Research Article

Prevalence, Patterns, and Correlates of Depression Among Drug-Susceptible Tuberculosis Patient Enrollees in Ogbomoso, Oyo State: A Cross-Sectional Study

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Background: Tuberculosis (TB), an infectious disease caused by *Mycobacterium tuberculosis*, is still one of the leading public health problems, despite advances in the effort to reduce its incidence, morbidity, and mortality. Studies have shown that the prevalence of depression correlates with the severity and duration of tuberculosis. Therefore, this study aims to find out the prevalence and pattern of depression among drug-susceptible TB patients to improve treatment outcomes and thereby reduce morbidity and mortality from the disease.

Methodology: The study was a cross-sectional hospital-based survey. The sample size of 333 respondents was calculated using Leslie Fischer's formula ($n= z^2pq /d^2$). A multistage sampling technique was used to select respondents. Data were collected using a pre-tested semi-structured questionnaire and analyzed using the Statistical Package for Social Sciences (SPSS) version 20. Descriptive analysis was done for all variables. Bivariate and multivariate analyses were done using chi-square and binomial regression, respectively. The level of significance was set with a p-value less than 0.05.

Results: More than half of the respondents (186, 55.9%) were depressed. The majority (122, 65.5%) of respondents had mild depression, 46 (24.7%) had moderate depression, and 18 (9.7%) had moderately severe depression. Sex, marital status, level of education, and average monthly income were

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significantly associated with depression status at the bivariate level. Multivariate analysis revealed that respondents with no formal education were 6 times less likely to develop depression (AOR = 0.175, P = 0.001). Respondents with a primary level of education were 2 times less likely to develop depression (AOR = 0.427, P = 0.023). Respondents with a secondary level of education were 3 times less likely to develop depression compared to those with a tertiary level of education. Respondents living with HIV were 35 times more likely to develop depression (AOR = 35.303, P = 0.017) compared to those who were HIV negative.

Conclusion: This study found a high prevalence of depression among TB patients. Factors such as no formal education, sex, marital status, low socioeconomic status, and comorbidities like TB/HIV and diabetes mellitus were statistically associated with depression.

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Introduction

Tuberculosis (TB), an infectious disease caused by *Mycobacterium tuberculosis*, is still one of the leading public health problems despite advances in the effort to reduce its incidence, morbidity, and mortality[1]. In 2021, about 10.6 million people were reported by the World Health Organisation (WHO) to be infected with Tuberculosis, with an estimated 23% of the global burden and 33% of the global TB deaths in Africa[2]. Nigeria ranks first in Africa, is one of the 10 countries with the highest number of missing TB cases, and is the sixth in the world, contributing to almost 4.6% of the global burden. It is also responsible for a high triple burden of Drug-susceptible TB; a bacteriologically confirmed or clinically diagnosed case of TB without evidence of infection with strains resistant to rifampicin and isoniazid[3][4].

Depression is a mental state characterized by loss of interest, feelings of guilt, disturbed sleep or appetite, loss of self-worth, and usually suicidal thoughts[1][2]. Depression is a common mental disorder; about 5% of adults suffer from depression globally. Depression is a major cause of suicide, with more than 700,000 people dying due to suicide every year[5]. Chronic pain, frequent hospital admissions, and dependency on the hospital found in patients with Tuberculosis have been reported to be associated with depression[6]. Studies have shown that the prevalence of depression correlated with the severity and duration of tuberculosis[7][8]. Depression that accompanies the disease is often due to the nature of the infection, side effects of medications, and other social determinants of health. Several studies have

shown a higher prevalence of depression among patients with Tuberculosis as compared to the general population. A study done in Nigeria by Ige and Lasebikan showed a prevalence of about 45.5%[7].

When TB and depression co-exist, patients tend to suffer in silence, and when accompanied by poor compliance to medication, the mortality rate also increases. Some previous studies identified a poor degree of suspicion of depression in patients being managed for TB by clinicians[3][8][9] Therefore, paying attention to some of the psychosocial issues that patients under treatment for tuberculosis experience and the improvement of consultation-liaison psychiatric services may optimise adherence and increase the success of treatment. It is therefore important to find out the prevalence and pattern of depression among drug-susceptible TB patients to improve treatment outcomes and thereby reduce morbidity and mortality from the disease; hence this study.

