Austin Journal of HIV/AIDS Research

Open Access

Austin Publishing Group

Research Article

Risk Factors Associated with Pulmonary Tuberculosis among HIV/AIDs Patients Visiting Mbagathi County Hospital, Nairobi, Kenya

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Received: April 12, 2022; **Accepted:** September 12, 2022; **Published:** September 19, 2022

Abstract

Background: Pulmonary Tuberculosis (PTB) remains a serious global public health concern ranked second to HIV as the leading cause of mortality from infectious diseases especially in developing countries. In 2012, PTB was associated with a global morbidity of 8.6 million and a mortality of 1.3 million annually with 320,000 of these deaths associated with HIV-TB co-infection. Developing countries like Kenya accounts for over 80% of global PTB burden and also has the highest HIV prevalence (WHO, 2013; 2009). The objective of this study was to determine the risk factors associated with pulmonary tuberculosis among HIV/AIDs patients visiting Mbagathi County Hospital.

Methods and Materials: A hospital-based, cross-sectional study design was conducted among 159 patients visiting Mbagathi County Hospital. Systematic random sampling method was used to select the study participants from the TB/HIV wards and from the CCC clinic until a sample size of 159 was achieved. A pre-tested, semi-structured questionnaire was used to collect data from the participants. Data was analyzed using SPSS software version 22.0.

Results: A total of 159 (n) participants were selected to participate in the study in Mbagathi County Hospital. All the participants selected for the study were HIV patients above 18 years of age. Most of them were male (62.9%). Most of them were married (58.5%). Most of them did not have a family history of TB (86.2%). Most of the respondents completed their education in high school (52.8%). Most of them were unemployed (76.1%) and most of them had an income of less than 10,000 shillings a month (83.0%). In this study I found out that most respondents had poor dietary habits, most of the respondents were smokers (68.6%) and were not aware of the effects of smoking on their health and most of the respondents had poor adherence to drugs. Factors such as occupation, family income, balanced meal and stopping to take medication whenever they felt their condition was under control had a significant association with the occurrence of PTB. While factors like age, gender, number of meals taken in a day, wanting to quit smoking and forgetting to take medication had no significant association with the occurrence of PTB in this study.

Conclusion: The study provides key insights into the risk factors associated with pulmonary tuberculosis among HIV/AIDs patients visiting Mbagathi County Hospital. The findings of this study therefore suggest that there was a significant association between level of education, monthly income, occupation, family history of PTB, lacking food appetite, taking a balanced meal, observing a healthy nutrition, smoking and stopping to take medication when one feels condition is under control with the occurrence of PTB among HIV/AIDs patients visiting Mbagathi County Hospital. Factors such as age, gender, marital status, number of meals eaten in a day, willingness to quit smoking and feeling hassled about sticking to treatment had no significant association with the occurrence of PTB.

Keywords: Pulmonary tuberculosis; HIV/AIDS; Mycobacterium tuberculosis; Chronic obstructive pulmonary disease; Comprehensive care clinic; World health organization

Abbreviations and Acronyms

CCC: Comprehensive Care Clinic; CDC: Centers for Disease Control and Prevention; COPD: Chronic Obstructive Pulmonary Disease; CVD: Cardiovascular Disease; HIV: Human Immunodeficiency Virus; MOH: Ministry of Health; PLHIV: People Living with Human Immunodeficiency Virus; PTB: Pulmonary Tuberculosis; TB: Tuberculosis

Citation: Oyunge RN and Ndukui JG. Risk Factors Associated with Pulmonary Tuberculosis among HIV/AIDs Patients Visiting Mbagathi County Hospital, Nairobi, Kenya. Austin J HIV/AIDS Res. 2022; 8(1): 1051.

Background Information

Globally, HIV/AIDs is a continuing health problem that causes high morbidity and mortality, especially in third world countries. Since its discovery, it has caused more than 35 million deaths, and as of 2015, about 37 million people were living with HIV/AIDS [28]. Tuberculosis is ranked second from HIV as a serious global health concern that leads to mortality from infectious diseases, mostly in third-world countries. In 2012, pulmonary tuberculosis was associated with worldwide morbidity of 8.6 million and a mortality of 1.3 million annually, with 320,000 of these deaths related to HIV-TB co-infection [21]. Kenya, a developing country, is ranked fifteenth. It accounts for over 80% of the global tuberculosis burden and has the highest HIV prevalence (WHO, 2013; 2009). In HIV-infected persons globally, pulmonary tuberculosis is the leading cause of respiratory morbidity and mortality, as suggested by data, accounting for 44% of all AIDS-related deaths (WHO, 2012). A recent study shows that P.T.B. incidences still account for over 39% of all T.B. cases in HIV-positive adults (Yuen; et al., 2014). However, the incidence is declining among HIV-negative adults in Kenya, suggesting that HIV impacts both the epidemiology and clinical outcomes of pulmonary tuberculosis.

