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Prevalence and Factors Associated with Pulmonary Tuberculosis Infection among HIV/AIDS Patients Attending an ART Clinic: A Study at Fort Portal Regional Referral Hospital

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ABSTRACT

Among the over 33 million individuals living with HIV/AIDS, one-third also contracted tuberculosis, making it a significant co-infection. Tuberculosis emerged as the primary cause of illness and death within the HIV/AIDS community, responsible for approximately 30% of all fatalities among those affected. While curable when accurately diagnosed and promptly treated, addressing tuberculosis in HIV/AIDS patients required special attention due to the intricacies involved in diagnosing and treating both conditions concurrently. Employing a quantitative cross-sectional design, the study aimed to ascertain PTB prevalence and its socio-demographic and behavioral determinants among HIV/AIDS patients attending the ART clinic. Eighty-seven participants were selected via simple random sampling, with questionnaires serving as the primary data collection tool. The findings revealed a significant association between age over 45 years and the occurrence of pulmonary TB, with an odds ratio of 0.71 (0.45–3.77) and a p-value of 0.035. Additionally, male gender exhibited a notable association with PTB among HIV patients, with an odds ratio of 0.48 (0.15-8.14) and a p-value of 0.001. Furthermore, the study indicated a correlation between PTB occurrence and HIV patients, with an odds ratio of 0.35 (0.001-3.79) and a p-value of 0.024. The study's conclusion highlighted that approximately 18.4% of HIV-positive patients had experienced pulmonary tuberculosis. Recommendations included promoting good adherence to ART and TB prophylaxis among HIV patients to bolster immunity against TB. Encouraging HIV patients to steer clear of behaviors that heighten TB risk, such as smoking and excessive alcohol consumption, was also advised. Additionally, the government was urged to enhance support and supplies for individuals living with HIV and tuberculosis, aiming to prevent disease progression through tertiary interventions.

Keywords: HIV/AIDS patients; Tuberculosis; PTB among HIV patients, Smoking and alcohol drinking, ART clinic.

INTRODUCTION

Globally, one-third of the more than 33 million people living with HIV/AIDS are also infected with tuberculosis.[1–3] TB is the leading cause of morbidity and mortality among HIV/AIDS patients, accounting for about 30% of all deaths among HIV/AIDS patients [4]. Tuberculosis in HIV/AIDS patients is curable provided it is diagnosed accurately and treated promptly, but this needs special attention due to the complexity of the diagnosis and treatment involved in tuberculosis and HIV/AIDS co-infection. [5]. WHO estimates that 9.2 million people contract TB annually [6]with developing countries accounting for 95% of all tuberculosis-infected people around the world [6]. Tuberculosis, being a major infectious cause of morbidity and mortality worldwide, was estimated to have accounted for 10 million new cases and 1.6 million deaths in 2018 [6]. Uganda, which is among the 22 countries with the highest TB burden, has a treatment success rate of 67%, where 50% of patients with tuberculosis are also Human Immunodeficiency Virus (HIV) co-infected [7]. The disease burden is excessively concentrated in low- and middle-income countries, which contribute approximately 95% of all TB-related deaths [7]. Even though most of these deaths are preventable through early diagnosis and treatment, nearly 40% of TB cases remained undiagnosed globally by 2019 [8]. Tuberculosis and HIV/AIDS co-infection is associated with a significantly increased likelihood of mortality, with HIV/AIDS co-infected TB patients having significantly lower cure rates and lower treatment success rates compared to non-HIV/AIDS-infected TB patients [9]. Several factors have been associated with TB incidence

among patients with HIV/AIDS, including low financial status, a very low CD4 count (<50 cells/µl), anaemia, inappropriate vaccinations, cigarette smoking, households with a family size of greater than 4 people, a lower social class, non-adherence to drugs, and severe immunosuppression [10, 11] However, prevalence and factors associated with tuberculosis infection among patients with HIV/AIDS have limited data in Uganda. It is important to study the factors associated with tuberculosis infection among patients with HIV/AIDS to guide medical personnel and policymakers on interventions and practices to improve health outcomes and help develop preventive measures to reduce the magnitude of the problem. This study has therefore investigated the prevalence and factors associated with tuberculosis infection among patients with HIV/AIDS on highly active antiretroviral therapy at Fort Portal Regional Referral Hospital.