Methodology

This study was carried out in Ogbomoso, Southwestern Nigeria. The study was a cross-sectional hospital-based survey involving quantitative methods of data collection. The study was conducted across the Direct Observed Therapy (DOT) centres in selected local governments in Ogbomoso. The DOT centres owned by both state and local governments were used for the study. TB patients, aged 18 years and above, who have been on drugs for two months and have proof of drug susceptibility, and who are mentally capable of providing consent were included in the study, while newly diagnosed and unregistered pulmonary tuberculosis patients, pregnant women with pulmonary TB, severely ill or debilitated patients, patients with extra-pulmonary TB, and patients who cannot give consent were not included. A written consent form was signed by each respondent.

Sample size was calculated using Leslie Fischer's formula ($n = z^2pq /d^2$) using the proportion for the prevalence of depression among drug-susceptible TB patients in the previous study, which was 27% (0.27)[10]. After 10% non-response was calculated, a total of 333 questionnaires were administered. A multistage sampling technique was used to select respondents:

First stage: From the list of urban and rural local government areas in Ogbomoso, Ogbomoso North and Ogooluwa Local Government Areas were chosen.

Second stage: The list of all registered DOT centres in Ogbomoso was collected from the Tuberculosis and Leprosy Supervisor for each Local Government Area. All DOT centres were included.

Third stage: Using proportional allocation based on sample size, clients were selected from each DOT centre using a systematic sampling approach until we recruited enough sample allocated percentage.

Data was collected from 21st January 2025 to 31st January 2024 using a pre-tested semi-structured questionnaire, which included questions on socio-demographic characteristics of respondents, lifestyle and other co-morbidities among respondents, and Patient Health Questionnaire-9 (PHQ-9)[11], which assessed depression among respondents. Questionnaires were sorted out to check for errors and omissions at the end of the collection of data. Thereafter, data were entered into the computer and analyzed using Statistical Package for Social Sciences (SPSS) version 20. Descriptive analysis was done or all variables. Bivariate and multivariate analysis was done using chi-square and binomial regression, respectively. The level of significance was set with a p-value less than 0.05.

Results

Sociodemographic characteristics of respondents

Table 1 shows the socio-demographic characteristics of the respondents revealed that the majority, 109 (32.7%), were within the age range of 30-40 years. Most respondents, 216 (64.9%), were married. Regarding education, the largest proportion, 108 (32.4%), had tertiary education. The predominant ethnic group was Yoruba, 271 (81.4%). Most respondents, 174 (52.3%), were Christians.

Variables	Categories	Frequency	Percent	
Age Group	<30 years	37	11.1	
	30-40 years	109	32.7	
	41-50 years	80	24.0	
	51-60 years	65	19.5	
	>60 years	42	12.6	
	Mean±SD = 44.86±14.29			
Sex	Male	165	49.5	
	Female	168	50.5	
Religion	Christian	174	52.3	
	Muslim	147	44.1	
	Traditional	11	3.3	
	Others	1	0.3	
Marital status	Single	77	23.1	
	Married	216	64.9	
	Widow	27	8.1	
	Widower	13	3.9	
Ethnicity	Yoruba	271	81.4	
	Igbo	21	6.3	
	Hausa	33	9.9	
	Others	8	2.4	
Level of education	No formal education	59	17.7	
	Primary	87	26.1	
	Secondary	79	23.7	
	Tertiary	108	32.4	
Occupational status	Employed	215	64.6	

Variables	Categories	Frequency	Percent	
	Unemployed	100	30.0	
	Student	18	5.4	
Average income per month	Less than ₦30 000	130	39.0	
	Above ₦30 000	203	61.0	

Table 1. Sociodemographic characteristics of respondents

Medical history of respondents

Table 2 shows the medical history of the respondents, which revealed that most respondents, 253 (76.0%), did not have diabetes, and 233 (70.0%) did not have hypertension. Concerning HIV status, the majority, 253 (76.0%), were HIV-negative. A large proportion, 282 (84.7%), had no history of mental illness, and 297 (89.2%) reported no family history of mental illness.