There were 10.4 million new tuberculosis cases worldwide, with 11% of these cases being HIV co-infected, according to a 2016 WHO report. Additionally, the deaths worldwide were 1.8 million, with 0.4 million occurring among HIV-positive patients. The first manifestation of HIV/AIDS is pulmonary tuberculosis in more than 50% of HIV-positive patients. The deaths linked to P.T.B. are significantly high, especially in Sub-Saharan Africa, where this rate in some countries is reported to be more than 50%.

In terms of the impact of TB-HIV co-infection, Sub-Saharan Africa is reported as the most affected region (WHO, 2009). The relatively high rates of HIV co-infection cause the high incidence rates thus, a tremendous public health challenge is posed by P.T.B. and HIV co-infection in this region (WHO, 2013, 2009). Kenya, which is ranked 5th in terms of tuberculosis burden in Africa, indicates that 39% were TB-HIV co-infected in 103,159 TB cases (Ministry of Health, 2013). Additional data suggest that the mortality rate attributed to P.T.B. in patients co-infected with HIV is above 130 per 100,000 (Ministry of Public Health and Sanitation, 2009). Due to factors that influence tuberculosis trends, in the past decade, the incidence of pulmonary tuberculosis infection has remarkably increased by 10%. However, the main reason for the increase is primarily due to the HIV epidemic and poverty (Borus; *et al*., 2013).

Public health interventions by the National T.B. and leprosy Program, WHO Stop T.B. strategy, and TB-HIV collaborative activities adopted and implemented at different levels nationwide have led to the evolution of the epidemiology of Tuberculosis in Kenya over time (Borus; *et al*., 2013). The risk factors associated with pulmonary tuberculosis among people living with HIV/AIDS could generally be divided into biological and non-biological factors. Biological factors are more evident. When individuals infected with HIV are infected with *Mycobacterium tuberculosis*, it can stimulate replication of the virus and accelerate the progression of the HIV disease. HIV infection induces cytokines-□, making a person get active pulmonary tuberculosis easier. External factors are, however, very complicated. Disease transmission can be influenced by social activities and the environment, which change their expected course.

It is essential to have a screening strategy to detect HIV among PTB patients and a screening program to see P.T.B. among HIV-positive patients to ensure effective collaboration between HIV/AIDs and tuberculosis control programs. The process is easy and can be done through a blood test quickly. HIV-infected PTB patients often lack the classic clinical symptoms of P.T.B.; thus, the latter is still challenging in many countries. Therefore, many studies have been done to determine the risk factors associated with P.T.B. among HIV-infected persons. These factors include different socio-demographic characteristics, WHO-clinical stage, CD4 count, antiretroviral and anti-TB therapeutic drug combinations, poor dietary habits, smoking and presenting symptoms.

The identified knowledge gaps include Community-level interventions, including care of the family, and the best way to deliver these interventions to effectively reduce the prevalence of T.B. in communities highly affected by HIV, Community-level impact of the implementation of collaborative TB/HIV interventions on tuberculosis and HIV transmission, the cost-effectiveness of collaborative TB/HIV interventions delivered through a community approach, efficacy, feasibility and acceptability of mass or targeted interventions for T.B. and HIV prevention and care in HIV-prevalent settings and the best delivery models of collaborative TB/HIV interventions to most-at-risk populations and special populations in all environments with different T.B. and HIV epidemiology and epidemic states(WHO, 2010).

This research is essential, and it fits into the existing gaps of the study whereby there will be an outcome to clarify the factors associated with pulmonary T.B. among HIV patients visiting Mbagathi County Hospital after completion of the study. It will add new findings to the existing body of literature.

Materials and Methods

Study Design

The study was a hospital-based-descriptive cross-sectional study design. A pre-tested questionnaire was used to investigate the risk factors associated with P.T.B. among HIV patients.

Study Area

The study was carried out at Mbagathi County Hospital located in Nairobi County. It is a public health facility under the County Government of Nairobi's Department of Health Services. It has inpatient and outpatient services for adults and children with a 320-bed capacity including a 100-bed maternity wing. A wide range of services are offered including accident and emergency, inpatient services, laboratory services, dental clinic services, radiology services, antenatal services, comprehensive care clinic services, ear nose and throat clinic services, eye clinic services, gynecology outpatient clinic services, pediatric outpatient clinic services, medical outpatient clinic services and surgical outpatient clinical services.

Study Population

The study population was HIV patients who visited Mbagathi County hospital during the study period.

Inclusion Criteria

All HIV patients that were aged above 18 years and that gave informed consent in the TB/HIV wards and at the CCC Clinic in Mbagathi County Hospital.

Exclusion Criteria

All HIV patients who transferred out to different hospitals, individuals with no HIV, HIV patients below 18 years and HIV patients who did not want to engage in the study.

Sample Size Determination

The sample size was determined using Fischer's formula (Fischers *et al*., 1998).

$n = z^2p\ (1\text{-}p)/d^2$

n= sample size

Z = Normal deviation at the desired confidence interval. In this case, it was taken at 95%. Z value at 95% is 1.96.

Q (1-P) = Proportion of the population without the desired characteristic.

d^2 = Degree of precision is taken to be 5%

According to NCBI, the Proportion of TB-HIV infection was taken to be 33.2%.