Currently, approximately 34 million people are infected with HIV, and at least one-third of them are also infected with TB [12, 13]. The dual epidemics of TB and HIV are particularly pervasive in Africa, where HIV has been the most important contributing factor in the increasing incidence of TB over the last 10 years [13]. In some countries in sub-Saharan Africa, up to 80 percent of individuals with active TB disease are also HIV-positive [13]. The risk of progressing from latent to active TB is estimated to be about 20 times greater in people living with HIV/AIDS than among those without HIV infection, with a higher risk of transmitting the infection to others [14]. Uganda is among the 30 countries with the highest tuberculosis burden and TB and HIV/AIDS co-infections in the world [15] The National Tuberculosis and Leprosy Program annual report of 2018 indicates that about 31% of all TB-notified cases had co-infection with HIV/AIDS [16]. Despite the increased access to antiretroviral therapy (ART), mortality among people living with HIV/AIDS is still high, and TB is the leading cause of mortality, especially in patients with a $CD4^+$ cell count less than 50 cells/microliter [16]. Understanding the factors associated with tuberculosis infection among people living with HIV/AIDS would help medical personnel, policymakers, and concerned authorities put forward measures and practices for people living with HIV/AIDS on how to prevent the infection with pulmonary tuberculosis, improve health outcomes, and develop preventive measures to reduce the magnitude of the problem. For this reason, this study has investigated the prevalence and factors associated with tuberculosis infection among people living with HIV/AIDS attending Fort Portal Regional Referral Hospital. The study was to determine the prevalence and factors associated with tuberculosis infection among HIV/AIDS patients attending Fortportal Regional Referral Hospital.

METHODOLOGY

Study design

A quantitative cross-sectional study approach was conducted to determine the prevalence and factors associated with pulmonary tuberculosis infection among HIV patients attending Fort Portal Regional Referral Hospital.

Area of Study

The study was conducted in the ART Clinic of Fort Portal Regional Referral Hospital in Fort Portal District, Western Uganda. Fort Portal Hospital lies within the city of Fort Portal, approximately 148 kilometres by road, west of Mubende District Hospital. This location is approximately 294 kilometres west of Mulago National Referral Hospital, in Kampala, Uganda's capital and largest city. The coordinates of the hospital are: 0°39' 19., 30°1653.0 E (latitude: 0.655278; 55278; longitude: 30.281389). Fort Portal Hospital is a public hospital funded by the Uganda Ministry of Health, and general care in the hospital is free. It is one of the 13 "Regional Referral Hospitals" in Uganda. The hospital is designated as one of the 15 "internship hospitals" where graduates of Ugandan medical schools can serve one year of internships under the supervision of qualified specialists and consultants. The bed capacity of Fort Portal Hospital is quoted as 333.

Study population

The study was conducted among HIV patients attending Fortportal Regional Referral Hospital.

Inclusion criteria and rationale

All patients with HIV/AIDS co-infected with TB attending the Fortportal Regional Referral Hospital ART clinic who presented at the time of collecting data and were willing to participate in the study were included.

Exclusion criteria

Patients who met the inclusion criteria but declined their willingness to participate in the study. Also, patients previously treated for TB and those with extra-pulmonary TB were excluded from the study.

Sample size determination and rationale

The sample size was determined using the Kish L. 1965 formula[17]. The formula was used to estimate the smallest possible categorical sample size required.

$n = z^2pq\ d2$

Where;

n = minimum sample size d = margin of error (0.05)

z=standard normal deviation, corresponding to 1.96

p = the existing prevalence of M. TB/HIV co-infection in the region (6%, LQAS 2016). q=1-p

Therefore,

taking p = 8/100 = 0.06

z = 1.96

q = 1 minus 0.06 = 0.94
d = 0.05,
n = 1.96x0.06x0.94
0.05^2
n= 87

Sampling Procedure

A simple random sampling technique was used to select participants. Patients were enrolled and interviewed using a structured questionnaire.

Dependent variables

Pulmonary tuberculosis infection among HIV patients

Independent variable

Participants' socio-demographic factors like age, occupation, and education, as well as social health behavioral factors such as smoking, alcohol drinking, and low living standards.