Variables	Categories	Frequency	Percent
Comorbidities	Diabetes	49	14.7
	Hypertension	73	21.9
	HIV	80	24.0
History of mental illness(es)	Yes	51	15.3
	No	282	84.7
Family history of mental illness(es)	Yes	36	10.8
	No	297	89.2

Table 2. Medical history of respondents

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Assessment of depression among respondents

More than half of the respondents (186, 55.9%) were depressed. Table 3 shows the responses of respondents using the PHQ-9. The majority, 168 (50.5%), reported "not at all" for having little interest or pleasure in doing things. Similarly, 168 (50.5%) reported "not at all" for feeling down, depressed, or hopeless. For poor appetite or overeating, most respondents, 154 (46.2%), experienced this on "several days." Trouble sleeping or sleeping too much was reported on "several days" by 171 (51.4%). The majority, 189 (56.8%), reported "not at all" for feeling bad about themselves or feeling like a failure. Similarly, 232 (69.7%) reported "not at all" for moving or speaking so slowly that others could have noticed or being restless. Regarding trouble concentrating, 154 (46.2%) reported experiencing it "not at all." For thoughts of self-harm or being better off dead, the majority, 225 (67.6%), reported "not at all."

The overall categories of depression among respondents revealed that the majority (122, 65.5%) of respondents had mild depression, 46 (24.7%) had moderate depression, and 18 (9.7%) had moderately severe depression. (Fig. 1)

Variables	Not at all n(%)	Several days n(%)	More than half the days n(%)	Everyday n(%)
Had little interest or pleasure in doing things	168(50.5)	131(39.3)	28(8.4)	6(1.8)
Had a poor appetite or been overeating	141(42.3)	154(46.2)	34(10.2)	4(1.2)
Feeling down, depressed, or hopeless	168(50.5)	119(35.7)	37(11.1)	9(2.7)
Had trouble falling or staying asleep, or been sleeping too much	111(33.3)	171(51.4)	44(13.2)	7(2.1)
Feeling tired or having little energy	131(39.3)	140(42.0)	51(15.3)	11(3.3)
Feeling bad about yourself - or that you are a failure or have let yourself or your family down	189(56.8)	119(35.7)	21(6.3)	4(1.2)
Moving or speaking so slowly that other people could have noticed or been restless	232(69.7)	73(21.9)	18(5.4)	10(3.0)
Had trouble concentrating on things, such as reading the newspaper or watching television	154(46.2)	140(42.0)	28(8.4)	11(3.3)
Had thoughts that you would be better off dead, or of hurting yourself in some way	225(67.6)	74(22.2)	27(8.1)	7(2.1)