$n = (1.96)^2\ 0.332\ 0.668/\ 0.05^2$

= 341

The sample size adjustment of the population was done since the target population is less than 10,000.

$nf = n/(1 + n/N)$

nf = The desired sample size for population less than 10,000

N = Total population during the data collection period

n = the calculated sample size = 341

$nf = 341/(1 + 341/300)$

Therefore, the minimum sample size of the study was 159 (n=159) patients.

Sampling Method and Recruitment Process

The systematic random sampling method was used to select participants for the study. The HIV center at Mbagathi County hospital attended an average of 20 patients in a day, equivalent to 600 in a month, which was the study period. The six hundred patients in a single month were divided by the adjusted sample size (159) to get a sampling interval of 3. Consequently, every third patient was included in the study till the desired sample size was achieved.

Data Collection Tools and Questionnaires

Data was collected using pretested closed ended questionnaires from HIV patients visited Mbagathi County Hospital during the study period. The following data was collected: Demographic and Socio-economic data of participants, smoking characteristics, dietary habits and drug adherence characteristics. The questionnaire was pre-tested among 8 participants (5% of the sample size) at Thika Level 5 Hospital. Any ambiguity was corrected before the actual data collection took place.

Data Analysis

Data was analyzed using SPSS version 22 and descriptive analysis was done using frequency, proportion and percentages. Cross-tabulation was used to get the association between dependent variable and independent variables, while statistical significance between categorical data was calculated using chi-square test. A P-value of less than 0.05 was considered statistically significant.

Ethical Consideration

Ethical clearance for conducting this study was sought from The Catholic University of Eastern Africa Administration at the School of Nursing, KNH-UON Ethics and Research Committee (UP965/12/2021), NACOSTI (License No: NACOSTI/P/22/16474), Nairobi Metropolitan Services and the Department of HIV Mbagathi County Hospital. Both oral and written consent was sought from each participant of the study after explaining in detail the method and procedure involved in the study in a language they were conversant with before interviewing them. The study individuals were advised that their participation was voluntary, have the right to invite any question and to get out of the study any time without giving any reason. Participants were educated about the study's purpose, the time they spend during the interview, benefits, and risks of their participation. No identifications of study participants (names and addresses) were documented in the questionnaires to enhance confidentiality. Privacy was maintained during the data collection period.

Results

Socio-Demographic Characteristics of the Respondents

The majority of respondents (64.2%) were above the age of 50. Majority of the participants were male (62.9%), with 37.1 percent being female. 58.5 percent of the respondents were married, 21.4 percent were single and 20.1 percent were divorced, separated or widowed. Most of the respondents did not have a family history of TB (n=137, 86.2%) followed by 13.8 percent who had a family history of TB. Majority of the respondents had ever experienced pulmonary tuberculosis in the past six months (59.1%).

Majority of the respondents (52.8%) completed their education in high school, followed by 26.4 percent who completed in college and the remaining 20.8 percent completed their education at the primary level. Out of the 159 respondents, 76.1 percent were unemployed and 23.9 percent were employed. Majority of the participants (83 percent) earned less than 10000 shillings per month, followed by those earning 10000-15000 shillings per month (11.9%), with the remaining 5.1 percent earning more than 15000 shillings per month. The socio-demographic characteristics of the respondents are shown by the table below (Table 1).

Most of the respondents take two (30.8%) and three meals (30.8%), followed by 19.5 percent who take more than three meals per day then lastly 18.9 percent who take one meal per day.44.7 percent of the respondents had breakfast as their main meal, 39 percent had lunch as their main meal while the remaining 16.4 percent took dinner as their main meal. Most of the respondents (69.8%) had food appetite while 30.2 percent lacked food appetite. Majority of the respondents (78.6%) did not have food allergies whereas 21.4 percent of them had allergies to some foods. Out of the 159 respondents, majority of

Table 1: Socio-demographic Characteristics of the Respondents.

Characteristics	Frequency(n=159)	Percentage (%)
Age in years		
20-30 years	15	9.4
31-50 years	42	26.4
>50 years	102	64.2
Total	159	100
Gender		
Male	100	62.9
Female	59	37.1
Total	159	100
Marital status		
Married	93	58.5
Single	34	21.4
Divorced/Separated/Widowed	32	20.1
Total	159	100
Family history of PTB		
Yes	22	13.8
No	137	86.2
Total	159	100
Level of education		
Primary	33	20.8
Highschool	84	52.8
College	42	26.4
Total	159	100
Occupation		
Employed	38	23.9
Unemployed	121	76.1
Total	159	100
Monthly income		
<10000	132	83.0
10000-15000	19	11.9
>15000	8	5.1
Total	159	100

Key: n= sample size; %= sample size/target population × 100%

them (42.1%) had their meals consisting of less than 25 percent of meat and meat products and also majority of them (51.6%) had their meals consisting of less than 25 percent of vegetables. Majority of the respondents (56.6%) took a balanced meal occasionally, followed by 33.3 percent who never took a balanced meal and 10.1 percent who usually took a balanced meal. Majority of the respondents did not watch out for a healthy nutrition (67.3%) while 32.7% watched out for a healthy nutrition. The dietary characteristics of the respondents are shown by the table below (Table 2).