Data collection method and tool.

Data were collected using an interviewer-administered questionnaire. Eligible participants were asked to participate in the study as they visited an HIV clinic for treatment. Patients were consecutively enrolled and interviewed using a structured questionnaire. Each participant was required to give informed consent before enrolling in the study. The researcher assisted the respondents in filling out the questionnaires by explaining to them for clarifications. The properly filled-out questionnaires were then collected, and data was taken for analysis. The researcher used a structured questionnaire, and participants were asked similar questions, and from the options, they picked the best alternative. A pen and paper were used to record the necessary information. Clinical signs and symptoms were considered for diagnosis.

Data entry and cleaning.

The data in the questionnaire was checked for completeness, cleaned, and sorted to eliminate obvious inaccuracies and omissions. The data was then coded and entered into the computer.

Data analysis

The qualitative data collected were statistically analyzed and documented using Microsoft Excel and Word version 2020, which were then analyzed using SPSS v.16. The analyzed data were then presented in the form of tables and graphs, which provided a basis for discussion and helped extract relevant conclusions. To achieve the above objectives, relevant questions were asked in the data collection tool, and participant answers were captured and assigned a value that was coded and analyzed.

Quality Control

To ensure quality control, the researcher conducted a pretest using at least 10 questionnaires, and data was collected before the actual study, which helped in the reconstruction of the questionnaire.

Ethical considerations.

Participants were given information regarding the research to seek consent. Each participant's choice to participate or not was respected, and the data collected from participants was kept confidential. The participants' names were not included while filling out the questionnaire to maintain privacy. It was communicated that the information obtained from the participants would be kept under lock and key to only be used for research purposes.

RESULTS

Table 1: Social demographic factors associated with PTB

Demographics	PTB (16)		No PTB (71)	
	Freq.	% age	Freq.	%age
Age				
20- 45	06	37.5	37	52.1
More than 45	10	62.5	34	47.9
Education level				
Primary	07	43.8	30	42.3
Post primary	09	56.2	41	57.7
Gender				
Male	11	68.8	28	39.4
Female	05	31.2	43	60.6
Occupation				
Peasant	13	81.3	55	77.5
Formerly employed	03	18.7	16	22.5

From Table three above, which showed an association between social demographic characteristics and the occurrence of pulmonary TB among HIV patients, it was shown that the majority of the participants, 10 (62.5%) with PTB, were aged above 45 years, while at least 37 (52.1%) of the participants who had not had PTB were aged 20–45 years. The study showed that age above 45 years was significantly associated with the occurrence of PTB among HIV patients at an odds ratio of 0.71 (0.45–3.77) and a p-value of 0.035. The study also showed that the majority of the participants, both with PTB (9.2%) and 41 (57.7%) of those who had not had PTB, said they had attained a post-primary level of education with a p-value of 0.125 and an odds ratio of 0.32 (0.21–7.39). The study showed that education level was not significantly associated with the occurrence of PTB among HIV patients.

11 (68.8%) of the participants with PTB-HIV were males, while 43 (60.6%) of the participants without PTB were females, with a p-value of 0.001 and an odds ratio of 0.48 (0.15-8.14). The study showed that the male gender was significantly associated with the occurrence of PTB among HIV patients. And also, that the majority of the participants, both with PTB 13 (81.3%) and the majority of those without pulmonary TB 55 (77.5%), said they were peasant farmers, with a p-value of 0.075 and an odds ratio of 0.22 (0.03–4.85). The study showed that participant occupation was not significantly associated with the occurrence of PTB among HIV patients.

Prevalence of pulmonary TB

Table 2: prevalence of TB among HIV patients.

