The study reveals a high inpatient mortality rate among advanced HIV-infected MSM, even among relatively young patients. Increased mortality was associated with being underweight, having sepsis, HBV coinfection, *C. neoformans* infection, and not receiving OI preventive treatment.

Keywords *Cryptococcus neoformans*, Hepatitis B, HIV/AIDS, Mortality, MSM, Opportunistic infections, Sepsis

*Correspondence:
Giao Huynh
hgiaoytcc@ump.edu.vn

Full list of author information is available at the end of the article

Background

Human immunodeficiency virus (HIV) is a virus that targets the body's immune system by infecting CD4 + T lymphocytes, crucial cells for immune function. Untreated HIV infection leads to a severe decline in CD4 + T lymphocytes, resulting in advanced HIV disease (AHD), characterized by a CD4 count of less than 200 cells/mm^3 or the presence of World Health Organization (WHO) stage 3 or 4 conditions [1]. This advanced stage is often accompanied by opportunistic infections (OIs) and malignant tumors, which are leading causes of mortality in HIV-infected individuals [2–4]. In Vietnam, common OIs among HIV patients include tuberculosis, *Pneumocystis jirovecii* pneumonia, lower respiratory tract infections, and talaromycosis [5, 6]. Effective prevention and treatment of OIs, along with antiretroviral therapy (ART), are essential to reduce mortality [7].

Globally, HIV/AIDS remains a significant public health concern. In 2022, about 39 million people were living with HIV, 1.3 million were new cases, and 630,000 were deaths from HIV-related causes [7]. Although incidence and mortality rates have decreased compared to previous years, they remain above the WHO's 2025 targets [8]. In Vietnam, over 249,000 people are living with HIV, with more than 130,000 diagnosed and 1,625 deaths reported in 2023 [9]. New HIV cases predominantly affect males (84.28%), with sexual transmission being the most common mode (80.8%) [9]. The majority of new infections are concentrated in southern Vietnam, particularly in the Mekong Delta (33%), and Ho Chi Minh City (23.5%) [10].

In Vietnam, the incidence of HIV among high-risk groups such as sex workers, people who inject drugs, and those with HIV-positive partners is declining [9]. However, the rate among men who have sex with men (MSM) has risen from less than 6.7% in 2014 to 12.47% in 2022, and MSM now constitutes over 50% of new cases in 2024 [9]. MSM group is at a higher risk of acquiring HIV due to the thinner rectal mucosal membrane compared to the vaginal mucosal membrane in women [11]. Risk behaviors, including multiple sexual partners, low condom usage, and drug abuse, further exacerbate the risk of acquiring HIV [12]. A study in Ho Chi Minh City found that an MsM individual had an average of 4.3 sexual partners in the past year, with only 26.2% regularly using condoms [13]. Additionally, 15% of MSM in An Giang were reported to use drugs [10].

Despite extensive research on HIV in Vietnam, there is limited data on the clinical characteristics and treatment outcomes of OIs specifically in MSM. Previous studies indicate that MSM experience higher mortality rates compared to women and heterosexual men [6]. In general, tuberculosis and toxoplasmosis are the most common OIs in adult HIV patients, but among MSM, human papillomavirus (11%) and hepatitis B virus (HBV) (8.5%) are more prevalent comorbidities [3]. These findings suggest differences in the clinical profiles and treatment outcomes of OIs in MSM compared to the general HIV-infected population. Understanding these differences is crucial for improving care, treatment, and prevention strategies for MSM living with HIV.

Methods

Study design and setting

A prospective cross-sectional study was conducted at the HIV ward of the Hospital for Tropical Diseases (HTD) in Ho Chi Minh City, Vietnam, from March to June 2023. HTD is a tertiary referral healthcare facility specializing in infectious diseases, particularly HIV/AIDS. Inclusion criteria for the study were MSM living with HIV (aged 18 years or older) who had advanced HIV disease and were hospitalized due to opportunistic infections and, had clinical stages 3 and 4 identified according to WHO guidelines [1]. Patients were excluded if they died within the first 24 h of admission, as their short hospital stay precluded adequate monitoring and data collection. Additionally, patients transferred to another hospital during the study period, making follow-up impossible, were also excluded. Data was collected through face-to-face interviews using a structured questionnaire and medical records review.

Sample size and sampling procedure

A single population proportion formula was used to estimate the mortality rate of adult MSM living with HIV. The calculation employed a 95% confidence interval ($Z_{\alpha/2}$= 1.96), a 10% margin of error, and a population proportion (p = 0.3), as discussed by Chun-Yuan Lee et al. [14]. This yielded a minimum required sample size of 81 participants.

Participants were selected using a convenience sampling method. During the study period, a list of newly admitted male patients was obtained weekly. Potential eligible participants were invited to participate.

Instrument

A structured questionnaire was developed for this study (Appendix 1), consisting of four parts. The first part covered sociodemographic characteristics, including age, height, weight, religion, living area, education, employment status, and marital status. The second part contained information on the use and adherence to ART [15]. The third part focused on clinical characteristics (symptoms, coinfection with HBV, HCV, syphilis), laboratory findings (WBCs, CD4 T cells, platelet counts, hemoglobin concentrations, serum creatinine concentration, ALT, AST, arterial blood gases, chest X-ray, cerebrospinal fluid (CSF) analysis, blood culture, CSF culture, skin lesion culture), and OI preventive treatments (Cotrimoxazole,

Isoniazid, Fluconazole). These prophylactic treatments were prescribed after advanced opportunistic infections were ruled out during outpatient evaluations. The questions were informed by previous studies [6] and aligned with WHO guidelines [1]. The final section included one question regarding treatment outcomes. Before the questionnaire was implemented, it was tested in a trial study involving 20 patients to ensure clarity, understandability, and appropriateness.

