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# Prevalence and impact of anxiety and depression in patients with chronic obstructive pulmonary disease: a comparative analysis of post-tuberculosis and non-tuberculosis chronic obstructive pulmonary disease cases

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**Abstract**

Chronic obstructive pulmonary disease (COPD) is a prevalent and debilitating condition, increasingly recognized for its complex interaction with psychiatric disorders such as anxiety and depression. This study assesses and compares the prevalence of anxiety and depression among COPD patients, including those with a history of pulmonary tuberculosis (TB), and examines their associations with COPD severity. This descriptive, cross-sectional study included 100 patients diagnosed with COPD, aged 40 to 80 years. Patients underwent comprehensive clinical evaluation, including spirometry and COPD assessment tests, and were assessed for anxiety and depression using the Hospital Anxiety and Depression Scale. Participants were classified based on their COPD status and history of TB. Data on sociodemographic and clinical characteristics was collected, and associations between psychiatric illnesses and COPD status were analyzed. The study population was predominantly male (73%), with a mean age of 56.33 years. The COPD assessment score was medium in 65% of participants, with 30% of patients exhibiting high levels. Anxiety was present in 21% of the cohort, while 30% had depression. Analysis revealed a significant association between high COPD scores and increased prevalence of both anxiety and depression ($p<0.05$). Additionally, patients with a history of pulmonary TB showed higher rates of psychiatric comorbidities. Specifically, anxiety was more prevalent among patients with severe COPD and a history of TB. These findings highlight a substantial burden of anxiety and depression among COPD patients, particularly those with severe disease and a history of TB. These results align with the existing literature, suggesting a strong link between COPD severity, psychiatric comorbidities, and the impact of historical TB on mental health. These insights underscore the need for integrated management strategies addressing both respiratory and psychiatric aspects of COPD care.

**Key words:** chronic obstructive pulmonary disease, anxiety, depression, pulmonary tuberculosis, COPD assessment test.

## Introduction

Chronic Obstructive Pulmonary Disease (COPD) is a leading cause of morbidity and mortality worldwide, especially among smokers over 40 years of age and individuals exposed to biomass smoke [1]. COPD ranks as the fourth leading cause of death globally, responsible for 3.5 million fatalities in 2021, equating to approximately 5% of all global deaths. In low- and middle-income countries (LMICs), nearly 90% of COPD-related deaths in individuals under 70 years of age occur. COPD also stands as the eighth leading cause of global health burden, measured in disability-adjusted life years (DALYs). In high-income countries, tobacco smoking contributes to over 70% of COPD cases. In contrast, in LMICs, tobacco smoking accounts for 30–40% of cases, with household air pollution emerging as a significant risk factor [2]. Despite substantial research on the physical aspects of COPD, such as airflow limitation and inflammation, gaps remain in understanding the interplay between psychosocial factors, comorbidities, and disease progression. A major factor complicating therapeutic approaches to managing COPD was that COPD was rarely the only chronic illness a patient contends with. Age and smoking serve as major risk factors for COPD and numerous other illnesses, often leading to COPD patients demonstrating multiple coexisting comorbidities [3,4]. The presence of comorbidities was so strongly associated with the management of COPD that the need for thorough attention to them was emphasized even in the COPD definition by GOLD (Global Initiative for Chronic Obstructive Lung Disease) guidelines [5]. Chronic obstructive pulmonary disease, a common preventable and treatable disease, was characterized by airflow limitation that was usually progressive and associated with an enhanced chronic inflammatory response in the airways and the lung to noxious particles or gases. Exacerbations and comorbidities contribute to the overall severity in individual patients [6]. Emotional frailty, including anxiety and depression, is poorly addressed in existing literature despite its known association with increased morbidity, mortality, and healthcare costs.

Comorbidities often impair the quality of life for early-stage patients, increase mortality in end-stage patients, raise the burden of COPD management on healthcare costs, and create therapeutic dilemmas for healthcare providers. Emotional frailty in COPD patients—manifesting as anxiety, depression, and fear of breathlessness—is associated with a documented increase in morbidity, mortality, hospitalization duration, and readmissions [6]. This study aims to bridge these gaps by evaluating the prevalence and impact of comorbidities and emotional frailty in COPD patients, investigating region-specific risk factors such as biomass smoke exposure, and proposing integrated strategies to improve multidisciplinary COPD care. Psychiatric disorders, particularly