Patient	Frequency	Percentage
With pulmonary TB	**16**	**18.4**
Without pulmonary TB	**71**	**81.6**

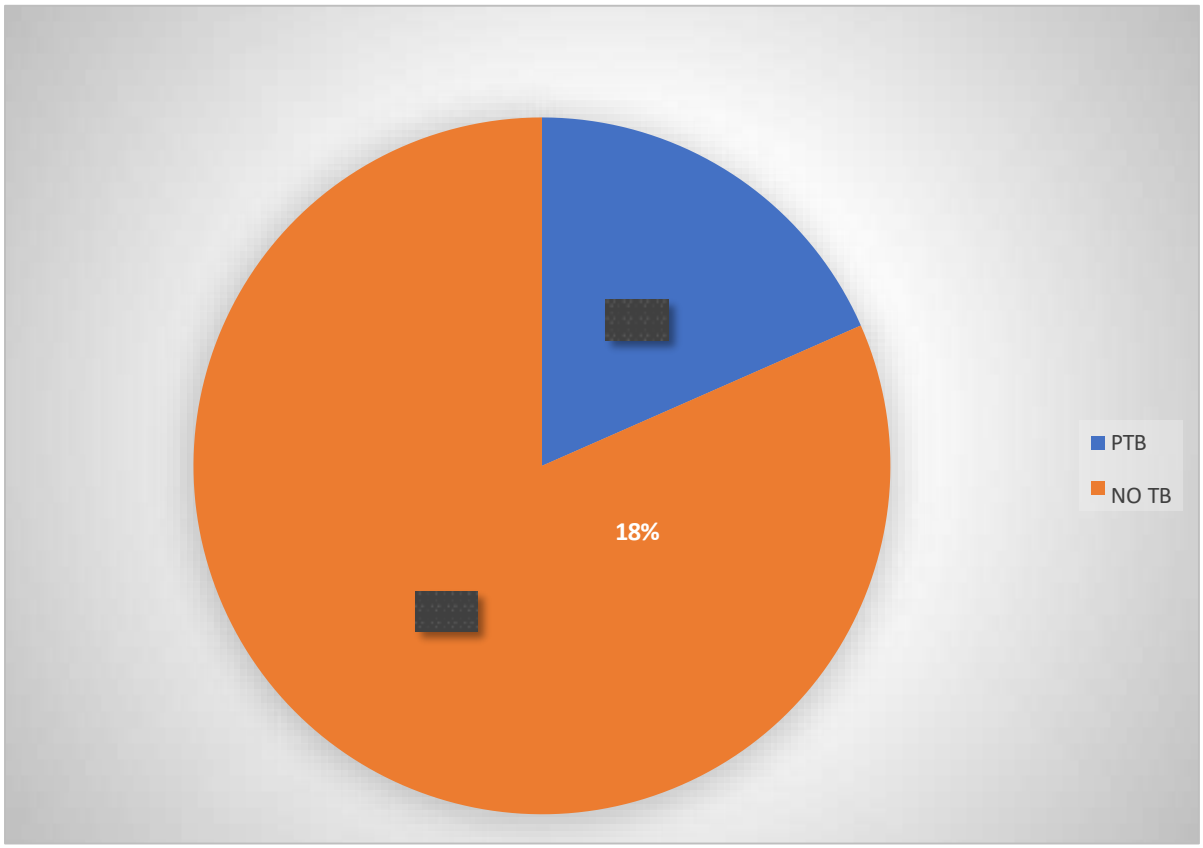

Figure 1: Pie chart showing prevalence of PTB among HIV patients

From table two above the study showed that at least 16(18%) of the participants had had pulmonary tuberculosis while 71(82) of the participants did not have pulmonary TB.