Table 3. Assessment of depression among respondents

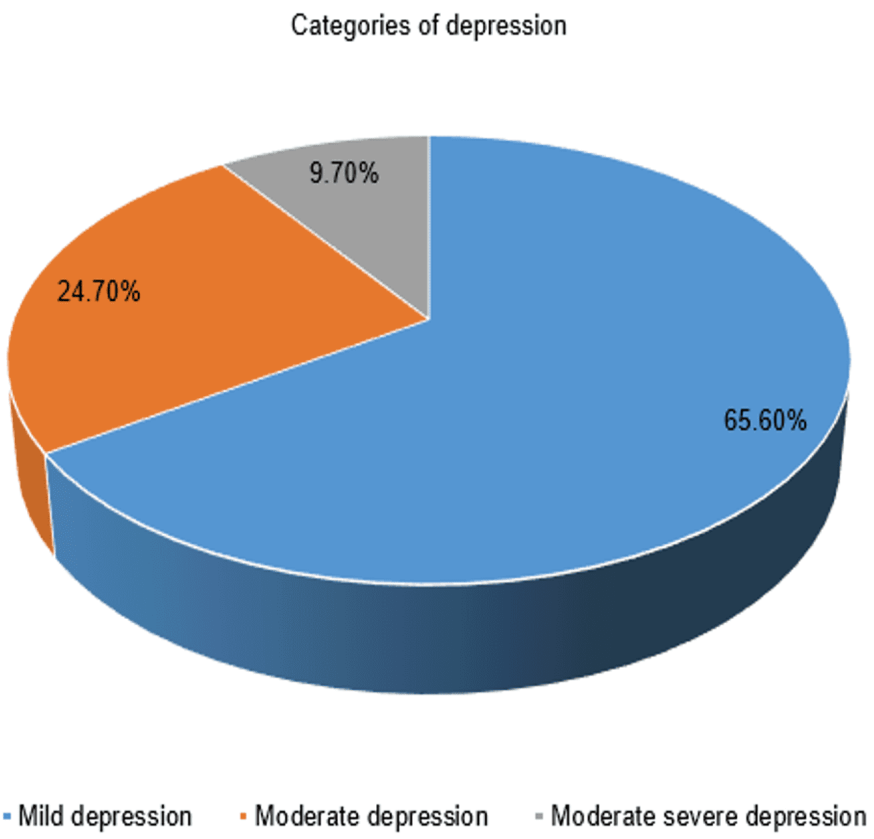

Figure 1. Categories of depression among respondents

Association between socio-demographic characteristics and depression status

Table 4 shows the relationship between socio-demographic characteristics and depression status, which revealed that sex (χ^2 = 6.633, P = 0.010), marital status (χ^2 = 23.948, P = <0.001), level of education (χ^2 = 11.810, P = 0.008), and average monthly income (χ^2 = 12.710, P = <0.001) were significantly associated with depression status among drug-susceptible tuberculosis patient enrollees in Ogbomoso, Oyo State.

Association of HIV Status and Self-Reported Hypertension and Diabetes Status with Depression

Table 5 shows the relationship between the presence of comorbidities and the depression status of the respondents. It revealed that HIV status (χ^2 = 61.381, P = <0.001) and Diabetes (χ^2 = 7.295, P = 0.026) were significantly associated with depression status among drug-susceptible tuberculosis patient enrollees in Ogbomoso, Oyo State.

Predictors of Depression Status among Drug Susceptible Tuberculosis Patient Enrollees in Ogbomoso, Oyo State

Table 6 shows the predictors of depression status among the respondents. It revealed that respondents with no formal education had significantly lower odds of being categorized as depressed in this study (AOR = 0.175, P = 0.001); however, this finding should be interpreted cautiously in light of potential unmeasured confounding factors or selection biases. Respondents with a Primary level of education were 2 times less likely to develop depression (AOR = 0.427, P = 0.023). Respondents with a Secondary level of education were 3 times less likely to develop depression compared to those with a Tertiary level of education. Respondents living with HIV were 35 times more likely to develop depression (AOR = 35.303, P = 0.017) compared to those who were HIV negative.

Variables	Categories	Depression		χ^2	df	P
		Not depressed	Depressed			
Age Group	<30 years	14(10.3)	14(9.6)	1.230	4	0.873
	30-40 years	44(32.4)	52(35.6)			
	41-50 years	38(27.9)	33(22.6)			
	51-60 years	22(16.2)	26(17.8)			
	>60 years	18(13.2)	21(14.4)			
Sex	Male	72(52.9)	55(37.7)	6.633	1	**0.010***
	Female	64(47.1)	91(62.3)			
Religion	Christian	71(52.2)	82(56.2)	.581	2	0.748
	Muslim	61(44.9)	59(40.4)			
	Traditional	4(2.9)	5(3.4)			
Marital status	Single	17(12.5)	43(29.5)	23.948	3	**<0.001***
	Married	108(79.4)	78(53.4)			
	Widow	53.7 ()	19(13.0)			
	Widower	6(4.4)	6(4.1)			
Ethnicity	Yoruba	111(81.6)	115(78.8)	6.904	3	0.075
	Igbo	4(2.9)	15(10.3)			
	Hausa	16(11.8)	13(8.9)			
	Others	5(3.7)	3(2.1)			
Occupational status	Employed	95(69.9)	91(62.3)	3.498	2	0.174
	Unemployed	38(27.9)	46(31.5)			
	Student	3(2.2)	9(6.2)			
Average income per month	Less than ₦30 000	38(27.9)	71(48.6)	12.710	1	**<0.001**