depression and anxiety, are highly prevalent in patients with chronic obstructive pulmonary disease (COPD). Studies have shown that up to 50% of COPD patients suffer from depression, with a similar percentage experiencing anxiety. The prevalence of these psychological conditions is even higher in patients with severe or exacerbated COPD, where the burden of disease-related symptoms significantly impacts their emotional well-being. These psychological issues not only affect the patient's quality of life but also contribute to poor disease outcomes, such as increased healthcare utilization, worse functional status, and reduced adherence to treatment regimens. It is crucial to recognize and address these psychological comorbidities in COPD management. Addressing depression and anxiety early in COPD patients can improve their overall health, enhance treatment compliance, and significantly improve their quality of life. Furthermore, screening for psychological issues should be an integral part of the routine care of COPD patients to ensure comprehensive and holistic management. As COPD is a progressive disease, managing the mental health aspect is equally important as managing the physical symptoms to achieve optimal health outcomes for the patients.

The primary objective of this study was to investigate the prevalence and association of anxiety and depression among COPD patients, with particular focus on those with a history of pulmonary tuberculosis (TB), and to compare these findings with post-TB COPD patients. The study aimed to assess the relationship between disease severity, COPD assessment scores, and psychiatric comorbidities, considering factors such as socio-economic status, education level, and smoking history. Additionally, the study sought to explore the potential impact of psychological disorders on the overall quality of life, functional status, and treatment adherence in this patient population. By highlighting these associations, the study intends to emphasize the importance of addressing psychiatric comorbidities, especially in post-TB COPD patients, to improve patient outcomes and guide future therapeutic strategies.

**Materials and Methods**

This descriptive and cross-sectional study involved 100 patients aged 40 to 80 years. The patients for this study were recruited using a consecutive sampling method. All patients who presented to the pulmonary outpatient department and met the inclusion criteria during the study period were invited to participate. Patients who gave informed consent and fulfilled the diagnostic criteria for COPD, including post-TB COPD, were enrolled in the study. Those who did not meet the inclusion criteria or chose not to participate were excluded from the study. Prior to data collection, patients and caregivers were informed about the study, and informed written consent was

obtained. All patients diagnosed with COPD through spirometry were included. Enrolled patients underwent a detailed clinical history and physical examination. The clinical history included the duration of COPD, any history of comorbid conditions and any complications associated with underlying disease. Risk factors such as smoking, hypertension, and diabetes mellitus were recorded. Ethics approval taken from ethics committee of the institute (BSA/234/2021).

A detailed physical examination, including general and systemic examinations, was performed. Routine investigations such as complete blood count, serum electrolytes, renal and liver function tests, viral markers, and chest x-rays were conducted. Sputum for acid fast bacilli (AFB) was also done. Spirometry was conducted using the RMS Helios 702 Spirometer. Parameters obtained include forced expiratory volume in one second (FEV1), forced vital capacity (FVC), and FEV1/FVC ratio. Post-bronchodilator spirometry was performed in all patients to exclude bronchial asthma.

Symptoms were assessed using:

1. The COPD Assessment Test (CAT) questionnaire.
2. The modified Medical Research Council (mMRC) dyspnea scale.
3. History of exacerbations in the last year, categorized as ABCD groups of COPD as per GOLD 2021.

For psychiatric illness screening, the Hospital Anxiety and Depression Scale (HADS) was used. Patients scoring borderline or abnormal were referred to psychiatry for definitive diagnosis and severity assessment per Diagnostic and statistical manual of Mental Disorders 5$^{th}$ edition (DSM-5) criteria. A uniform documentation form was used to record all data.

Inclusion criteria:

- Patients diagnosed with COPD and post-TB COPD by spirometry.
- Sputum-negative patients for acid fast bacilli.
- Participants aged 40–80 years consented to the study.

Exclusion criteria:

- Patients did not consent to participate.
- Patients with intellectual disabilities or other comorbidities like bronchial asthma, active TB, lung cancer, or cerebrovascular accident (CVA).
- Patients with acute exacerbations of COPD or on oral steroid therapy.

### *Data management and statistical analysis*

The data for this study was entered into MS Excel 2010 and analyzed using R software version 4.0.2. The one-sample Kolmogorov-Smirnov test was used to evaluate whether the data followed a normal distribution. Graphical representations, including bar charts and scatter plots, were employed for visual clarity of variable distributions and relationships. Categorical data associations were analyzed using the Chi-Square test, while Fisher's exact test was used where applicable. The Independent T-test was applied to assess mean differences between two groups. Correlations were calculated to determine the strength of relationships between quantitative variables such as COPD assessment scores, spirometry parameters, and years' post-pulmonary TB treatment. Statistical significance was set at $p < 0.05$.

