

Assessment of Exacerbation of Depression in Pulmonary Tuberculosis Patients by using PHQ-9 Scale at Tertiary Care Hospital

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Abstract

Context: Depression leads to more dysfunction and stress, which could affect the patient's life condition. Tuberculosis is a leading cause of comorbidity with depression. Those suffering from tuberculosis and depression are at higher risk of bad health-seeking nature, resulting in higher morbidities, drug resistance, and mortality. The relationship is not well established. **Aims:** To identify multiple variables/ dependent factors affecting depression respectively in tuberculosis patients and check the medication adherence among pulmonary tuberculosis patients using Morisky Scale. **Settings and Design:** A cross-sectional study was conducted at tertiary care hospital in Udaipur, Rajasthan. **Methods and Material:** A cross-sectional study was conducted in a tertiary care hospital at Udaipur, Rajasthan, between October 2021- July 2022. The cross-sectional study was performed on people with active pulmonary tuberculosis of 18 years and above who are on anti-tuberculous medications. **Results:** The subjects with a mean age of 80.07 ± 17.33 had moderately severe depression, and 52.07 ± 17.3 had severe depression as per the PHQ-9 score. Out of 53 males, 12 were severely depressed, and out of 39 females, 13 had depression. The influence of medication adherence on tuberculosis patients with depression showed a negative correlation i.e; ($R = -0.762$). The correlation findings were found to be significant (0.01). Our results were consistent with the expected hypothesis, and finally, a substantial interaction between tuberculosis patients and depression was observed. **Conclusions:** We noticed a significant association between pulmonary tuberculosis and depression. Also, the study interpreted that low medication adherence to anti-tuberculosis treatment may lead to severe depression.

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Received Date: June 19, 2024

Accepted Date: July 05, 2024

Published Date: July 31, 2024

Citation: Mahendra Singh Rathore, Bhaktraj Singh Chauhan, Udit Singh, Nidhi Kaushal Karva, Deepali Pathak. Assessment of Exacerbation of Depression in Pulmonary Tuberculosis Patients by using PHQ-9 Scale at Tertiary Care Hospital. International Journal of Pathogens. 2024; 1(2): 18–25p.

Keywords: Tuberculosis, Depression, Medication Adherence, pulmonary tuberculosis, Major depressive disorder, Morisky Medication Adherence Scale, PHQ-9 Scale

INTRODUCTION

Mycobacterium Tuberculosis causes contagious bacterial tuberculosis disease. It is one of the world's top 10 diseases that cause death, especially in people who have HIV. According to 2020 statistics, around 10 million people got ill due to tuberculosis worldwide. The risk of tuberculosis increased by a factor of 3.3 times in alcohol abusers and 1.6 times in smokers [1]. On the other hand, we have the most common mental illness, and the cause of this disease burden affecting 280 million people worldwide is depression [2]. Depression leads to more dysfunction and stress, which could affect the 'patient's life condition [3].

Tuberculosis is a leading cause of comorbidity with depression [4]. Results have been observed that those suffering from tuberculosis and depression are at higher risk of bad health-seeking nature, resulting in higher morbidities, drug resistance, and mortality [5]. Similar outcomes have shown previously that the prevalence of depression is higher in tuberculosis patients [6]. Challenges faced by tuberculosis patients cause them to lead a difficult economic, socially unproductive life, and due to social isolation, they have to suffer through adverse conditions [7–10]. Malnutrition, older age, female sex, genetic defects, and hepatitis are considered to be a cause of adverse psychiatric status [11]. Poor social life, disgracefulness, and HIV infection have increased the risk of depression development in patients with tuberculosis [12–14]. These factors mostly affect the life quality of patients with tuberculosis [15]. There were other multiple influencing factors, including consumption of drugs and their side effects, illness duration, and education level, which affect depression in tuberculosis patients [16, 17] and various scoring scales are available to rate current situations. This study was conducted to put forward the assessment of the association between depression in tuberculosis patients by using the PHQ9 Scale. Few field works have established this fact of association. So, to build the outcomes of this association more concrete with some significant influencing factors and values, we considered it worth exploring further. Other objectives gained the acceptance of multiple dependent variables with significant and non-significant results. The medication adherence of patients also has shown evidence of insightful factors. This assessment could lead to new avenues for the research so that some explanation may occur for new research avenues and resolution may occur for these problems.