The diagnostic criteria for infectious diseases were as follows [16]:

HBV infection: Confirmed by the detection of Hepatitis B surface antigen (HBsAg) in the blood.

HCV infection: Diagnosed by the detection of antibodies to Hepatitis C virus (anti-HCV) in the blood.

Syphilis is screened using enzyme immunoassays, a nontreponemal test as a routine test for advanced HIV diseases upon admission.

Cryptococcal meningitis: Diagnosed through the isolation of *Cryptococcus neoformans* in CSF or a positive cryptococcal antigen (CrAg) test in the CSF.

Talaromycosis: Diagnosed by isolating *Talaromyces marneffei* in skin lesions, blood, or bone marrow.

Histoplasmosis: Diagnosed by isolating *Histoplasma* in skin lesions, blood, or bone marrow, or by detecting *Histoplasma* antigen in urine.

Toxoplasmosis Encephalitis: Diagnosed based on clinical and radiographic presentation, presence of anti-*Toxoplasma* IgG antibodies, and response to anti-*Toxoplasma* therapy.

Pneumocystis jirovecii pneumonia (PCP): Diagnosed based on interstitial lesions on chest X-ray and positive sputum PCR results.

Tuberculosis (TB): Diagnosed by demonstrating acid-fast bacilli or positive Xpert MTB/RIF test in sputum, CSF, or other specimens.

Disseminated *Mycobacterium avium Complex* (MAC) Disease: Diagnosed based on clinical signs and symptoms and isolation of MAC from cultures of blood, lymph fluid, bone marrow, or other sterile tissues.

Sepsis was diagnosed based on finding a focus of infection or suspected infection with SOFA ≥ 2 [17].

Table 1 Sociodemographic characteristics of the participants ($n = 121$)

Characteristics	Value	Total *n* (%)
Age group	≤ 24 years old	17 (18.3)
	25–34 years old	57 (61.3)
	≥ 35 years old	19 (20.4)
Underweight (BMI < 18.5 kg/m^2)	Yes	51 (42.2)
	No	70 (57.8)
Level of education	≤ Secondary school	32 (26.4)
	High school	48 (39.7)
	University/College	41 (33.9)
Religion	Buddhism	45 (37.2)
	No	63 (52.1)
	Other	13 (10.7)
Residence	Ho Chi Minh City	50 (41.3)
	Other provinces	71 (58.7)
Employment status	Trade	46 (38.0)
	Office staff	28 (23.1)
	Workers	40 (33.1)
	Other	7 (5.8)
Marital status (n = 116)	Single	106 (91.4)
	In couple	10 (8.6)
MSM having sex with women	Yes	19 (15.7)
	No	102 (84.3)

Data collection

The interviews were conducted by trained researchers and took approximately 20–25 min to complete. Upon completion of the hospital treatment, data on participants' opportunistic infections (OIs), clinical characteristics, preventive treatments, laboratory findings, and treatment outcomes were collected from medical records.

Data analysis

The data were analyzed using Epidata 4.6.0.4 and STATA 17.0 software. Independent variables included sociodemographic characteristics, opportunistic infections (OIs), clinical characteristics, laboratory findings, treatment process, and patient adherence. The dependent variable was the OI treatment outcome, with participants categorized into two groups: deceased and surviving individuals, based on their treatment results.

Descriptive statistics were expressed as frequencies, percentages, means, or medians. Univariate analysis was performed using the chi-square test, Fisher's exact test, and logistic regression. Variables with p-values < 0.2 from the univariate analysis were included in the multivariate model to adjust for potential confounders. Interaction terms were used to examine the potential compounding effects of risk factors, such as underweight status and lack of opportunistic infection prophylaxis. Results were reported as odds ratios (OR) with 95% confidence intervals (95% CI). The model's fit was assessed using the Akaike Information Criterion (AIC) and pseudo-R-squared values. Statistical significance was set at a p-value < 0.05.

Results

Characteristics of the participants

Table 1 presents the general characteristics of the studied HIV-infected MSM. A total of 121 hospitalized HIV-infected MSM patients were enrolled in the study. The majority of participants (61.3%) were between 25 and 34

years old, and slightly more than one-third (42.2%) were underweight (BMI < 18.5 kg/m^2). Buddhism was the most common religion, accounting for 37.2% of the religious participants. 39.7% of the patients had a high school degree, and 33.9% had a college or advanced degree. 38% worked in the service industry, 33.1% were manual workers, and 23.1% were office workers. Approximately 41.3% of the participants resided in Ho Chi Minh City.

12.4% tested positive for HBV, 2.5% tested positive for HCV, and 43.8% tested positive for syphilis coinfection. Additionally, 20.7% of the patients were diagnosed with sepsis (Table 2).

Approximately 76.9% of the individuals received a positive HIV diagnosis within the past 12 months, and only 43% of the participants had received ART. Among those receiving ART treatment, 90.4% were on the first-line ART regimen (Table 2).