Smoking Characteristics of the Respondents

Majority of the respondents (68.6%) are smokers, followed by 31.4 percent who don't smoke. Most of the respondents (51.6%) smoke one stick a day followed by 17.0 percent who smoke several sticks a day. Most respondents (59.1%) disagree that smoking can

Table 2: Dietary Characteristics of the Respondents.

Characteristics	Frequency(n=159)	Percentage (%)
Meals per day		
One meal	30	18.9
Two meals	49	30.8
Three meals	49	30.8
>Three meals	31	19.5
Total	159	100
Main meal of the day		
Breakfast	71	44.7
Lunch	62	39.0
Dinner	26	16.4
Total	159	100
Lack food appetite		
Yes	48	30.2
No	111	69.8
Total	159	100
Have food allergies		
Yes	34	21.4
No	125	78.6
Total	159	100
Meat and meat products		
<25%	67	42.1
25-50%	41	25.8
>50%	51	32.1
Total	159	100
Vegetables		
<25%	82	51.6
25-50%	39	24.5
>50%	38	23.9
Total	159	100
Balanced meal		
Never	53	33.3
Occasionally	90	56.6
Usually	16	10.1
Total	159	100
Healthy nutrition		
Yes	52	32.7
No	107	67.3
Total	159	100

Key: n= sample size; %= sample size/target population × 100%

risk one to TB with only 40.9 percent agreeing. Most respondents (76.1%) agree that more smoking risks one's health. Majority of the respondents (58.5%) agree that smoking keeps the weight down. Only a few of the respondents (5%) found it difficult to refrain smoking in public places. 27.7 percent of the respondents were ready to quit smoking. The smoking characteristics of the respondents are shown by the table below (Table 3).

Table 3: Smoking Characteristics of the Respondents.

Characteristics	Frequency (n=159)	Percentage (%)
Do you smoke		
Yes	109	68.6
No	50	31.4
Total	159	100
How many cigarette sticks you smoke in a day		
Never	50	31.4
One in a day	82	51.6
Several in a day	27	17.0
Total	159	100
Smoking risk TB		
Agree	65	40.9
Disagree	94	59.1
Total	159	100
More smoking risk health		
Agree	121	76.1
Disagree	38	23.9
Total	159	100
Smoking keeps weight down		
Agree	93	58.5
Disagree	66	41.5
Total	159	100
Difficult to refrain smoking in public places		
Agree	8	5.0
Disagree	151	95.0
Total	159	100
Do you want to quit smoking		
Yes	44	27.7
No	64	40.3
Do not smoke	51	32.1
Total	159	100

Key: n= sample size; %= sample size/target population × 100%

Drug Characteristics of the Respondents

Out of the 159 respondents, 66.0 percent of them forgot to take their medication. 63.5 percent of the respondents stopped taking medication because they felt bad when taking them. Most of the respondents (57.2%) forgot to carry their medication when travelling. Majority of the respondents (67.3%) stopped taking their medication when they felt their condition is under control. Only a few of the respondents (22%) felt hassled about sticking to their treatment. The drug adherence characteristics of the respondents are shown by the table below (Table 4).

Association between Socio-Demographic Characteristics and Occurrence of Pulmonary Tuberculosis among HIV Patients

There was a significant association between having a family history of PTB (p=0.020), level of education (p=0.012), monthly income (p=0.010) and occupation (p=0.014) with the occurrence of PTB. However, there was no significant association between age, gender and marital status with the occurrence of PTB (p>0.05). The table below shows an association between socio-demographic variables and ever experiencing PTB in the past six months (Table 5).

Table 4: Drug adherence Characteristics of the Respondents.

Characteristics	Frequency (n=159)	Percentage (%)
Forgetting to take medication		
Yes	105	66.0
No	54	34.0
Total	159	100
Stopping medication because you felt worse		
Yes	101	63.5
No	58	36.5
Total	159	100
Forgetting to carry medication when you travel		
Yes	91	57.2
No	68	42.8
Total	159	100
Stop taking medication when condition is under control		
Yes	107	67.3
No	52	32.7
Total	159	100
Feel hassled about sticking to treatment		
Yes	35	22.0
No	124	78.0
Total	159	100

Key: n= sample size; %= sample size/target population × 100%

Association between Dietary Habits and Occurrence of Pulmonary Tuberculosis among HIV/Aids Patients Visiting Mbagathi County Hospital

There was a significant association between lack of food appetite (p=0.048), taking a balanced meal (p=0.013) and watching out for healthy nutrition (p=0.020) with the respondents ever experiencing PTB in the past six months. However, there was no significant association between the meals taken per day, the main meal of the day, having food allergies, the amount of meat and meat products and the amount of vegetables in their diet with the respondents ever experiencing PTB in the past six months (p>0.05). The table below shows an association between dietary habits variables and ever experiencing PTB in the past six months (Table 6).