Variables	Categories	Depression		χ^2	df	P
		Not depressed	Depressed			
	Above ₦30 000	98(72.1)	75(51.4)			
Level of education	No formal education	28(20.6)	23(15.8)	11.810	3	**0.008***
	Primary	45(33.1)	32(21.9)			
	Secondary	33(24.3)	32(21.9)			
	Tertiary	30(22.1)	59(40.4)			

Table 4. Association between socio-demographic status and depression status

*χ^2-Pearson chi square value, df-degree of freedom, P -Probability value, *-significant at P<.050*

Variables	Categories	Depression		Total	χ^2	df	P-value
		Not depressed	Depressed				
HIV	HIV positive	3(2.2)	60(41.1)	63(22.3)	61.381	1	**<0.001***
	HIV negative	133(97.8)	86(58.9)	219(77.7)			
Diabetes	Yes	19(14.0)	24(16.4)	43(15.2)	7.295	2	**0.026***
Hypertension	Yes	29(21.3)	36(24.7)	65(23.0)	4.446	2	0.108

Table 5. Association of HIV status and self-reported hypertension and diabetes status with depression

*χ^2-Pearson chi square value, df-degree of freedom, P -Probability value, *-significant at P<.050*

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Variables	AOR	95% C.I.		P-value
		Lower	Upper	
Sex (ref. Female)				
Male	0.669	0.363	1.234	0.198
Marital status (ref. Widower)				
Single	1.606	0.283	9.111	0.593
Married	1.071	0.221	5.179	0.932
Widow	3.836	0.585	25.156	0.161
Level of education (ref. Tertiary)				
No formal education	0.175	0.065	0.470	**0.001***
Primary	0.427	0.205	0.888	**0.023***
Secondary	0.374	0.164	0.856	**0.020***
Average income per month (ref. Above ₦30 000)				
Less than ₦30 000	1.976	0.952	4.101	0.067
HIV (ref. Negative)				
Positive	35.303	10.045	124.072	**<0.001***
Diabetes (ref. Not sure)				
Yes	0.577	0.150	2.220	0.424
No	0.351	0.104	1.180	0.091

Table 6. Predictors of depression status among drug susceptible tuberculosis patient enrollees in Ogbomoso, Oyo state

*AOR- Adjusted Odd Ratio, CI-Confidence Interval, P -Probability value, *-significant at P<.050*

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Discussion

The prevalence of depression among TB patients in this study was 51.8%, which is found to be similar to the prevalence of 55.9%, 45.5%, 51.9%, 52.1%, and 54.0%[1][12][13][14][15] respectively from studies in Ethiopia, 45.5% in Southwest Nigeria[10] and considerably lower than studies in South Africa (64.3%) [16] and Cameroon (61.1%)[2]. The observed differences could be due to the difference in population characteristics, prevalence among multidrug-resistant TB, time of assessment, or phase of TB treatment.

This study observed that having no formal education, sex, and marital status are statistically associated with depression. Interestingly, unlike many previous studies[3][6], which found no formal education to be a risk factor for depression, this study observed that individuals with no formal education were significantly less likely to screen positive for depression. This counterintuitive finding may reflect differential access to healthcare or underrepresentation in the study sample due to poor health-seeking behavior or limited exposure to mental health screening. Being a male, which was statistically associated with depression, is, however, not identified as a predictor in the multivariate analysis, similar to other studies that have identified the female gender as a significant predictor. This could be a result of the global prevalence of depression among women[14], and other factors, including hormonal factors, household responsibilities, and the social roles of women in society, have been mentioned[2][14]. There was no association between age, religion, ethnicity, and depression among the respondents in this study; however, some studies report old age as a significant predictor of depression among TB patients[7] [14]. Patients in the older age group are believed to be prone to depression due to low financial status and susceptibility to TB stigma and the side effects of anti-TB drugs[10].