Table 2 Clinical characteristics, laboratory findings, antiretroviral therapy history, and adherence of participants ($n = 121$)

Characteristics	Value	Total *n* (%)
HBV	Yes	15 (12.4)
HCV	Yes	3 (2.5)
Syphilis	Yes	53 (43.8)
Sepsis	Yes	25 (20.7)
Time since diagnosis	≤ 12 month	93 (76.9)
	> 12 month	28 (23.1)
ART treatment	No prior treatment	69 (57.0)
	≤ 12 month	33 (27.3)
	> 12 month	19 (15.7)
ART adherence (n = 52)	Yes	30 (57.7)
	No	22 (42.3)
ART regimen (n = 52)	First line	47 (90.4)
	Second line	5 (9.6)
OI preventive treatment	Yes	43 (35.5)
Cotrimoxazole for PCP and toxoplasmosis prophylaxis ($n = 43$)	Yes	39 (90.7)
INH for prophylaxis ($n = 43$)	Yes	8 (18.6)
Number of OI	1 OI	50 (41.3)
	2 OI	53 (43.8)
	≥ 3 OI	18 (14.9)
Mycobacterium tuberculosis	Yes	56 (46.3)
P. jiroverci pneumonia	Yes	54 (44.6)
C.neoformans	Yes	23 (19.0)
Talaromyces marneffei	Yes	9 (7.4)
Esophageal candidiasis	Yes	8 (6.6)
Herpes simplex	Yes	6 (5.0)
Toxoplasma gondii	Yes	3 (2.5)
MAC	Yes	1 (0.8)
Histoplasma capsulatum	Yes	1 (0.8)
CD4 T-cell count (cell/mm^3)!		20 (7–50.5)
Hemoglobin (g/dl)!		9.5 (7.1–11.9)
Platelet Count (K/μL)!		182 (125–256)
WBC (K/μL)		9.16 (6–13.7)

 # Percentage by column,! Median (quartile)

The results revealed that out of 121 individuals, 35.5% of the patients had received preventive treatment for OIs. Among those eligible for OI prophylaxis, 18.6% were receiving tuberculosis prevention with isoniazid (INH), while 90.7% were on cotrimoxazole for *Pneumocystis jirovecii* pneumonia prevention. A total of 41.3% had at least one OI, 43.8% had two OIs, and 14.9% developed three or more OIs. Mycobacterium tuberculosis (TB) was the most common OI, affecting 46.3% of the patients, followed by *P. jiroveci* pneumonia and infections caused by the *C. neoformans* (Cn) fungus, which occurred in 44.6% and 19% of the patients, respectively. Laboratory findings indicated a median CD4 cell count of 20 cells/mm^3 (IQR, 7–50.5), reflecting severe immune suppression. More than half of the patients experienced anemia, with a median hemoglobin concentration of 9.5 g/dL (IQR, 7.1–11.9). Additionally, the median platelet count was 182 K/μL (IQR, 125–256), and the median white blood cell (WBC) count was 9.16 K/μL (IQR, 6–13.7) (Table 2).

Treatment outcome characteristics

During treatment, 81% of the patients were discharged, while 19% died in the hospital.

Factors associated with inpatient mortality

Univariable analysis revealed significant associations between several factors and inpatient mortality These included underweight ($p < 0.05$), HBV coinfection ($p < 0.05$), lack of OIs preventive treatment ($p < 0.05$), number of OIs ($p < 0.05$), *C. neoformans* fungal disease ($p < 0.05$), sepsis ($p < 0.001$), CD4 + T-cell count ($p < 0.05$), and platelet count ($p < 0.05$) (Table 3).

No significant correlation was found between mortality and factors such as age group, coinfection with syphilis, time since diagnosis, prior ART, ART adherence, or OIs, including *P. jiroveci* pneumonia, *Mycobacterium tuberculosis*, oesophageal candidiasis, *Talaromyces marneffei*, and *Herpes simplex*. Additionally, hemoglobin concentration and WBC count did not show significant associations with mortality (Table 3).

Multivariate logistic regression analysis identified several predictors of inpatient mortality, including being underweight, HBV coinfection, lack of OI preventive treatment, *C. neoformans* fungal disease, and sepsis. The mortality rate was 4.60 times higher in underweight patients compared to those who were not underweight (OR = 4.60, 95% CI: 1.14–18.55). Patients with HBV coinfection had a 15.90 times greater risk of death compared to those without HBV coinfection (OR = 15.90, 95% CI: 2.85–88.58) (Table 4).