SUBJECTS AND METHODS

The study was conducted in a tertiary care hospital at Udaipur, Rajasthan, between October 2021–July 2022. The cross-sectional study was performed on people with active pulmonary tuberculosis of 18 years and above. All patients diagnosed with tuberculosis by at least (a chest X-RAY, CT chest, complete blood count, and sputum culture) or one of the following findings were recruited for the study. Only patients on their anti-tuberculosis treatment were recruited randomly for the assessment. Moreover, patients with other types of TB were excluded from the study; all patients with a prior history of depression & psychosis were not included in the study. Patients suffering from GERD, cancer peptic ulcer, or other chronic illnesses were excluded from the study.

The recruited subjects' data were collected during the ward-round participation in the Respiratory Department. All the data was recorded and documented in the pre-designed Data Collection Form through face-to-face interviews with included subjects. Every subject was given a written informed consent form before their interview to ensure their willingness to participate in the study. The interviews of participants were encapsulated in three parts- In the first part, the questions were asked about their sociodemographic details, and data was retrieved regarding the vitals, general examination details, and lab investigation & imaging reports. The second part had public health questionnaire-9 Scale, which was used to rate their depression score. The categories were established into (Normal, Mild, Moderate, Moderately Severe, and Severe depression) [18, 19] and the third part had a medication adherence examination using the Morisky medication adherence Scale to rate their adherence status to anti-tuberculosis treatment.

MAIN OUTCOME VARIABLE

The primary outcome variable of this study was the public health questionnaire-9 scale score with variables focussing on hopelessness, suicidal ideation, fatigue, poor appetite, anhedonia, feeling bad about yourself, bradykinesia, trouble concentrating, and insomnia. Moreover, Morisky Medication Adherence Score Categories were split into three parts: low, moderate, and high adherence.

STATISTICAL ANALYSIS

The total sample size of the study was 92 and was calculated by OpenEpi.info on the current incidence of patients visiting the respiratory ward. All the examinations and analyses were done using the statistical software IBM SPSS. Demographic characteristics were used for the descriptive analysis.

Continuous variables were indicated as unadjusted means with standard deviation, and categorical variations were displayed as percentages. A Chi-square test was performed for categorical variables. P value <0.05 was statistically significant. The data was further subjected to measure the strength of the association between the two variables, i.e., The public health questionnaire nine score category and the Morisky medication adherence scale. Pearson's test was used for curating the correlation between the Morisky medication adherence scale score and the Public health questionnaire-9 Scale category. ANOVA test was applied to establish a relationship between categorical and continuous variables.

RESULTS

Overall, 119 participants were screened in the study. After the final curation, only 92 were selected for the analysis. In total, 27 participants were excluded due to some reasons like- 8 participants were denied participating in the study, 5 participants were rejected because of GERD, and four were rejected due to a peptic ulcer. Ten participants suffering from extrapulmonary tuberculosis were excluded from the study, as shown in Figure 1.

