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Tuberculosis burden and its predictors among people living with HIV/AIDS at a Nigerian treatment centre: a prospective study

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ABSTRACT

INTRODUCTION: Tuberculosis (TB) remains a major cause of death in people living with HIV/AIDS (PLWHA). This study assessed TB burden and its predictors among PLWHA receiving care at the State Specialist Hospital, Osogbo, Nigeria.

METHODS: A prospective study was conducted among PLWHA screened clinically for TB from February 2009 till December 2019. Information collected included their socio-demographic characteristics, other variables, TB signs and symptoms, and CD4 count. PLWHA with at least one TB symptom or sign underwent laboratory diagnosis. Data were analyzed using descriptive and inferential statistics.

RESULTS: A total of 4057 PLWHA were screened clinically for TB during the study period. They were 982 (24.2%) males and 3075 (75.8%) females. Six hundred and ninety-eight (33.4%) were diagnosed with TB. On logistic regression analysis, predictors of TB included being female (AOR=3.53, 95%CI=2.72-4.59, p<0.001), having lower education (AOR=2.53, 95%CI=2.07-3.10, p<0.001), having low socio-economic status (AOR=34.54, 95%CI=21.10-56.52, p=0.0001), being underweight (AOR=3.28, 95%CI=2.69-4.10, p<0.001) and having CD4 count <200/ml (AOR=3.69, 95%CI=3.04-4.47, p<0.001).

CONCLUSION: PLWHA had a high TB burden with predictors including low socio-economic status, being female, having had lower education, low CD4 count, and being underweight. Addressing these factors may reduce the TB burden among PLWHA.

Keywords: Tuberculosis, TB burden, predictors, PLWHA, HIV/AIDS

INTRODUCTION

The World Health Organisation (WHO) has identified pulmonary tuberculosis (TB) and HIV/AIDS as major infectious causes of morbidity and mortality, with most cases occurring in the lower- and middle-income world [1]. These countries with the highest proportion of people living below the poverty line are mostly affected by various socio-economic factors resulting in a high TB prevalence, especially among people living with HIV/AIDS (PLWHA) [1,2]. Various studies show that socio-

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demographic, clinical, lifestyle, and environmental factors determine TB incidence among PLWHA [3]. Factors associated with TB diagnosis among PLWHA include socio-economic status, race/ethnicity, gender, education, employment, income, and residence [4].

TB is a major threat to global public health, with the highest prevalence, particularly in African countries [5,6]. TB is the most frequent life-threatening opportunistic disease among PLWHA and remains a leading cause of mortality, even among those receiving antiretroviral therapy (ART) [7–11]. The risk of TB is greater among PLWHA when compared with the general population, especially in some African countries where a large proportion of persons with TB have HIV/AIDS, and without prevention, PLWHA develops TB [3,12–14].

The WHO recommends HIV/TB control measures, including TB preventive therapy (TPT), intensified case finding, and TB infection control, which form the core pillars of prevention, care, and treatment services for HIV infection [13–15]. In addition, there has been progress in implementing testing for HIV infection, providing trimethoprim-sulfamethoxazole preventive therapy, and ART [12,16]. Intensified case finding for TB ensures early TB diagnosis and treatment, reducing morbidity and mortality from TB. The early commencement of TPT in those not infected with TB also reduces transmission to healthcare workers, clients, partners, families, the community members with decreased incidence and prevalence of TB [14,15]. The need to reduce TB prevalence among PLWHA made the Nigerian State Ministry of Health and other non-governmental and international agencies put in place strategies for early TB detection, prevention through intensive case finding, IPT, and infection control. Hence, this study assessed TB burden and its determinants among PLWHA receiving care at the HIV clinic of State Specialist Hospital, Osogbo, Nigeria.

METHODS

Study site: The HIV Clinic of the State Specialist Hospital, Osogbo, Nigeria, was opened to the general public in February 2009. The clinic provides comprehensive HIV care, including HIV counseling and testing, prevention of maternal-to-child transmission of HIV, provision of free combination antiretroviral therapy, and screening and treatment of vulnerable populations, including women, children, and people living with TB. The clinic is headed by the ART coordinator, while the other healthcare workers providing care for these patients include medical officers, nurses, counselors, pharmacists, and laboratory workers. The clinic opens daily from 8 to 4 pm with 24-hour emergency care provided to critically ill patients admitted into the medical ward. Free antiretroviral and anti-TB therapies are provided to eligible PLWHA. The clinic receives referrals from primary health care centers in the thirty local government areas in the State and neighboring States.

Study population: The study population included PLWHA, who were recruited consecutively at the clinic from February 2009 to December 2019. Every PLWHA at recruitment and follow-up underwent clinical screening for TB, while those suspected to have TB were referred for laboratory diagnosis, and those confirmed positive were treated.

Study design: Prospective study was conducted among PLWHA.