For participants who did not receive OIs preventive treatment, the odds of death were 9.74 times higher than those who received such treatment (OR = 9.74, 95% CI: 1.43–66.42). Patients with *C. neoformans* fungal disease

Table 3 Death and associated factors based on bivariable analysis ($n = 121$)

Characteristics	Total[#] *n* (%)	Death[$]		*p*
		Yes *n* (%)	No *n* (%)	
Total	121 (100)	23 (19.0)	98 (81.0)	.
Age group				
≤ 24 years old	17 (18.3)	3 (17.7)	14 (82.3)	*ref **
25–34 years old	57 (61.3)	14 (24.6)	43 (75.4)	0.746
≥ 35 years old	19 (20.4)	6 (31.6)	13 (68.4)	0.451
Underweight (BMI < 18.5 kg/m^2)				
Yes	51 (42.2)	14 (27.5)	37 (72.5)	0.043
No	70 (57.8)	9 (12.9)	61 (87.1)	*ref*[@]
HBV				
Yes	15 (12.4)	8 (53.3)	7 (46.7)	0.001
No	106 (87.6)	15 (14.2)	91 (85.8)	*ref **
Syphilis				
Yes	53 (43.8)	12 (22.6)	41 (77.4)	0.369
No	68 (56.2)	11 (16.2)	57 (83.8)	*ref*[@]
Time since diagnosis				
≤ 12 month (& new case)	93 (76.9)	18 (20.2)	71 (79.8)	0.570
> 12 month	28 (23.1)	5 (15.6)	27 (84.4)	*ref*[@]
ART treatment				
No prior treatment	69 (57.0)	18 (26.1)	51 (73.9)	*ref*[@]
≤ 12 month	33 (27.3)	4 (12.1)	29 (87.9)	0.129
> 12 month	19 (15.7)	1 (5.3)	18 (94.7)	0.062
ART adherence				
Yes	30 (24.8)	3 (10.0)	27 (90.0)	0.147
No (& new treatment)	91 (75.2)	20 (22.0)	71 (78.0)	*ref*[@]
OI preventive treatment (n = 121)				
Yes	43 (35.5)	2 (4.7)	41 (95.4)	ref [@]
No	78 (64.5)	21 (26.9)	57 (73.1)	0.003
Number of OI				
1 OI	50 (41.3)	4 (8.0)	46 (92.0)	*ref*[&]
2 OI	53 (43.8)	11 (20.8)	42 (79.2)	0.076
≥ 3 OI	18 (14.9)	8 (44.4)	10 (55.6)	0.003
***P.jiroverci*pneumonia**				
Yes	54 (44.6)	13 (24.1)	41 (75.9)	0.202
No	67 (55.4)	10 (14.9)	57 (85.1)	*ref*[@]
C.neoformans				
Yes	23 (19.0)	8 (34.8)	15 (65.2)	0.042
No	98 (81.0)	15 (15.3)	83 (84/7)	*ref **
Mycobacterium tuberculosis				
Yes	56 (46.3)	12 (21.4)	44 (78.6)	0.529
No	65 (53.7)	11 (16.9)	54 (83.1)	*ref*[@]
Esophageal candidiasis	8 (6.6)	1 (12.5)	7 (87.5)	*1.000*
Yes	113 (93.4)	22 (19.5)	91 (80.5)	*ref **
No				
Talaromyces marneffei	9 (7.4)	0 (0)	9 (100)	*0.205*
Yes	112 (92.6)	23 (20.5)	89 (79.5)	*ref **
No				
Herpes simplex	6 (5.0)	1 (16.7)	5 (83.3)	*1.000*
Yes	115 (95.0)	22 (19.1)	93 (80.9)	*ref **
No				
Sepsis				
Yes	25 (20.7)	14 (56.0)	11 (44.0)	< 0.001
No	96 (79.3)	9 (9.4)	87 (90.6)	*ref **

Table 3 (continued)

Characteristics	Total[#] *n* (%)	Death[$]		*p*
		Yes *n* (%)	No *n* (%)	
CD4 T-cell count (cell/mm^3)[!]	20 (7–50.5)	20 (5–31)	20 (9–62)	0.036[&]
Hemoglobin (g/dl)[!]	9.5 (7.1–11.9)	8.4 (6.3–11.9)	9.9 (7.3–12.2)	0.258[&]
Platelet Count (K/µL)[!]	182 (125–256)	138 (76–192)	185 (129–263)	0.008[&]
WBC (K/µL)	9.16 (6–13.7)	10.3 (6.9–14.5)	9.0 (5.6–13.1)	0.480[&]

*# Percentage by row; ref: Reference group;! Median (quartile); @ Chi-square test; * Fisher's test; & logistic regression*

Table 4 Multivariable logistic regression for factors independently associated with death ($n = 121$)

	p	OR (95%CI)
Underweight (BMI < 18.5 kg/m^2)		
Yes	0.032	4.60 (1.14–18.55)
No	*ref*	*ref*
HBV		
Yes	0.002	15.90 (2.85–88.58)
No	*ref*	*ref*
OI preventive treatment		
Yes	*ref*	*ref*
No	0.020	9.74 (1.43–66.42)
Number of OI		
1 OI	.	.
2 OI	.	.
≥ 3 OI	.	.
C.neoformans		
Yes	0.042	4.41 (1.06–18.39)
No	*ref*	*ref*
Sepsis		
Yes	< 0.001	24.20 (5.57–105.16)
No	*ref*	*ref*
CD4 T-cell count (cell/mm^3)[!]	.	.
Model fit index		
Pseudo R-squared	0.455	
AIC	98.202	
BIC	91.477	

Logistic regression with independent variables included variables with p < 0.2 from the bivariable analysis. Each variable that had a significant relationship in the test (p < 0.2) was calculated via the multivariate logistic regression method, with an odds ratio (OR) and 95% confidence interval (95% CI). Significance was considered when the p-value was less than 0.05.

were 4.41 times more likely to die compared to those without this infection (OR = 4.41, 95% CI: 1.06–18.39). The mortality rate was significantly higher in patients with sepsis, with a 24.20 times greater likelihood of death compared to those without sepsis (OR = 24.20, 95% CI: 5.57–105.16) (Table 4).