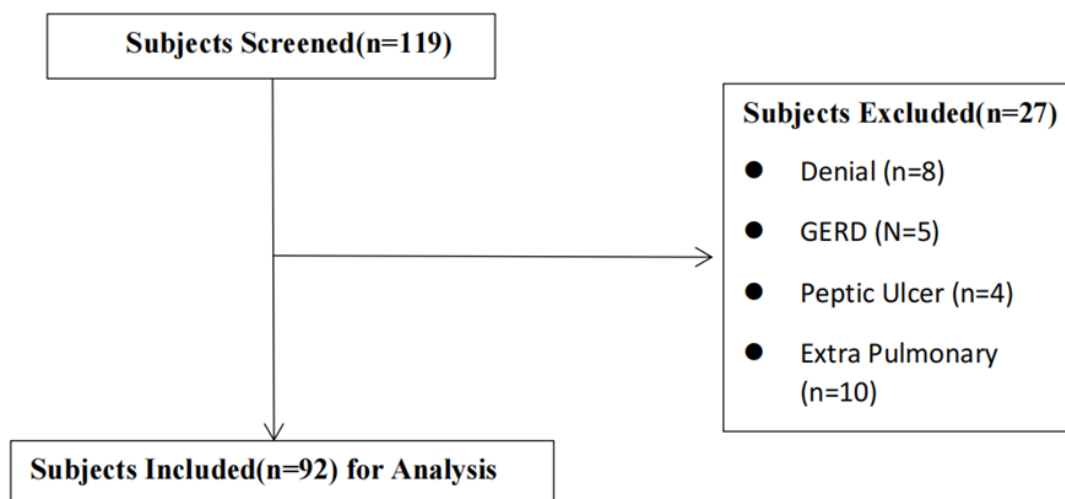


Figure 1. Flow-chart of screening of participants.

This study's demographic characteristics analyzed 92 participants with a mean age of 46.64 ± 18.06 years. Of the total population of 92 participants, 53 (57.6) were males, and 39 (42.3) were females.

Eighty-seven percent of the total participants were married. Occupation status showed the maximum proportion of the sample population suffering from depression were farmers. Fifty-one of the study subjects were smokers, and 52.1 % had a history of alcohol consumption.

This investigation identified numerous general trends that could lead to strong support for the association of depression with tuberculosis patients. Perhaps not surprisingly, the subjects with a mean age of 46 ± 19.33 were found with moderate depression, 80.07 ± 17.33 had moderately severe depression, and 52.07 ± 17.3 had severe depression as per the Scale score. Followed by the gender category, the depression score as per the PHQ9 Scale analyzed that males were more depressed than females. Out of 53 males, 22.6 % were observed to be severely depressed; out of 39 females, 25.6 % had moderate depression, and 7.7% had severe depression. In a similar vein, depression category of occupation, statistics detected that the majority of the population suffering from severe depression were farmers (26.7%) and students (11.5%). All the findings were observed to be non-significant. The probable factors of substance consumption evidence clarified that subjects who were smokers and alcoholics had more depression than those who were not. From the total sample population, 47 were smokers with 9 and 14 subjects, 47 were smokers with 9 and 14 subjects, and 47 were smokers, with 9 and 14 subjects having moderately severe Depression and severe Depression, respectively. Out of the

total of 92 participants, 48 were alcoholics; among those 48 subjects, 29.2% of participants had moderately severe depression, and 33% of the enrolled candidates were found with severe depression. These findings were observed to be statistically significant. ($p < 0.05$) Furthermore, the depression bar of residency showed that the population of the rural area was more depressed as compared to the urban population. Sixty-eight and 31.6% of participants from the total sample were from urban and rural areas, respectively Table 1.

Table 1. The demographic study of the participants.