## Results

In this study of 100 participants, the majority were males (73%) aged 51 to 60 years (36%). A significant portion were current or ex-smokers (61%), and 41% had a history of pulmonary tuberculosis. Various occupations were represented, with vendors/shopkeepers being the most common (33%), as shown in Table 1. The COPD assessment score was medium in 65% of cases, followed by high in 23%, very high in 1%, and low in 11%. Most cases fall within mMRC grade 1 and grade 3 categories, each constituting 27%, as depicted in Table 2.

The mean COPD assessment score was 16.20 with a standard deviation of 5.96, while the mean mMRC grading was 1.82 with a standard deviation of 1.201. Additionally, mean values and standard deviations for lung function parameters (FEV1, FVC, and FEV1/FVC ratio), as well as pack years in current and past smokers and years since pulmonary tuberculosis treatment, were presented in Table 3.

The study also showed that 21% of participants had borderline/abnormal anxiety levels, while 30% exhibit borderline/abnormal depression levels. Among those experiencing anxiety, 57.14% were males and 42.86% were females. Similarly, for depression, 56.67% were males and 43.33% were females. Anxiety and depression rates were 42.86% and 40%, respectively, among current smokers, and 57.14% and 60%, respectively, among non-smokers/ex-smokers. Among individuals with a history of pulmonary tuberculosis, 38.1% reported anxiety and 33.33% reported depression, while those without a TB history reported 61.9% and 66.67%, respectively. The association between psychiatric illnesses and COPD status, as well as COPD with a history of pulmonary tuberculosis, indicated a higher prevalence of psychiatric comorbidities among COPD patients with high CAT scores, particularly those with a history of pulmonary TB ($p < 0.05$),

as shown in Tables 4 and 5. Among those with post-TB status, COPD prevalence was categorized as very high/high in 19.5% and as low/medium in 80.5%, as depicted in Table 6.

**Discussion**

COPD is considered not only as a disease of the lungs but as a part of the chronic systemic inflammatory syndrome [7]. Patients with COPD may have a spectrum of symptom severity ranging from short-term depressive symptoms to dysthymia (long-term chronic symptoms that were not disabling) to clinical depression.

Prevalence and incidences' rates vary widely across studies, owing to differences in sampling methods and degrees of illness severity as well as in assessment instruments adopted. The reported prevalence of depression in COPD ranges from 10% to 42% in people with stable COPD and from 10% to 86% in those with an acute exacerbation. Prevalence rates for clinical anxiety in COPD range from 13% to 46% in outpatients and 10% to 55% among inpatients [8]. According to Biswas et al, the prevalence of depression and anxiety varies from 12% to 57% in different studies from western countries [9]. Existing evidence suggested that there was an increasing prevalence of anxiety disorders in COPD patients varying from 2% to 50%, and as many as 55% of these patients may suffer from psychiatric disorders [10-12].

Previous studies had revealed symptoms of anxiety and depression in up to 41% and 44% of COPD patients respectively [13,14]. The degree of lung function impairment was not adequate on its own to explain the presence of anxiety and depression symptoms in COPD. Our findings were in concordance with previous studies that FEV1% predicted alone did not predict or correlate with the presence of anxiety and depression symptoms [14-16]. Katare et al. found that 43 (58.5%) of the 73 TOPD (tuberculosis associated obstructive pulmonary disease) patients had some form of depression and 16 (21.9%) had moderate to severe anxiety symptoms [17]. Depression can affect 1.71% to 87.5% of TB patients, and anxiety can affect 7.14% to 74% of TB patients [17]. Anxiety and depression often appear together in patients with COPD [10]. The prevalence of clinical depression ranges between 10% and 42%, while that of anxiety ranges between 10% and 19% in many studies as per Maurer J et al. study [10]. The risk of depression (odds ratio, 2.5; 95% confidence interval, 1.2 to 5.4) was higher in patients with severe COPD compared to control subjects, with the highest rates, up to 62%, found in oxygen-dependent patients [18,19]. In patients who had recently recovered from an acute exacerbation of COPD, the prevalence of depression was high and ranged between 19.4% and 50%, while anxiety ranged between 9.3% and 58% [10].

A few studies had reported that approximately two thirds of COPD patients with depression had from moderate-to-severe depression [20]. However, the prevalence of minor or subclinical depression may be even higher in this population, assuming that it was similar to other chronic illnesses. In one study it was reported that approximately one fourth of COPD patients had unrecognized subclinical depression [21]. Such patients commonly had a high burden of physical disability and were at risk for major depression. Depression and anxiety were often untreated or undertreated in patients with COPD [22]. The impact of anxiety and depression on COPD patients, their families, and society was significant.