Discussion

A total of 121 participants were included in the study. The findings of this study indicate that most hospitalized patients (76.9%) were newly diagnosed with HIV within the past 12 months, and only 43% had initiated ART treatment. These rates are notably lower than the 2023 statistics reported by the Vietnamese Ministry of Health, which showed that 88% of people living with HIV were aware of their status, and 80% of those diagnosed were receiving ART treatment [9]. Collectively, these figures highlight significant gaps in Vietnam's progress toward the UNAIDS 95-95-95 targets [18]. While improvements have been made in diagnosing HIV, significant barriers remain in initiating treatment for newly diagnosed individuals. Concerns about the potential side effects of ART medications and the pervasive stigma surrounding HIV serve as major obstacles. Many individuals fear rejection by family, colleagues, and community members if their HIV status or ART usage is discovered. These delays in treatment contribute to advanced HIV disease, severe immunosuppression (median CD4 count of 20 cells/mm^3), and a high prevalence of opportunistic infections (OIs), with 58.7% of patients presenting with more than two OIs at the time of hospitalization. These findings underscore the urgent need for robust linkage-to-care strategies to ensure newly diagnosed individuals rapidly transition to treatment. Addressing structural and behavioral barriers, such as stigma, limited access to healthcare services, and adherence support, is critical. Expanding community-based testing and implementing rapid ART programs can enhance treatment coverage and support the achievement of the second "95" in the UNAIDS framework. These efforts are particularly vital for high-risk populations, such as MSM, who disproportionately experience HIV-related morbidity and mortality in Vietnam.

The mortality rate among advanced HIV-infected MSM patients hospitalized due to OIs was 19%. This rate is significantly higher than the 12% mortality rate from OIs observed in the general HIV-positive population [2]. Gender may be a contributing factor to this disparity, as previous studies have shown that mortality rates are higher in men than in women [3, 14]. A cohort study conducted in China from 2011 to 2019 demonstrated that OIs increase the risk of in-hospital death, with males being at greater risk of contracting OIs than females [2].

Mycobacterium tuberculosis is the most common OI among inpatients, affecting 46.3% of the participants, followed by *Pneumocystis jirovecii* pneumonia (44.6%) and *Cryptococcus neoformans* fungal disease (19%). These

findings are consistent with studies by Sirun Meng et al. [2], Linh Vu Phuong Dang et al. [6], and Louie Mar A. Gangcuangco et al. [5], which highlights the prevalence of TB, PCP, and *C. neoformans* infections among people living with HIV (PLWH), including MSM in Vietnam.

There are notable variations in the prevalence of common OI among PLWH in different countries. For instance, in Japan, the incidence of PCP is significantly higher compared to other OIs. In contrast, Thailand shows nearly equal prevalence rates for tuberculosis and PCP [5].

The odds of death are significantly higher for underweight patients (BMI < 18.5 kg/m^2) compared to those who are not underweight. These findings align with results reported by Selam Tesfayohannes et al. [19] and Hannah Kibuuka et al. [4]. According to WHO, being underweight is a form of malnutrition [20]. Malnutrition is a critical issue in chronic diseases, including HIV/AIDS [21].

In PLWH, malnutrition can be attributed to factors such as increased basal energy demands, decreased food intake, and impaired nutrient metabolism, especially in individuals with OIs [20]. This condition can exacerbate an already compromised immune system, increasing the risk of OIs and mortality [22].

Improving nutritional status through a proper diet may help prevent OIs and reduce mortality rates in HIV/AIDS patients. A tailored nutrition plan should account for local cultural and dietary practices, ensuring that meals are nutritionally adequate for individuals living with HIV [22].

The study also revealed that 12.4% of participants were coinfected with both HIV and HBV. This rate is similar to the 8.5% reported in a previous study in Vietnam [6]. Patients hospitalized with HBV coinfection had a 15.90-fold higher mortality rate compared to those without HBV. This finding is consistent with results from earlier large cohort studies, which also reported higher all-cause and liver-related mortality in individuals with HIV/HBV coinfection compared to those with HIV or HBV alone [23, 24]. Among patients with HIV/HBV coinfection, liver-related mortality was highest in those with a low nadir CD4 cell count [25].

The effect of HBV on the natural history of HIV infection remains unclear. Some research suggests that individuals coinfected with HIV and HBV may have lower CD4 + cell counts [26]. Despite this, vaccination against HBV remains important. However, Klaus Jansen et al. reported that HIV can reduce the efficacy of the HBV vaccine. In Germany, less than 50% of MSM living with HIV were effectively vaccinated against HBV during vaccination campaigns [27]. Therefore, people living with HIV must receive HBV vaccination as soon as possible, particularly when their HIV viral load is low.

For participants who did not receive OI preventive treatment therapy (PTT), the odds of death were 9.74 times higher compared to those who did receive the treatment. These results are consistent with findings from Selam Tesfayohannes et al., who reported that PTT can reduce mortality rates among PLWH, including MSM [19].