		Total Participants	Normal	Minimal Depression	Mild Depression	Moderate Depression	Moderately Severe Depression	Severe Depression	P Value
Gender	Male	53	0	12(22.6)	15(28.3)	7(13.2)	7(13.2)	12(22.6)	0.216
	Female	39	1(2.6)	10(25.6)	8(20.5)	9(23.1)	8(20.5)	3(7.7)	
Marital status	Married	12	0	5(41.7)	3(25)	2(16.7)	1(8.3)	1(8.3)	0.692
	Unmarried	80	1(1.3)	17(21.3)	20(25)	14(17.5)	14(17.5)	14(7.5)	
Occupation	Homemaker	36	1(2.8)	8(22.2)	8(22.2)	9(25)	7(19.4)	3(8.3)	0.577
	Student	8	0	3(37.5)	3(37.5)	0	2(25)	0	
	Shopkeeper	4	0	3(75)	1(250)	0	0	0	
	Farmer	15	0	3(20)	5(33.3)	2(13.3)	1(6.7)	4(26.7)	
	Labour	9	0	1(11.1)	1(11.1)	2(22.2)	2(22.2)	3(33.3)	
	Business	9	0	0	4(44.4)	2(22.2)	1(11.1)	2(22.2)	
	Others	11	0	4(36.4)	1(9.1)	1(9.1)	2(18.2)	3(27.3)	
Smoker	Yes	47	0	4(8.9)	11(24.4)	7(15.6)	9(20)	14(31.1)	0.001
	No	45	1(1.5)	18(38.3)	12(25.5)	9(19.1)	6(12.8)	1(2.1)	
Education	ILLETRATE	43	0	7(16.3)	11(25.6)	9(20.9)	9(20.9)	7(16.3)	0.200
	Primary	6	0	1(16.7)	1(16.7)	1(16.7)	0	3(50)	
	Intermediate	8	0	2(25)	1(12.5)	2(25)	0	3(37.5)	
	Secondary	17	0	4(23.5)	5(29.4)	3(17.6)	3(17.6)	2(11.8)	
	Higher secondary	9	0	5(55.6)	2(22.2)	1(11.1)	1(11.1)	0	
	Graduate	9	1(11.1)	3(33.3)	3(33.3)	0	2(22.2)	0	
Alcoholic	No	44	1(1.8)	18(31.6)	17(29.8)	7(15.9)	1(2.3)	0	000
	Yes	48	0	4(11.4)	6(17.1)	9(18.8)	14(29.2)	15(31.3)	
Residency	Urban	63	1(3.4)	10(34.5)	8(27.6)	5(17.2)	5(17.2)	0	0.048
	Rural	29	0	12(19)	15(23.8)	11(17.5)	10(15.9)	15(23.8)	

They considered the issue by measuring of adherence score of participants by using Morisky Scale. The relevance of medication adherence associated with depression was examined. The influence of medication adherence on tuberculosis patients with depression showed undeniable results. Adherence to medication or anti-tubercular therapy exhibits the classic signs of the depression status of the participants. Of the total 92 included participants, 54 participants were of the low adherence category, 15 participants were observed to have moderately severe depression, and the PHQ9 score of 15 subjects showed severe depression. The Anova test revealed that MMAS score differs across the different PHQ-9 scale categories and all the findings differ significantly i.e; $P = 0.029$, shown in Table 2.

The correlation between PHQ9 and medication adherence to -anti-tuberculosis treatment was observed to be highly negative. This shows the inverse relationship between the two variables ($R = -0.762$). The correlation findings are statistically significant with $p < 0.05$; the correlation result is shown in Table 3. The scatter plots are formulated by keeping the PHQ9 Score on Y-axis and Morisky medication adherence scale score on X-axis, which shows a negative linear curve. The scatter plot

shows that there is a decrease in the PHQ9 score as the Morisky medication adherence scale score increases, as shown in Figure 2.

Table 2. Relationship between PHQ-9 category and MMAS Score.

Test for Homogeneity Anova						
PHQ-9 Category	Mean	STD.Deviation	Levene's Statistic	SIG	F	SIG
NORMAL	8.00	.00	2.847	0.029	95.391	0.00
MINIMAL DEPRESSION	6.86	.710				
MILD DEPRESSION	6.83	.717				
MODERATE DEPRESSION	6.19	.981				
MODERATELY SEVERE DEPRESSION	4.80	.676				
SEVERE DEPRESSION	1.47	1.187				

$P < 0.05$

Table 3. The Correlation between PHQ-9 Score with Morisky Medication Adherence Score by using karl pearson correlation.