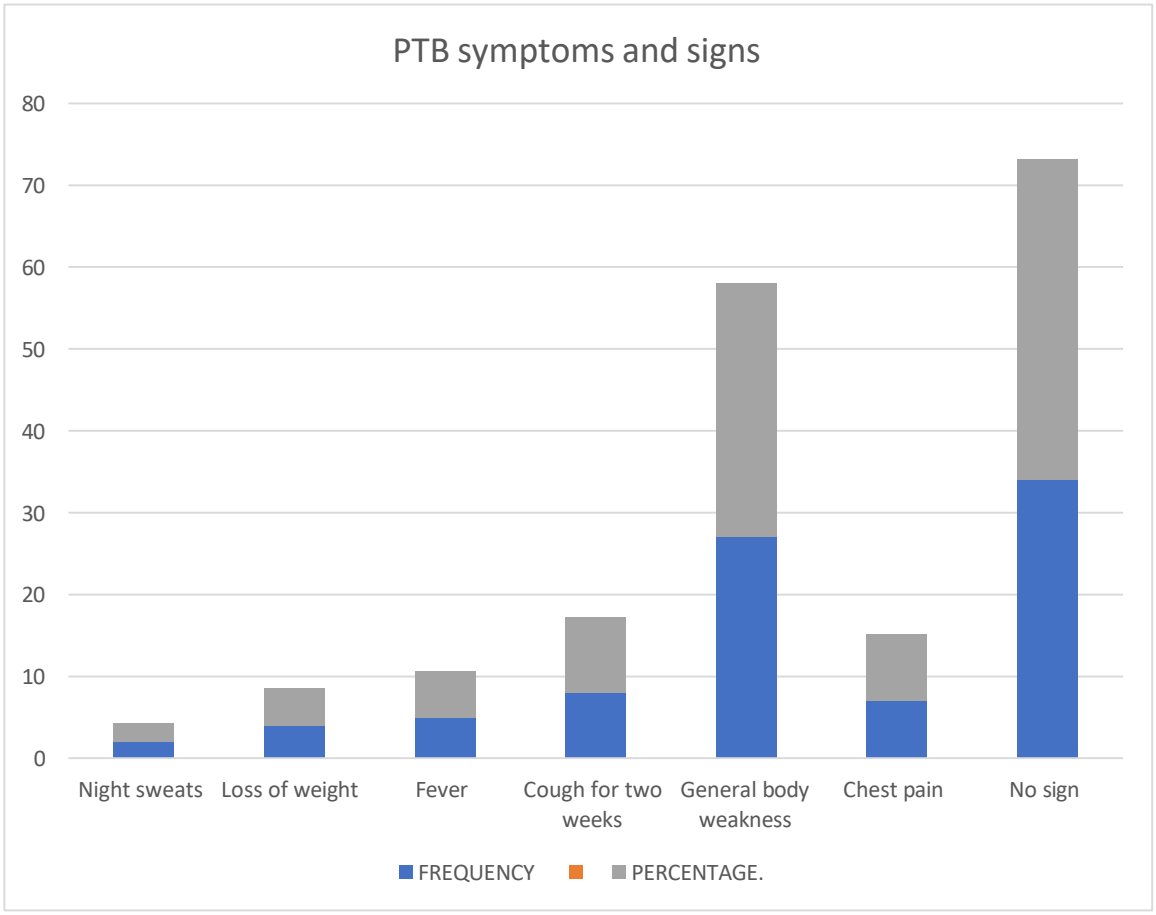

Figure 2: A bar graph showing tuberculosis signs and symptoms among HIV patients attending ART Clinic at FRRH

Table one above, which showed clinical signs of pulmonary tuberculosis among HIV patients, it showed that the majority of the participants, 27 (31.0%), said they had gotten generalized body weakness. 8 (9.2%) said they had had a cough for two weeks. 5 (5.7%) had had persistent fever, and 4 (4.6%) had lost weight. 7 (8.1%) had chest pain. 2 (2.3) had night sweats, and at least 34 (39.1%) did not have clinical signs.

Social health behaviour factors predisposing patients living with HIV/AIDS to TB co-infection

Table 3: Social health behaviour factors predisposing patients living with HIV/AIDS to TB co-infection

Social factors	PTB		NO PTB		Odds ratio	p-value
	Freq.(16)	%age	Freq.(71)	%age	95% CI	< 0.05 sg*
Cigarette Smoking						
Yes	02	12.5	09	12.7	Ref	
No	14	87.5	62	87.3	0.47(0.05- 5.02)	0.286
Alcohol					Ref	
drinking Yes	06	37.5	13	18.3		
No	10	62.5	58	81.7	0.25(0.22-3.34)	0.101
Over crowding						
Yes	01	6.3	03	4.2	Ref	
No	15	93.7	68	95.8	0.82(0.45-6.28)	0.374
ART adherence						
Good	07	43.8	50	70.4	Ref	
Poor	09	56.2	21	29.6	0.35(0.01-3.79)	0.024