Association between Smoking and Occurrence of Pulmonary Tuberculosis among HIV/Aids Patients Visiting Mbagathi County Hospital

There was a significant association between smoking (p=0.023) with the respondents ever experiencing PTB in the past six months. However, there was no significant association between how many sticks of cigarette they smoked in a day, their knowledge of smoking risk PTB, their knowledge on the more they smoke the more they risk their health, their knowledge on smoking keeps their weight

Table 5: Association between socio-demographic variables and occurrence of Pulmonary Tuberculosis.

Characteristics	Ever experienced PTB in the past six months		Total	Chi-square	df	p-value
	Yes	No				
Age						
20-30	7 (46.7)	8 (53.3)	15 (100)	1.847	2	0.397
31-50	23 (54.8)	19 (45.2)	421 (100)			
>50	64 (62.7)	38 (37.3)	102 (100)			
Total	94 (59.1)	65 (40.9)	159 (100)			
Gender						
Male	64 (64)	36 (36)	100 (100)	2.656	1	0.103
Female	30 (50.8)	29 (49.2)	59 (100)			
Total	94 (59.1)	65 (40.9)	100 (100)			
Marital status						
Married	57 (61.3)	36 (38.7)	93 (100)	1.503	2	0.472
Single	17 (50.00	17 (50.0)	34 (100)			
Divorced/Separated/ Widowed	20 962.5)	12 (37.5)	32 (100)			
Total	94 (59.1)	65 (40.9)	159(100)			
Family history of PTB						
Yes	18 (81.8)	4 (18.2)	22 (100)	5.443	1	0.020
No	76 (55.5)	61 (44.5)	137 (100)			
Total	94 (59.1)	65 (40.9)	159 (100)			
Occupation						
Employed	16 (42.1)	22 (57.9)	38 (100)	5.9981	1	0.014
Unemployed	78 (64.5)	43 (35.5)	121 (100)			
Total	94 (59.1)	65 (40.9)	159 (100)			
Level of education						
Primary	27 (81.8)	6 (18.2)	33 (100)	8.894	2	0.012
Highschool	45 (53.6)	39 (46.4)	84 (100)			
College	22 (52.4)	20 (47.6)	42 (100)			
Total	94 (59.1)	65 (40.9)	159 (100)			
Monthly income						
<10000	85 (64.4)	47 (35.6)	132 (100)	9.274	2	0.010
10000-15000	7 (36.8)	12 (63.2)	19 (100)			
>15000	2 (25.0)	6 (75.0)	8 (100)			
Total	94 (59.1)	65 (40.9)	159 (100)			

Key: YES: Respondents who experienced PTB in the past six months; **NO:** Respondents who had not experienced PTB in the past six months; Chi –square: Establishing relationships between variables; df: Degree of freedom; P-value: level of significance

down, their ability to refrain smoking in forbidden places and their willingness to quit smoking with the respondents ever experiencing PTB in the past six months (p>0.05). The table below shows an association between smoking variables and ever experiencing PTB in the past six months (Table 7).

Association between Drug Adherence and Occurrence of Pulmonary Tuberculosis among HIV/Aids Patients Visiting Mbagathi County Hospital

There was a significant association between sometimes stopping taking their medication when they felt like their condition was under control (p=0.031) with the respondents ever experiencing PTB in the past six months. However, there was no significant association between forgetting to take their medication, stopping to take their medication without telling the doctor because they felt worse when they took it, sometimes forgetting to bring along their medication when they travel or leave home and ever feeling hassled about sticking to their treatment with the respondents ever experiencing PTB in the past six months (p>0.05). The table below shows an association between drug adherence variables and ever experiencing PTB in the past six months (Table 8).

Discussion

This study was conducted to determine the risk factors associated

Table 6: Association between dietary habits and occurrence of Pulmonary Tuberculosis.

Characteristics	Ever experienced PTB in the past six months		Total	Chi-square	df	p-value
	Yes	No				
Meals per day						
One meal	18 (60.0)	12 (40.0)	30 (100)	1.925	3	0.588
Two meals	30 (61.2)	19 (38.8)	49 (100)			
Three meals	31 (63.3)	18 (36.7)	49 (100)			
>Three meals	15 (48.4)	16 (51.6)	31 (100)			
Total	94 (59.1)	65 (40.9)	159 (100)			
Main meal of the day						
Breakfast	43 (60.6)	28 (39.4)	71 (100)	2.052	2	0.358
Lunch	33 (53.2)	29 (46.8)	62 (100)			
Dinner	18 (69.2)	8 (30.8)	26 (100)			
Total	94 (59.1)	65 (40.9)	159 (100)			
Lack food appetite						
Yes	34 (70.8)	14 (29.2)	48 (100)	3.904	1	0.048
No	60 (54.1)	51 (45.9)	111 (100)			
Total	94 (59.1)	65 (40.9)	159 (100)			
Have food allergies						
Yes	18 (52.9)	16 (47.1)	34 (100)	0.683	1	0.409
No	76 (60.8)	49 (39.2)	125 (100)			
Total	94 (59.1)	65 (40.9)	159 (100)			
Meat and meat products						
<25%	39 (58.2)	28 (41.8)	67 (100)	1.168	2	0.558
25-50%	27 (65.9)	14 (34.1)	41 (100)			
>50%	28 (54.9)	23 (45.1)	51 (100)			
Total	94 (59.1)	65 (40.9)	159 (100)			
Vegetables						
<25%	49 (59.8)	33 (40.2)	82 (100)	0.719	2	0.698
25-50%	21 (53.8)	18 (46.2)	39 (100)			
>50%	24 (63.2)	14 (36.8)	38 (100)			
Total	94 (59.1)	65 (40.9)	159 (100)			
Balanced meal						
Never	34 (64.2)	19 (35.8)	53 (100)	8.621	2	0.013
Occasionally	56 (62.2)	34 (37.8)	90 (100)			
Usually	4 (25.0)	12 (75.0)	16 (100)			
Total	94 (59.1)	65 (40.9)	159 (100)			
Healthy nutrition						
Yes	24 (46.2)	28 (53.8)	52 (100)	5.375	1	0.020
No	70 (65.4)	37 (34.6)	107 (100)			
Total	94 (59.1)	65 (40.9)	159 (100)			