Preventive treatment in this study included tuberculosis prophylaxis with isoniazid, cotrimoxazole for *Pneumocystis jirovecii* pneumonia, and fluconazole for *Cryptococcus* prophylaxis, as outlined by WHO guidelines [1]. This treatment therapy can help prevent common OIs such as TB, PCP, and *C. neoformans*. To optimize the effectiveness of PTT, physicians must assess the risk of OIs and administer preventive treatment accordingly to reduce mortality from these infections.

Patients hospitalized with *C. neoformans* fungal disease were approximately 4.41 times more likely to die compared to those without this infection. This finding is consistent with results from Erin E. McClelland et al. [28] and Tiffany E. Guess et al. [29]. *C. neoformans* is a yeast that predominantly affects immunocompromised individuals, often involving the meninges, endocardium, skin, and lymph nodes [30].

The prevalence and mortality rate of *C. neoformans* is higher in males than in females, which is attributed to the differing interactions between *C. neoformans* and macrophages influenced by testosterone in males and 17-β estradiol in females [28]. This gender disparity contributes to the increased mortality rate observed in MSM coinfected with *C. neoformans* and HIV.

To reduce mortality from *C. neoformans*, the use of fluconazole for preventive treatment should be considered for patients with a CD4 cell count below 100 cells/mm^3, as recommended by WHO guidelines [1]. Sepsis emerged as the most critical factor affecting the mortality rate of HIV patients in this study. This aligns with previous research indicating that sepsis mortality was 28% higher among PLWH compared to healthy controls, based on a study of 82,905 patients [31]. In cases of sepsis among HIV-positive patients, 44.4% of infections were due to fungi and 16.7% to mycobacteria [32]. The previous studies showed patients receiving mechanical ventilation, renal replacement therapy, positive blood cultures, or platelet transfusions had a higher mortality rate from sepsis compared to those who did not undergo these treatments [33]. Preventing sepsis in newly hospitalized patients, especially those with HIV and a CD4 count below 200 cells/mm^3, is crucial [34]. Additionally, addressing malnutrition by improving the patient's weight and total protein levels may help reduce the risk of death from sepsis [33].

The strengths of this study lie in its valuable insights into treatment outcomes for opportunistic infections

among advanced HIV patients within the MsM population, identifying critical associated factors. These findings can guide physicians in developing targeted prevention and treatment strategies, potentially reducing inpatient mortality rates.

However, the study has some limitations. It was conducted exclusively at the Hospital for Tropical Diseases, which may not fully represent the broader population of HIV-infected MSM in Vietnam. The reliance on patient recall introduces the potential for recall bias, and data collection did not differentiate between infection and active disease in comorbidities like HBV and HCV or include details on ART in HIV/HBV coinfected patients. Additionally, the relatively small sample size limited the analysis of demographic factors and their association with mortality. The cross-sectional design further constrained the ability to explore longitudinal effects.

Future research with larger, longitudinal cohorts is recommended to address these gaps and comprehensively examine demographic influences on mortality. Despite these limitations, this study offers meaningful contributions to understanding and managing opportunistic infections in this population.

Conclusion

Mycobacterium tuberculosis was the most common OI, followed by *P. jirovecii* pneumonia and *C. neoformans*. Recognizing these common OIs in advanced HIV-infected MSM can help physicians administer necessary treatments and preventative measures to protect patients from complications and death. The inpatient mortality rate among advanced HIV-infected MSM is notably high, even among relatively young patients. Factors associated with increased mortality include being underweight, having sepsis, HBV coinfection, or an OI with *C. neoformans*, and not receiving OI preventive treatment. Improving nutritional status, timely vaccination against HBV, and implementing OI preventive treatments could reduce mortality rates among this group.

Abbreviations

OIs	Opportunistic infections
MSM	Men who have sex with men
HIV	Human Immunodeficiency Virus
AHD	Advanced HIV disease
ART	Antiretroviral therapy
HBV	Hepatitis B virus
WHO	World Health Organization
PLWH	People living with HIV
TB	Mycobacterium tuberculosis
C. neoformans	Cryptococcus neoformans
PCP	Pneumocystis jirovecii pneumonia
PTT	Preventive treatment therapy
INH	Tuberculosis prophylaxis using Isoniazid
WBC	White blood cells
MAC	Mycobacterium avium complex

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12879-025-10679-y.

Supplementary Material 1

Supplementary Material 2

Acknowledgements

We are deeply grateful to the leaders of the HIV ward at the Hospital for Tropical Diseases in Ho Chi Minh City, as well as the dedicated healthcare workers who facilitated this research. We also extend our sincere thanks to all the participants and collaborators who contributed their time to this study. A special thank you to Mrs. Uyen Nu Thanh Le for her invaluable support.

Author contributions

LTV and PHN were responsible for the conception and design of the study. PHN and DPQ were involved in data collection. LTV and YLV entered and managed the data. GH, TNLN, and LTV were involved in data analysis and the creation of the tables. DPQ, AG, LTV, NMV, TNLN, and GH contributed to the finalization of the manuscript. All the authors have consented to the manuscript and its contents.

Funding

Our research did not receive any funding.