		PHQ9 Score	Morisky Scale Score
PHQ9 Score	Pearson's Correlation	1	-.762**
	Sig. (2-tailed)		0.000
	N	92	92
Morisky Scale Score	Pearson's Correlation	-.762**	1
	Sig. (2-tailed)	0.000	
	N	92	92

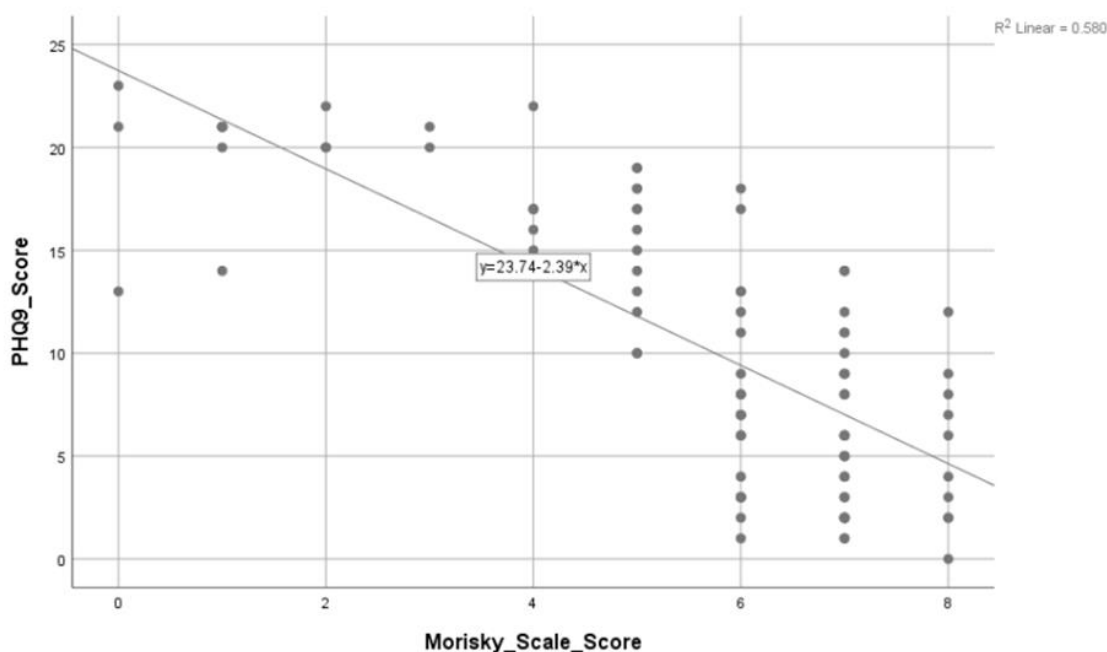


Figure 2. Scatter-Plot shows highly negative correlation.

DISCUSSION

This Cross-sectional research study demonstrated the hypothesis that depression and tuberculosis patients are mutually inclusive. The cornerstone, which had indisputable evidence, examined the influence of medication adherence. Medication adherence data of the participants showed their impact and control over the depression status of tuberculosis patients. All the findings and outcomes were

consistent with the previous studies that were performed across the globe regarding the increment of depression in tuberculosis patients. Roba et al., Laurence et al., Fitzpatrick et al. and Fuady et al. all of them comprehended depression in tuberculosis patients [20, 21, 22, 23]. Our outcomes estimated multiple factors and components that affect depression. The study revealed that males were found to be more depressed. Not surprisingly, the older age participants were observed to be more depressed. In addition, the occupation status showed farmers to have more depression. Some interesting findings popped up with a highly raised bar of depression in the married population. Furthermore, other factors like education status revealed that illiterate people were depressed majorly. All these above findings were statistically non-significant (p -value >0.05). Similarly, other more relevant factors like participants' residency and exposure to substance consumption like alcohol and smoking were observed to have an increment in depression status. They built this data on a statistically significant scale.