Key: YES: Respondents who experienced PTB in the past six months; NO: Respondents who had not experienced PTB in the past six months; Chi –square: Establishing relationships between variables; df: Degree of freedom; P-value: level of significance

with pulmonary tuberculosis among HIV/AIDs patients visiting Mbagathi County Hospital. People living with HIV are more likely than others to be infected with PTB. Worldwide, tuberculosis is one of the leading causes of death among people living with HIV. Without treatment, as with other opportunistic infections, HIV and PTB can work together to shorten lifespan. The challenge is in high-burden settings, HIV coinfection is the most important risk factor to develop active TB, which dramatically increases the susceptibility to primary infection or reinfection and also the risk of PTB reactivation for patients with latent pulmonary tuberculosis infection (Kwan and

Table 7: Association between Smoking and Occurrence of Pulmonary Tuberculosis.

Characteristics	Ever experienced PTB in the past six months		Total	Chi-square	Df	p-value
	Yes	No				
Do you smoke						
Yes	71 (65.1)	38 (34.9)	109 (100)	5.194	1	0.023
No	23 (46.0)	27 (54.0)	50 (100)			
Total	94 (59.1)	65 (40.9)	159 (100)			
How many cigarette sticks you smoke in a day						
Never	23 (46.0)	27 (54.0)	50 (100)	5.229	2	0.073
One in a day	53 (64.6)	29 (35.4)	82 (100)			
Several in a day	18 (66.7)	9 (33.3)	27 (100)			
Total	94 (59.1)	65 (40.9)	159 (100)			
Smoking risk TB						
Agree	42 (64.6)	23 (35.4)	65 (100)	1.374	1	0.241
Disagree	52 (55.3)	42 (44.7)	94 (100)			
Total	94 (59.1)	65 (40.9)	159 (100)			
More smoking risk health						
Agree	67 (55.4)	54 (44.6)	121 (100)	2.942	1	0.086
Disagree	27 (71.1)	11 (28.9)	38 (100)			
Total	94 (59.1)	65 (40.9)	159 (100)			
Smoking keeps weight down						
Agree	53 957.0)	40 (43.0)	93 (100)	0.421	1	0.517
Disagree	41 62.1)	25 (37.9)	66 (100)			
Total	94 (59.1)	65 (40.9)	159 (100)			
Difficult to refrain smoking in public places						
Agree	6 (75.0)	2 (25.0)	8 (100)	0.879	1	0.348
Disagree	88 (58.3)	63 (41.7)	151(100)			
Total	(59.1)	65 (40.9)	159 (100)			
Do you want to quit smoking						
Yes	26 (59.1)	18 (40.9)	44 (100)	3.876	2	0.144
No	43 (67.2)	21 (32.8)	64 (100)			
Do not smoke	25 (49.0)	26 (51.0)	51 (100)			
Total	94 (59.1)	65 (40.9)	159 (100)			

Key: YES: Respondents who experienced PTB in the past six months; NO: Respondents who had not experienced PTB in the past six months; Chi –square: Establishing relationships between variables; df: Degree of freedom; P-value: level of significance

Ernst, 2011).

Socio-Demographic Factors

Having a family history of TB had a significant association with the occurrence of PTB in this study (p=0.02). Most of the respondents who had a family history of PTB have ever experienced PTB in the past six months. This is consistent with the findings of a study conducted in Nepal, which yielded similar results (Nilaramba *et al.*, 2021). People with a family history of PTB were nearly five times more likely to develop PTB than those who had no family history of PTB.

In the current study, level of education and occupation were found to have a significant relationship with the occurrence of PTB among HIV patients (p=0.012) and p=0.014) respectively. This study found out that the occurrence of PTB among HIV patients was more common among respondents who completed their education in primary followed by high school than those who completed in college. This study also found out that the occurrence of PTB among HIV patients was more among the unemployed respondents as compared to the employed ones. This finding is consistent with the findings of a study conducted in South West Ethiopia (Tegegne *et al.*, 2022). Educated HIV patients might have better knowledge on how HIV patients have lived long with the virus and they have good knowledge about how to use medication. Hence, educated HIV patients are less likely to be exposed to the development of PTB as compared to non-educated patients. Most of the unemployed respondents probably had a low level of education.