Data availability

The dataset generated and analyzed during this study is available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

The study was approved by the Ethics Committee for Biomedical Research at the University of Medicine and Pharmacy at Ho Chi Minh City, Vietnam (Approval No. 97/HDDD, dated February 1, 2023). Before participating, all participants were fully informed about the study's objectives and procedures. The researcher provided detailed explanations and addressed any questions related to the study. Participants were assured of the confidentiality and security of their information. Informed consent was obtained from all participants. They were allowed to withdraw from the study at any time or choose not to answer specific questions without any consequences. The questionnaire used in the study did not collect personally identifiable information. Each participant was assigned a unique identification number to ensure anonymity and facilitate medical record retrieval.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Author details

[1]Hospital for Tropical Diseases, Ho Chi Minh City, Vietnam
[2]Faculty of Medicine, University of Medicine and Pharmacy at Ho Chi Minh City, Ho Chi Minh City, Vietnam
[3]Faculty of Control Disease, Health Center District 8, Ho Chi Minh, Vietnam
[4]Faculty of Public Health, University of Medicine and Pharmacy at Ho Chi Minh City, 217 Hong Bang, District 5, Ho Chi Minh City, Vietnam
[5]University of Michigan School of Public Health, Michigan, USA
[6]Le Van Thinh Hospital, Ho Chi Minh City, Vietnam

Received: 19 August 2024 / Accepted: 18 February 2025
Published online: 25 February 2025