Roba et al, reported their mean age, urbanization level (p value= 0.0001), comorbidities (p value= 0.0001), and monthly income (p value= 0.001) were all as significant values. Still, gender was reported as a non-significant value [20]. Similarly, Fuady et al. reported that older age, female sex, lower wealth levels, and smoking were detected as significant values [23]. Along with mentioned factors, our study also observed medication adherence influencing the depression subjects who did not adhere to their anti-tuberculosis treatment medication were found to be more depressive than those who adhered to anti-tuberculosis medications.

Morisky Scale Scoring clearly demonstrated the increment in depression status of the subjects who were less adhered to their treatment (p value= 0.001) as compared to those who were regular to their medications. These findings did not provide any conclusive support to the literature. Bereket Duko et al. revealed the prevalence of depression in their study was 45.19% [24]. Fuady et al. analyzed the depression status in tuberculosis patients of 23.7%, and those who were healthy were 6.8% (p value <0.001) i.e., significant data [23]. Tamirat et al. showed the prevalence of depression among tuberculosis patients at about 1.9% (95% CI=42.5 [20]. Fitzpatrick et al. reported an association between depression symptoms and negative tuberculosis outcomes (OR= 4.26; CI 95%=2.33-7.79, $I^2=0\%$) [22] and Laurence et al., observed the overall incident rate of depression was 1.54fold higher in tuberculosis cohort as compared with controlled cohort (8.15 vs. 5.29 per 1000 per person) years, (95% CI=1.45-1.64) [21]. Another study also found that being on therapy for tuberculosis [aOR=11.2, 95% CI: 5.2-31.1, $P<0.001$] and having irregular treatment [aOR=8.2, 95% CI:1.1-23.3, $P< 0.005$] were major factors associated with a higher chance of depression [26]. The association of depression could be seen in chronic conditions like tuberculosis if they were poorly adhering to their treatment [27, 28]. Higher adherence to treatment, completion of treatment, and cure rates can be increased through psycho-education found in a prospective controlled trial. Our study outcomes closely matched those obtained by previous studies. Our results were consistent with the expected hypothesis, and finally, a significant interaction between tuberculosis patients and depression was indicated between them. This study's implications and outcomes could bring the prospect of overcoming the breakthrough.

Strengths

It was the first study to establish the correlation between the severity of depression and medication adherence to -anti-tuberculosis treatment by using the Morisky scale. However, this study provides new insights into the regions of medication adherence and depression status.

Limitations

There were a few limitations in our study; since this was a cross-sectional study, we failed to follow up with our subjects about their anti-tuberculosis treatment medications. We also did not assess the effect of various comorbidity conditions in our study. Moreover, this study fails to explain the cross relationship that, due to depression, patients are -non-adherent to the therapy.

CONCLUSION

Apparently, we were able to draw numerous conclusions through this assessment and it was worth exploring. Tuberculosis is very contagious and it can lead various effects on the patients. Accordingly, it can lead to depression in the patients. It would be reasonable to conclude that there is high possibility of developing depression in tuberculosis patients. Some convincing evidences interpreted that low medication adherence to anti-tuberculosis treatment may leads to severe depression (Table 2). Moreover, further investigations need to be conducted to provide possible relationship between the depression and tuberculosis. Our study emphasizes on the need to create awareness among the clinicians on the role of medication adherence in the tuberculosis patients so that early detection and treatment can be performed.

Acknowledgement

We would like to express a deep sense of gratitude to Geetanjali Medical College and Hospital, Udaipur for support provided to our team. We would like to extend our sincere thanks to Dr. Divax Oza and Dr. Monica Bansal for their valuable inputs in our project.

Registration and Ethics Approval

The protocol of the study includes the scope of the study, objectives, methodology and outcome. The protocol was presented to be members of ethical committee for approval and the authorization. The research study proposal was approved by Geetanjali Medical College and Hospital and Human Research Ethics Committee [HREC]. The study was conducted with the expert guidance of senior and junior physicians of the study department.

Ref: GU/HREC/EC/2022/2030.

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