There was a significant relationship between monthly income with the occurrence of PTB among HIV patients (p=0.010). The

Table 8: Association between Drug Adherence and Occurrence of Pulmonary Tuberculosis.

Characteristics	Ever experienced PTB in the past six months		Total	Chi-square	Df	p-value
	Yes	No				
Forgetting to take medication						
Yes	67 (63.8)	38 (36.2)	105 (100)	2.814	1	0.093
No	27 (50.0)	27 (50.0)	541 (100)			
Total	94 (59.1)	651 (40.9)	59 (100)			
Stopping medication because you felt worse						
Yes	65 (64.4)	36 (35.6)	101 (100)	3.142	1	0.076
No	29 (50.0)	29 (50.0)	58 (100)			
Total	94 (59.1)	65 (40.9)	159 (100)			
Forgetting to carry medication when you travel						
Yes	49 (53.8)	42 (46.2)	91 (100)	2.448	1	0.118
No	45 (66.2)	23 (33.8)	68 (100)			
Total	94 (59.1)	65(40.9)	159 (100)			
Stop taking medication when condition is under control						
Yes	57 (53.3)	50 (46.7)	107 (100)	4.630	1	0.031
No	37 (71.2)	15 (28.8)	52 (100)			
Total	94 (59.1)	65 (40.9)	159 (100)			
Hassled about sticking to treatment						
Yes	24 (68.6)	11 (31.4)	35 (100)	1.659	1	0.198
No	70 (56.5)	54 (43.5)	124 (100)			
Total	94 (59.1)	65 (40.9)	159 (100)			

Key: YES: Respondents who experienced PTB in the past six months; NO: Respondents who had not experienced PTB in the past six months; Chi –square: Establishing relationships between variables; df: Degree of freedom; P-value: level of significance

study's findings revealed that the occurrence of PTB among HIV patients was more common among respondents who's monthly income was less than 10,000 shillings a month, followed by those who earned between 10,000-15,000 shillings and was less common among those who earned more than 15,000 shillings per month. This study was similar to one carried out in Northern Nigeria which had similar results (Padmanesan *et al*., 2013). The reason could be that people with low socioeconomic status are exposed to several risk factors including malnutrition, indoor air pollution, which increases their risk for PTB. They also have a higher likelihood of being exposed to crowded and less ventilated places. There was no significant relationship between the age of the respondents with the occurrence of PTB (p>0.05). However, the study found out that respondents aged more than 50 years had a higher prevalence of PTB than other age groups. The increased risk could be because aged people are less likely to be medication adherent and this leads to co-infection by other diseases. This study's findings are contrary with those of a study conducted in Amhara Region, Ethiopia (Awoke *et al*., 2015), which found out that as the age of the patients increased, the possibility of being co-infected with PTB also increased.

In this study, there was no significant relationship between gender and the occurrence of PTB among HIV patients (p>0.05). Men, on the other hand, had a higher prevalence than women. The potential reason might be because women are more likely to be medical adherent, smoke less and observe a healthy nutrition as compared to men. A similar discovery was made in Algeria where more men had PTB as compared to women (Pradoet *et al*., 2011).

In this study, there was no significant relationship between marital status and the occurrence of PTB among HIV patients (p>0.05). However, in this study marred people had a higher prevalence followed by divorced/separated/widowed people then followed by single respondents. This study's findings are contrary with those of a study conducted in Amhara Region, Ethiopia (Cui *et al.,* 2017), which found out that marital status significantly affected in HIV patients with married people less likely to be co-infected with PTB.

Dietary Factors

Lacking food appetite, eating a balanced meal and watching out for healthy nutrition had a significant association with the occurrence of PTB in this study (p=0.048), (p=0.013), (p=0.020) respectively. In this study the occurrence of PTB among HIV patients was more common among respondents who lacked appetite, those who never took a balanced meal and those who did not watch out for healthy nutrition. This finding is consistent with the findings of a study conducted in Iran (Gebremichael *et al*., 2018). This could be because nutrition affects the immune system. Inadequate dietary intake endangers the immune system, which then increases susceptibility to diseases. The diseases then reduce the body's appetite and the ability to absorb nutrients and the cycle continues. HIV infection increases intestinal permeability and impairs the absorption of proteins, carbohydrates, fats, vitamins, minerals and water. Lack of nutrients and HIV are related and exacerbate each other at the same time so that HIV disrupts the immune system and increases their vulnerability to infection leading to increased nutrient deficiencies. Impaired immunity also creates a prerequisite for PTB infection,

proliferation and spread.

The number of meals taken per day had no significant association with the occurrence of PTB among HIV patients (p>0.05). In this study respondents who took three meals per day had a higher prevalence of PTB. This could be because they were not balanced and thus lacked essential nutrients. There was no significant relationship between the main meal of the day of the respondents with the occurrence of PTB (p>0.05). In this study respondents who dinner was their main meal had a higher prevalence of PTB. In this study, there was no significant relationship between having food allergies and the occurrence of PTB among HIV patients (p>0.05) though in this study, respondents who did not have food allergies had a higher prevalence of PTB unlike those who have allergies. These findings were consistent with findings from some studies have shown that only micronutrient supplementation may affect progression and transmission of HIV (Fawzi *et al*., 2002; 2004), and micronutrients may be of importance for primary PTB infection or actual PTB disease (van Lettow and Whalen, 2008).