Low socio-economic status among drug-susceptible TB patients was also found to be statistically associated with depression, as seen in some other studies conducted among TB patients[3][10][13]. Patients who received an average income less than the minimum wage were observed to be statistically associated with depression; however, it was not identified as a predictor in the multivariate analysis.

The presence of TB/HIV comorbidity and diabetes mellitus is found to be statistically associated with depression in this study, which is consistent with other studies[6][14] and the TB-HIV coinfection may be a result of the stigma associated with HIV-positive patients, the depression associated with HIV infection[14]. Patients living with TB/HIV comorbidity were observed to be 35 times more likely to develop

depression. This is considered significantly higher than other studies that observed the prevalence of depression in TB/HIV coinfection[12].

Conclusion

This study found a high prevalence of depression among TB patients. “Factors such as sex, marital status, low socioeconomic status, and comorbidities like TB/HIV and diabetes mellitus were statistically associated with depression. The observed inverse association between no formal education and depression warrants cautious interpretation and further investigation. The findings highlight the need for integrated mental health screening and support programs for TB patients, particularly for those with TB/HIV comorbidity and low socioeconomic status. Addressing stigma, improving healthcare access, and providing psychosocial interventions may help to mitigate depression in this population.

Future research should aim to investigate the apparent protective association of low educational attainment with depression in TB populations, preferably using longitudinal designs and qualitative methods to explore underlying mechanisms. Caution is warranted in interpreting these findings given potential residual confounding and limitations in generalizability.

Limitations

This study has several limitations. First, its cross-sectional design precludes any inference of causality between the identified factors and depression outcomes. Second, the observed inverse association between educational attainment and depression contradicts prior literature and may reflect unmeasured confounding variables such as stigma, mental health literacy, or reporting bias. Third, depression was assessed using a self-reported instrument (PHQ-9) rather than a clinical diagnosis, which may lead to misclassification. Lastly, the study population, limited to registered TB patients attending DOTS centers, may not be representative of all TB patients, particularly those with poor access to care or differing socio-demographic characteristics.

List of abbreviations

- DOT - Direct Observed Therapy
- HIV - Human Immunodeficiency Virus
- TB - Tuberculosis

- WHO - World Health Organisation

Statements and Declarations

Ethical Approval and Consent to Participate

Ethical approval for the study was obtained from the LAUTECH Teaching Hospital Ethical Review Committee, and permission to carry out the study was obtained from the State Coordinator, Tuberculosis and Leprosy Control, Oyo State, and from the Tuberculosis and Leprosy Control Supervisors in the chosen Local Government Areas. This study was conducted according to the Declaration of Helsinki for Medical Research involving Human Subjects.

Right of decline/withdraw from study: Respondents were told that participation is voluntary and they will not suffer any consequences if they choose not to participate.

Confidentiality of data: All information gathered was kept confidential, and participants were identified using serial numbers.

Consent form: A written consent form signed by each respondent was included in the questionnaires.

Non-maleficence: No harm is intended nor befell any respondent in the course of the research study. Respondents were reassured of this.

Data Availability

The data for this study are available on reasonable request from the corresponding author.

Conflicts of Interest

The authors know of no competing interests for this study.

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Author Contributions

SOO, SCA, and ATK worked on the study design; ATK, JOA, OOO, JTO, DVO, OJO, and ZAA collected data; SOO and SCA supervised the project; SOO, SCA, and ARA ensured ethical compliance; SOO, SCA, EDO, and

ARA analyzed the data; SOO, EDO, and SCA were major contributors in writing the manuscript. All authors read and approved the final manuscript.

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Declarations

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