References

1. World Health Organization (WHO). Consolidated guidelines on the use of antiretroviral drugs for treating and preventing Hiv infection. Switzerland; 2016.
2. Meng S, Tang Q, Xie Z, Wu N, Qin Y, Chen R, et al. Spectrum and mortality of opportunistic infections among HIV/AIDS patients in Southwestern China. Eur J Clin Microbiol Infect Dis. 2023;42(1):113–20. https://doi.org/10.1007/s10096-022-04528-y.
3. Coelho L, Grinsztejn B, Castilho JL, De Boni R, Quintana MS, Campos DP, et al. Mortality in HIV-infected women, heterosexual men, and men who have sex with men in Rio de Janeiro, Brazil: an observational cohort study. Lancet HIV. 2016;3(10):e490–8. https://doi.org/10.1016/s2352-3018(16)30052-2.
4. Kibuuka H, Musingye E, Mwesigwa B, Semwogerere M, Iroezindu M, Bahemana E, et al. Predictors of All-Cause mortality among people with human immunodeficiency virus (HIV) in a prospective cohort study in East Africa and Nigeria. Clin Infect Dis. 2022;75(4):657–64. https://doi.org/10.1093/cid/ciab995.
5. Gangcuangco LMA, Sawada I, Tsuchiya N, Do CD, Pham TTT, Rojanawiwat A, et al. Regional differences in the prevalence of major opportunistic infections among Antiretroviral-Naïve human immunodeficiency virus patients in Japan, Northern Thailand, Northern Vietnam, and the Philippines. Am J Trop Med Hyg. 2017;97(1):49–56. https://doi.org/10.4269/ajtmh.16-0783.
6. Dang LVP, Nguyen QH, Ishizaki A, Larsson M, Vu NTP, Do Duy C, et al. Prevalence of opportunistic infections and associated factors in HIV-Infected men who have sex with men on antiretroviral therapy in Bach Mai hospital, Hanoi, Vietnam: A Case-Control study. Am J Mens Health. 2020;14(3):1557988320926743. https://doi.org/10.1177/1557988320926743.
7. World Health Organization (WHO). HIV and AIDS 2024 [Available from: https://www.who.int/news-room/fact-sheets/detail/hiv-aids
8. World Health Organization (WHO). Global health sector strategies on, respectively, HIV, viral hepatitis and sexually transmitted infections for the period 2022–2030. 2022.
9. Vietnam Ministry of Health. Plan for HIV/AIDS prevention and control in 2024. Vietnam: Hanoi; 2024.
10. Thuong NV, Tu LN. HIV prevalence and associated factors among men who have sex with men in central Mekong Delta of Vietnam, 2019. Vietnam J Prev Med. 2021;30(2):111–20. https://doi.org/10.51403/0868-2836/2020/286.
11. Patel P, Borkowf CB, Brooks JT, Lasry A, Lansky A, Mermin J. Estimating per-act HIV transmission risk: a systematic review. AIDS. 2014;28(10):1509–19. https://doi.org/10.1097/qad.0000000000000298.
12. Centers for Disease Control and Prevention (CDC). Men Who Have Sex with Men (MSM) 2021 [updated August 22, 2022. Available from: https://www.cdc.gov/std/treatment-guidelines/msm.htm
13. Huong NTT, Ngoc NM, Thoi DV, Nghia CH, Lan NTP, Thuy NTT, et al. Epidemiological characteristics, risk behaviors and immune decline status in newly diagnosed HIV-positive men who have sex with men Pasteur Institute in Ho Chi Minh City and the hospital for tropical diseases in Ho Chi Minh City in 2019–2020. Vietnam J Prev Med. 2021;31(9):73–82. https://doi.org/10.51403/0868-2836/2021/476.
14. Lee CY, Lin YP, Tu HP, Wang SF, Lu PL. Sex stratification of the trends and risk of mortality among individuals living with HIV under different transmission categories. Sci Rep. 2022;12(1):9266. https://doi.org/10.1038/s41598-022-13294-y.
15. Wilson IB, Fowler FJ, Cosenza CA, Michaud J, Bentkover J, Rana A, et al. Cognitive and field testing of a new set of medication adherence self-report items for HIV care. AIDS Behav. 2014;18:2349–58.
16. HIV Medicine Association of the Infectious Diseases Society of America. Guidelines for the prevention and treatment of opportunistic infections in adults and adolescents with HIV. ClinicalInfoHIVgov. H-1 - CC;; 2024.
17. Singer M, Deutschman CS, Seymour CW, Shankar-Hari M, Annane D, Bauer M, et al. The third international consensus definitions for Sepsis and septic shock (Sepsis-3). JAMA. 2016;315(8):801–10. https://doi.org/10.1001/jama.2016.0287.
18. The Joint United Nations Program on HIV/AIDS (UNAIDS). The urgency of now: AIDS at a crossroads. Geneva; 2024.
19. Tesfayohannes S, Shine S, Mekuria A, Moges S. Mortality and its predictors among adult human Immune-Deficiency Virus-Infected patients attending their antiretroviral treatment at health centers, addis Ababa, Ethiopia: multi-center retrospective cohort study. AIDS Res Treat. 2022;2022:6128718. https://doi.org/10.1155/2022/6128718.
20. World Health Organization (WHO). Malnutrition 2024 [updated March 1. 2024. Available from: https://www.who.int/news-room/fact-sheets/detail/malnutrition?gad_source=1%26;gclid=CjwKCAjw4_K0BhBsEiwAfVVZ_1UAYRrp0Dc_Iv9XI1SHmr39BS0E3O1wY2AgfX6pJDoCbTydNu7iOBoCvF0QAvD_BwE#.
21. Norman K, Pichard C, Lochs H, Pirlich M. Prognostic impact of disease-related malnutrition. Clin Nutr. 2008;27(1):5–15.
22. Fathima A, Maxima M, Udaya K, Sameer D, Nitesh K, Sanjiv S, et al. Nutritional aspects of people living with HIV (PLHIV) amidst COVID-19 pandemic: an insight. Curr Pharmacol Rep. 2022;8(5):350–64. https://doi.org/10.1007/s40495-022-00301-z.
23. Thio CL, Seaberg EC, Skolasky R Jr., Phair J, Visscher B, Muñoz A, et al. HIV-1, hepatitis B virus, and risk of liver-related mortality in the multicenter cohort study (MACS). Lancet (London England). 2002;360(9349):1921–6. https://doi.org/10.1016/s0140-6736(02)11913-1.
24. Thornton AC, Jose S, Bhagani S, Chadwick D, Dunn D, Gilson R, et al. Hepatitis B, hepatitis C, and mortality among HIV-positive individuals. AIDS. 2017;31(18):2525–32. https://doi.org/10.1097/qad.0000000000001646.
25. Falade-Nwulia O, Seaberg EC, Rinaldo CR, Badri S, Witt M, Thio CL. Comparative risk of liver-related mortality from chronic hepatitis B versus chronic hepatitis C virus infection. Clin Infect Dis. 2012;55(4):507–13.
26. Thio CL, Smeaton L, Saulynas M, Hwang H, Saravan S, Kulkarni S, et al. Characterization of HIV–HBV coinfection in a multinational HIV-infected cohort. AIDS. 2013;27(2):191–201.
27. Jansen K, Thamm M, Bock CT, Scheufele R, Kücherer C, Muenstermann D, et al. High prevalence and high incidence of coinfection with hepatitis B, hepatitis C, and syphilis and low rate of effective vaccination against hepatitis B in HIV-Positive men who have sex with men with known date of HIV seroconversion in Germany. PLoS ONE. 2015;10(11):e0142515. https://doi.org/10.1371/journal.pone.0142515.
28. McClelland EE, Hobbs LM, Rivera J, Casadevall A, Potts WK, Smith JM, et al. The role of host gender in the pathogenesis of Cryptococcus neoformans infections. PLoS ONE. 2013;8(5):e63632. https://doi.org/10.1371/journal.pone.0063632.
29. Guess TE, Rosen JA, McClelland EE. An overview of sex Bias in C. neoformans infections. J Fungi (Basel). 2018;4(2). https://doi.org/10.3390/jof4020049.
30. Page KR, Chaisson R, Sande M. CHAPTER 34 - Cryptococcosis and other fungal infections (Histoplasmosis and Coccidioidomycosis) in HIV-infected patients. In: Volberding PA, Sande MA, Greene WC, Lange JMA, Gallant JE, Walsh CC, editors. Global HIV/AIDS medicine. Edinburgh: W.B. Saunders; 2008. pp. 375–91.
31. Pyarali FF, Iordanov R, Palacio A, Tamariz L. Excess mortality risk from sepsis in patients with HIV–a meta-analysis. J Crit Care. 2020;59:101–7.
32. Silva JM Jr., dos Santos Sde S. Sepsis in AIDS patients: clinical, etiological and inflammatory characteristics. J Int AIDS Soc. 2013;16(1):17344. https://doi.org/10.7448/ias.16.1.17344.
33. Gray K, Engoren M. Outcomes of sepsis in patients with and without HIV infection:a retrospective study. American Journal of Critical Care. 2023;32(4):288– 93;
34. Liu B, Guo C, Liu L, Zhou H, Li L, Si Y, et al. Management and prognosis of HIV infected patients with postoperative sepsis. Sci Res Essays. 2011;6(11):2389-94; living with HIV.

Publisher's note