There was no significant relationship between the amount of meat and meat products in the diet and the amount of vegetables in the diet of the respondents with the occurrence of PTB (p>0.05). However, this study found out that the respondents whose diet consisted of 25-50% of meat and meat products and those whose diet had more than 50% vegetables had a higher prevalence for PTB. These findings were contrary to a study conducted in Woldya (Tadesse *et al*., 2018) which found out that the risk is high among HIV positive people having contact to domestic cattle and consuming raw or undercooked milk and/or meat.

Smoking Factors

In the current study, smoking was found to have a significant relationship with the occurrence of PTB among HIV patients (p=0.023). Respondents who smoke had a higher prevalence of TB in this study. This is consistent with the findings of a study conducted in Ukraine, which yielded similar results (Shaofa et *al.,* 2016). The reason could be that smoking destroys the lungs adversely affects the immune system making them more susceptible to PTB disease. Exposure to tobacco smoking impairs cell-mediated immunity and macrophage function essential to the host defense against PTB infection. The number of cigarettes sticks the respondents smoked per day had no significant relationship with the occurrence of PTB (p>0.05).In this study, the respondents who smoked several sticks in a day had a high prevalence for PTB than those who smoked one stick in a day. This can be because the more the cigarette sticks a person smokes, increases the risk. These finding is contrary to a study carried out in China (Theresa, 2014), which found out that heavy smoking has been reported to double the risk of PTB in HIV-seropositive patients.

In this study, there was no significant association between the respondents' knowledge on: by smoking they risk PTB, the more they smoke the more they risk their health and smoking keeps their weight down, with the occurrence of PTB (p>0.05). However, in this study, respondents who disagreed that smoking risks TB, those who disagreed that more smoking risk their health and those who disagreed that smoking keeps their weight down had a higher prevalence for PTB more than those who agreed. This finding was contrary to study carried out in Kendari City (Buton *et al*., 2017) which found out that knowledge is the basis for taking pulmonary tuberculosis prevention and treatment. There was no significant relationship between the respondents' ability to refrain from smoking in places where it is forbidden with the occurrence of PTB (p>0.05). In this study however, the respondents who found it difficult to refrain from smoking in places where it is forbidden had a higher prevalence for PTB than those who were able to refrain from smoking in forbidden areas. There was no significant relationship between the respondents wanting to quit smoking with the occurrence of PTB (p>0.05). In this study however, those who were not ready to quit smoking had a higher prevalence for PTB. This finding was contrary to study carried out in Taiwan (Pang *et al*., 2010) which found out that when they quit smoking, the risk was reduced by more than half (65%), to a level not different from those who had never smoked.

Adherence to Drugs

Stopping to take medication when feeling like one's condition is under control had a significant association with the occurrence of PTB in this study (p=0.031). Most of the respondents who stopped to take medication when feeling like their condition is under control had a higher prevalence for PTB unlike those who did not stop taking their medication. This study was similar to the one carried out in South West Ethiopia which had similar results (Abebe *et al*., 2012). In this study, there was no association among forgetting to take medication, stopping to take medication because of feeling worse when taking it, forgetting to bring along medication when travelling and feeling hassled about sticking to treatment with the occurrence of PTB (p>0.05). In this study, the respondents who forgot to take medication, those who stopped taking their medication because they felt worse, those who sometimes forgot to carry their medication and those who felt hassled about sticking to their treatment had a higher prevalence for PTB unlike those who did not. These findings are contrary with those of a study conducted in South West Ethiopia which had different results (Kabede *et al*., 2012). The study found out that strict adherence to drugs significantly reduced the risk of being co-infected with PTB. Adherence to drugs prevents the body from becoming more immune-compromised.

Conclusion

The study provides key insights into the risk factors associated with pulmonary tuberculosis among HIV/AIDs patients visiting Mbagathi County Hospital. The findings of this study therefore suggest that there was a significant association between level of education, monthly income, occupation, family history of PTB, lacking food appetite, taking a balanced meal, observing a healthy nutrition, smoking and stopping to take medication when one feels condition is under control with the occurrence of PTB among HIV/AIDs patients visiting Mbagathi County Hospital. Factors such as age, gender, marital status, number of meals eaten in a day, willingness to quit smoking and feeling hassled about sticking to treatment had no significant association with the occurrence of PTB.

Acknowledgement

We thank the medical staff at Mbagathi County Hospital their great support during the undertaking of this study. We also appreciate the staff at the School of Nursing- Catholic University of Eastern Africa for their comments and support during this study period. This

research was financed internally by the researchers.

Authors' Contributions

RNO, and NJG conceptualized the project, performed all the research work, data entry and statistical analysis and wrote the manuscript.NJG assisted in drafting and finalizing the manuscript. Both authors read and approved the final manuscript.

Conflict of Interest

No conflict of interest whatsoever.

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