Sg* < 0.05 ; PTB pulmonary TB

From Table 4 above, which showed a relationship between behavioural factors and PTB among HIV patients, participants were asked if they were smoking, and the majority of the participants, both those with PTB (87.5%) and those without PTB (62.87%), said they were not practising smoking. At a p-value of 0.286 and an odds ratio of 0.47 (0.05–5.02), the study showed that smoking was not significantly associated with the occurrence of PTB among HIV patients. The participants were also asked if they were drinking alcohol, and the majority, both 10 (62.5%) with PTB and 58 (81.7%) of those without PTB, said they were not drinking alcohol. At an odds ratio of 0.25 (0.22–3.34) and a p-value of 0.101, the study showed that drinking alcohol was not significantly associated with the occurrence of PTB. As for the number of people sharing their room, a majority of 15 (93.7%) of the participants both with and without PTB and 68 (95.8%) of those without PTB said they were not living in overcrowded areas. At an odds ratio of 0.82 (0.45–6.28) and a p-value of 0.374, the study showed that overcrowding was not significantly associated with the occurrence of PTB. They were also assessed for ART adherence, and 9 (56.2%) of the participants with PTB had poor adherence to ART, whereas 50 (70.4%) of the participants without PTB reported good ART adherence at a p-value of 0.024 and an odds ratio of 0.35 (0.01-3.79). The study showed that poor art adherence was significantly associated with the occurrence of PTB among HIV patients.

DISCUSSION

Pulmonary tuberculosis among patients living with HIV/AIDS

The study showed that the majority of the participants, 27 (31.0%), had generalized body weakness, 8 (9.2%) had coughed for two weeks, and 5 (5.7%) had persistent fever. 4 (4.6%) had a loss of weight, and 7 (8.1%) had chest pain. 2 (2.3%) had night sweats, while at least 34 (39.1%) did not have clinical signs. This could be because the already immune-compliant patient could suffer from tuberculosis easily from secondary TB when compared with other studies.

A study by Tegegne et al. [18] stated that currently approximately 34 million people are infected with HIV, and at least one-third of these patients are also infected with TB. Mollel et al. [19] also showed that the dual epidemics of TB and HIV are particularly pervasive in Africa, where HIV has been the most important contributing factor in the increasing incidence of TB over the last 10 years. Another study by Agbor et al. [20] also showed that in some countries in sub-Saharan Africa, up to 80 per cent of individuals with active TB disease are also HIV-positive.

Social demographic factors with PTB

The above study also shows that the majority of the participants, 10 (62.5%) with PTB, were aged above 45 years, while at least 37 (52.1%) of the participants who had not had PTB were aged 20–45 years. The study showed that age above 45 years was significantly associated with the occurrence of PTB among HIV patients at an odds ratio of 0.71 (0.45-0.77) and a p-value of 0.035, this could be because as one age, their immunity is lowered coupled with HIV infection, making them more susceptible to tuberculosis, and those below 45 years, when compared with other studies [21]. A study conducted in the Uganda estimated that over 50% of people living with HIV in the United States were 50 and over by 2017[22]. The study also showed that the majority of the participants, both with PTB (9.2%) and 41 (57.7%) of those who had not had PTB, said they had attained a post-primary level of education with a p-value of 0.125 and an odds ratio of 0.32 (0.21–