Data collection: Data collected include information on socio-demographic characteristics, and clinical screening, including a history of current cough of two weeks and above, fever, weight loss, and night sweats. Other relevant histories suggest TB, such as contact with somebody with a chronic cough or confirmed TB, previous diagnosis or treatment with TB was taken. This clinical screening was done at baseline and at subsequent visits. Also, weight (kg) and height (m) were measured, body mass index (BMI) was calculated, and CD4 counts were measured. The PLWHA suspected to have TB had laboratory diagnoses and were treated with anti-TB drugs, while others without TB were followed up according to the National guideline. The laboratory diagnosis included sputum Ziehl–Neelsen (ZN) staining and GeneXpert.

Data analysis: The data were entered and analyzed using SPSS version 20 (IBM Armonk, NY, USA). Simple descriptive and inferential statistics were performed, and the results were presented in tables. The chi-square test was used to independently evaluate the association between socio-demographic variables, socio-economic variables, and TB diagnosis. A multivariate logistic regression analysis was used to build a model between the outcome and explanatory variables

with p-values <0.2. The main outcome variable was TB diagnosis, while the explanatory variables were socio-demographic variables and other variables. The adjusted odds ratios (AORs) and 95% confidence intervals (CIs) were used as measures of association. Tests were considered significant for a p-value of <0.05. Participants earning <1US$ per day were considered poor.

Ethical consideration: A written informed consent was obtained from all participants and serial code numbers were used instead of names.

Table 1: Characteristics of participants

Variable	Frequency (N=4057)	%
Age group (years)		
<18	398	9.8
18-29	1404	34.6
30-39	884	21.8
40-49	763	18.8
≥50	608	15.0
Sex		
Male	982	24.2
Female	3075	75.8
Marital status		
Single	601	14.8
Married	3148	77.6
Divorced	125	3.1
Widow	183	4.5
Highest level of education		
None	706	17.4
Primary	1537	37.9
Secondary	1323	32.6
Tertiary	491	12.1
Occupation		
None	556	13.7
Trading	1834	45.2
Artisan	1164	28.7
Civil servant	503	12.4
Income/day (US$)		
<1	2774	68.4
≥1	1283	31.6

Also, the Hospital's Ethics and Research Committee granted permission to conduct the study with protocol number (SHO/ERC/06/00003). Confidentiality of collected data was maintained as only the investigators stored and accessed the data collected.

RESULTS

All eligible PLWHA (4057) consented and were screened during the study period (982 (24.2%) males, 3075 (75.8%) females) and were included in the final analysis.

Table 2: Tuberculosis clinical presentation and other variables at recruitment

Variable	Frequency	%
*Clinical presentation (N=4057)		
Weight loss	2012	49.6
Current cough two weeks and above	1266	31.2
Fever	503	12.4
Night sweat	418	10.3
None	1968	48.5
TB result (n=2089)		
Positive	698	33.4
Negative	1391	66.6
BMI (kg/m^2) (n=2089)		
<18.5	1154	55.2
≥18.5	935	44.8
CD4 count (n=2089)		
<200/ml	969	46.4
200-350/ml	783	37.5
>350/ml	337	16.1

**Multiple responses*

About two-fifths (44.4%) were less than 30 years of age, mean age 40.1 (14.9) years, range 3-75 years. Most were married (77.6%), had primary education (37.9%), were trading (45.2%), and earned <1US$ per day (68.4%) (Table 1).

Table 2 shows TB clinical presentation and other variables at recruitment. At least one TB symptom was reported by 2089 respondents (51.5%), with the most common symptoms reported

Table 3: Association between selected variables and TB diagnosis among PLWHA (n=2089)

Variable	Tuberculosis		Test statistic
	Yes (%)	No (%)	(χ^2; p value)
Age group (years)			
<50 (Ref.)	569 (33.8)	1114 (66.2)	0.609; 0.435
≥50	129 (31.8)	277 (68.2)	
Sex			
Male	78 (15.4)	428 (84.6)	97.220; <0.001
Female	620 (39.2)	963 (60.8)	
Level of education			
None/primary	527 (45.7)	627 (54.3)	174.017; <0.001
Secondary/tertiary (Ref.)	171 (18.3)	764 (81.7)	
Income/day (US$)			
<1	681 (47.7)	747 (52.3)	413.400; <0.001
≥1 (Ref.)	17 (2.6)	644 (97.4)	
BMI (kg/m^2)			
<18.5	514 (44.5)	640 (55.5)	143.493; <0.001
≥18.5 (Ref.)	184 (19.7)	751 (80.3)	
CD4 count/ml			
<200	470 (48.5)	499 (51.5)	184.989; <0.001
≥200	228 (20.4)	892 (79.6)	

being weight loss (49.6%) and cough (31.2%). Six hundred and ninety-eight (33.4%) were diagnosed with TB. The majority of the respondents were underweight (55.2%) and had CD4 count <200/ml (46.4%).

Table 3 shows the univariate association between socio-demographic variables, other variables, and TB burden among PLWHA. The variables significantly associated with TB burden include being female (39.2% vs. 15.4%, p<0.001), lower education (45.7% vs. 18.3%, p<0.001), being poor (47.7% vs. 2.6%, p<0.001), underweight (44.5% vs. 19.7%, p<0.001), and CD4 count <200/ml (48.5% vs. 20.4%, p<0.001).