7.39). The study showed that education level was not significantly associated with the occurrence of PTB among HIV patients. This study shows a difference from studies by Macfarlane & Newell in 2016, who instead showed that educational level affected the behaviour of HIV patients, and an understanding of education level helped target interventions to prevent infection progression in about 20% of the patients. There was no significant association between educational level and social behaviours in PTB HIV patients. Most of the HIV/TB-co-infected patients had less than eight years of schooling and also had low incomes. This apparent association might have been a consequence of other health hazards, including the lack of health education and not having access to health care [23, 24]. The study also showed that the majority (68.8%) of the participants with PTH were males, while 43 (60.6%) of the participants without PTB were females, with a p-value of 0.001 and an odds ratio of 0.48 (0.15-8.14). The study showed that male gender was significantly associated with the occurrence of PTB among HIV patients. This could be because male gender is more associated with behaviours that could increase the risk of getting the disease than their female counterparts, such as drinking alcohol and smoking, among others, when compared with other studies. Qi *et al.*, [24] Studies in southern Asia found that HIV-TB co-infection was diagnosed in 18.9% with a higher prevalence among males (75.3%), in the sexually active age group 31-45 years (61.3%), with less than primary education (44.15%), who were married (56.1%), laborers (42.4%), from rural backgrounds (88.2%), and having low income-earning capacity (94.4%). In addition, a study in Brazil also found that there are more men with registered cases of TB without HIV, at a ratio of 2:1 men to women [25]. ***A study*** by Kirenga *et al.* [26], conducted in Mulago, Uganda, also found that the prevalence was higher among men than women. And the majority of the participants, both with PTB (81.3%) and those without pulmonary TB (55.7%), said they were peasant farmers, with a p-value of 0.075 and an odds ratio of 0.22 (0.03–4.85). the study showed that participants' occupation was not significantly associated with the occurrence of PTB among HIV patients, this could be because the peasant farmers may have a poor ART adherence to HIV which can lead them to the development of tuberculosis due to immunity being severely compromised when compared with other studies, Mulugeta *et al.*,[27]had also indicated that HIV patient who worked as casual labours in smiling factors were 4 times more likely to develop PTB than their non-HIV counterparts, and in different parts of the world, consumption of **unpasteurized milk** was observed to accelerate occurrence PTB caused by M. bovis among HIV patients than in health individuals [27]. Other researchers reported the occurrence of TB transmission in hospitals in association with health-related care workers born in countries with a high TB burden but without further continued spread [26].

Social health behaviour factors predisposing patients living with HIV/AIDS to TB co-infection

From the study, the majority of the participants, both those with PTB (87.5%) and those without PTB (87.3%), were not active smokers at a p-value of 0.286 and an odds ratio of 0.47 (0.05–5.02), implying that smoking was not significantly associated with the occurrence of PTB among HIV patients. Smoking has been linked to tuberculosis because smoke damages the lungs and makes smokers more susceptible to TB infection. When compared with other studies, a study conducted by Murrison *et al.* in [28] showed that the association between smoking and TB among HIV patients has been found to rapidly decrease immune response or damage the protective effect of tiny hair-like structures called cilia in the airways, resulting in increased TB risk. It has also been shown that HIV patients who are heavy smokers are more likely to have a cough, dyspnea, chest radiograph appearances of upper zone involvement, cavity and military appearance, and positive sputum culture and are more likely to have isolated extra-pulmonary involvement than HIV-negative smokers [27]. From the study, when asked about drinking alcohol, the majority of the participants, both 10 (62.5%) with PTB and 58 (81.7%) of those without PTB, said they were not drinking alcohol at an odds ratio of 0.25 (0.22–3.34) and a p-value of 0.101. The study showed that drinking alcohol was not significantly associated with the occurrence of PTB. People who drink alcohol are at a social risk of tuberculosis since they can even be infected by their colleagues during drinking times. When compared with other studies, Baluku et al.,[29] in their 2020 studies, also showed a more positive correlation (p-value of 0.04) at a 55% risk ratio between HIV-positive alcohol users and developing PTB than HIV-negative patients.

The participants were also assessed for their adherence to ART, and 9 (56.2%) of the participants with PTB had poor ART adherence, while 50 (70.4%) of the participants without PTB had good ART adherence at a p-value of 0.024 and an odds ratio of 0.35 (0.01-3.79). The study showed that poor art adherence was significantly associated with the occurrence of PTB among HIV patients. Poor art adherence makes patient immune to decline even further, and they therefore become prone to opportunistic infections, including TB. When this study is compared with other studies, Studies by Nyasulu *et al.* [30] showed a close association between secondary PTB and HIV in 80% of patients who had stopped taking ART. Poor ART adherence puts a person at greater risk of TB and is a potential independent risk factor for latent TB. Latent TB-

infected people with poor ART adherence develop active TB rapidly, and then these patients have poor treatment outcomes.

CONCLUSION

Conclusively, from this study, at least 18.4% of the HIV-positive patients have pulmonary tuberculosis. The study also concludes that age above 45 years was significantly associated with the occurrence of pulmonary TB at an odds ratio of 0.71 (0.45–3.77) and a p-value of 0.035. And that poor adherence to ART was significantly associated with the occurrence of PTB among HIV patients at an odds ratio of 0.35 (0.001-3.79) and a p-value of 0.024.

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