On logistic regression analysis, the variables predicting TB include being female (AOR=3.53, 95%CI=2.72-4.59,p <0.001), lower education (AOR=2.53, 95%CI=2.07-3.10, p<0.001), being poor (AOR=34.54, 95%CI=21.10-56.52, p<0.001), underweight (AOR=3.28, 95%CI=2.69-4.10, p<0.001) and CD4 count <200/ml (AOR=3.69, 95%CI=3.04-4.47, p<0.001) (Table 4).

DISCUSSION

This study assessed TB burden and its predictors among PLWHA receiving care at an HIV center in South-west Nigeria. It showed that the majority of PLWHA seen had at least one TB symptom. Various studies have reported the usefulness of clinical screening in diagnosing TB in PLWHA, which, when backed by laboratory diagnosis, ensures early diagnosis and treatment [17–21]. Several studies in resource-limited countries with a high burden of TB and HIV/AIDS, such as Nigeria, have reported this finding [21–25]. For instance, Zeru [22], in 2021, reported 37.4% of PLWHA studied in Harari region, Ethiopia, had TB, whereas Fekadu et al.[16], reported 18.2% in south Ethiopia, Musa et al. [9] reported 13.6% in Kano, Nigeria, and Zerdali et al. [21], reported 5.3% in Turkey. These studies show that the proportion of PLWHA with TB varies across study sites both within and outside Nigeria, and this could be explained by the difference in HIV/AIDS prevalence, health-seeking behavior of the community studied, and accessibility to screening and treatment sites. This study reported that most

Table 4: Logistic regression analysis on variables associated with TB diagnosis among PLWHA (n=2089)

Variable	AOR	95%CI	p-value
Sex			
Female	3.53	2.72-4.59	<0.001
Male (Ref.)	1		
Level of education			
None/Primary	2.53	2.07-3.10	<0.001
Secondary/Tertiary (Ref.)	1		
Income/day (US$)			
<1	34.54	21.10-56.52	<0.001
≥1 (Ref.)	1		
BMI (kg/m^2)			
<18.5	3.28	2.69-4.10	<0.001
≥18.5 (Ref.)	1		
CD4 count/ml			
<200	3.69	3.04-4.47	<0.001
≥200 (Ref.)	1		

Ref. = Reference category

PLWHA had weight loss and cough as the most common symptoms. Studies in resource-limited settings such as Nigeria have consistently reported this finding [6,10,11,25]. Also, one-third of PLWHA that were screened had TB. This further confirms the usefulness of clinical screening when applied to this vulnerable population. It reinforces the need to ensure that PLWHA undergo the clinical screening at recruitment and every follow-up visit. This study found that two-thirds of PLWHA with at least one TB symptom were negative on laboratory screening. This could be because of the advanced immunodeficiency among the patients with other opportunistic infections causing these symptoms. These symptoms resolve especially with the commencement of combination antiretroviral therapy which was provided free to these PLWHA (data not shown). Previous studies at the center and other treatment centers locally and internationally have confirmed the efficacy of combination antiretroviral therapy in improving the immune status of PLWHA thereby reducing the prevalence of opportunistic infections [22–27]. This study also found that most PLWHA were underweight with advanced immunosuppression at recruitment. This could be explained by immune suppression predisposing to opportunistic infections, as reported by previous studies [26,27]. However, the commencement and adherence to HAART improve body mass index and CD4 count, thus improving the clinical State of PLWHA.

Some patients initially asymptomatic with severe immunodeficiency status at recruitment were noticed to get worse with clinical symptoms on commencement of HAART (Note: data not shown). This immune reconstitution syndrome was explained as the 'wake up' of the immune system as the ability of the PLWHA to become symptomatic becomes higher. This has been reported in several studies [23–27]. This shows the necessity for follow-up clinical screening as done in this study.

This study identified predictors of TB among PLWHA. These include being female, having lower education, being poor, underweight, and having a low CD4 count. The finding that females were more likely to have TB than males is consistent with the higher proportion of females living with HIV/AIDS in the center's catchment. This type of gender disparity has been reported worldwide

[17,25,27]. In addition, the lower socio-economic status of the female gender in this study makes them prone to diseases such as TB and HIV/AIDS. The females generally are family caregivers of HIV-infected patients who could become readily infected. The identified risk factors such as poverty, underweight and poor immune status are previously reported to TB vulnerability. In order to reduce the burden of TB among PLWHA, the triad of poverty, malnutrition, and immunodeficiency need to be tackled [17,19,23,27]. This could be done through engagement in income-generating activities by PLWHA, early diagnosis and treatment of HIV/AIDS, and opportunistic infections, including TB.

Strengths and limitations: The strength of this study lies in the large number of PLWHA that were clinically screened for TB over a ten-year period, but a study limitation is that it is from a single specialist hospital although the hospital serves as a referral hospital that receives referred patients from peripheral hospitals within and outside Osun State, Nigeria. However, the study provides useful information that could influence the policy and care of PLWHA.

CONCLUSION

TB burden was high among PLWHA. Socio-economic variables and other variables predicting TB burden among PLWHA should be addressed to reduce the TB magnitude among the study population. These findings would inform policies and strategies for fight against HIV and TB.

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