The literature lacks studies about the impact of anxiety on adherence and relationships. This fact elicits a doubt on the methodological value of research instruments and designs. The number of studies with a high or medium risk of bias was surely a limitation, especially among reviews. These kinds of publications were useful to frame and understand a phenomenon, but they were not sufficient to systematically observe the state of literature about a topic. Moreover, included reviews had at least a paragraph focused on the link between depression/anxiety and compliance, but none of these studies were directly aimed at studying this relationship.

Socioeconomic status and education levels play a crucial role in the psychological well-being of COPD patients. Research has shown that individuals from lower socioeconomic backgrounds or with lower levels of education are more likely to experience poorer mental health outcomes, including higher rates of anxiety and depression. These factors can influence not only the direct management of COPD but also the psychosocial stressors that exacerbate the disease's symptoms. Our study found a significant association between low socioeconomic status**,** education levels**,** and the severity of psychiatric comorbidities among COPD patients. Patients with lower education levels and those in lower socioeconomic strata exhibited higher levels of depression and anxiety, which aligns with previous studies highlighting the impact of social determinants on mental health. Socioeconomic factors, including income, education, and access to healthcare, play a significant role in the manifestation and severity of depression and anxiety in patients with COPD [23].

Our study involved 100 participants, predominantly males aged 51-60, with a significant portion being current or ex-smokers and having a history of pulmonary tuberculosis. Most were vendors or shopkeepers. Assessments revealed medium COPD scores and MMRC grades 1 and 3. Analysis showed a mean COPD Assessment score of 16.20 and MMRC Grading of 1.82. Psychiatric illness rates indicated notable levels of anxiety and depression. Associations between COPD, tuberculosis history, and psychiatric comorbidities were explored, showing higher prevalence

among those with high COPD scores and tuberculosis history. Post-TB status indicated varying COPD prevalence.

Our study highlights the significant psychological burden experienced by COPD patients, particularly those with a history of tuberculosis. By identifying the prevalence of anxiety and depression in this population, the study underscores the importance of early detection and management of psychiatric comorbidities. Addressing these psychological issues can improve not only mental health outcomes but also overall COPD management. Psychological distress can negatively impact adherence to treatment regimens, exacerbate physical symptoms, and decrease quality of life. By integrating mental health screening and appropriate interventions into the care of COPD patients, healthcare providers can offer a more holistic approach, leading to better disease management, improved patient outcomes, and enhanced quality of life. Additionally, recognizing the relationship between psychological and physical health in COPD patients may pave the way for the development of multidisciplinary care models, where pulmonologists and mental health professionals collaborate to deliver comprehensive treatment strategies. This approach could ultimately reduce hospital admissions, improve symptom control, and enhance the long-term prognosis of COPD patients.

Our study has potential limitations and biases that may influence its findings. The reliance on self-reported measures for psychiatric symptoms, such as the Hospital Anxiety and Depression Scale (HADS), might result in underreporting or overreporting due to stigma associated with mental health disorders, and the use of a single assessment tool may not capture the full spectrum of psychiatric conditions. Additionally, the referral to psychiatry for definitive diagnosis and severity assessment, while valuable, could introduce referral bias, as patients experiencing more severe or noticeable psychiatric symptoms may be overrepresented. Furthermore, the study's focus on a specific region limits the generalizability of its findings to other populations, particularly in areas with differing COPD risk factors, such as variations in air pollution, dietary habits, and healthcare access.

**Conclusions**

Our study underscored the significant burden of psychiatric comorbidities among COPD patients, particularly those with a high CAT score and a history of pulmonary tuberculosis. These findings align with previous research indicating a complex interplay between respiratory and psychiatric conditions in this patient population. Further investigation was warranted to explore the mechanisms underlying these associations and to develop tailored interventions to address the

holistic needs of COPD patients, including considering the influence of socioeconomic factors and education levels on the mental health of COPD patients.

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**Table 1. Distribution of study participants according to demographic, behavioral and occupational status (n=100).**

| S No. | Group | Frequency | % age |
|---|---|---|---|
| **Age** | | | |
| 1. | 31 to 50 yrs | 34 | 34 |
| 2. | **51 to 60 yrs** | **36** | **36** |
| 3. | More than 60 yrs | 30 | 30 |
| 4. | **Mean Age** | **56.33±9.474** | |
| **Gender** | | | |
| 5. | **Male** | **73** | **73** |
| 6. | Female | 27 | 27 |
| **Smoking History** | | | |
| 7. | **Current Smoker** | **31** | **31** |
| 8. | Ex-smoker | 45 | 45 |
| 9. | Non-smoker | 24 | 24 |
| **History of Pulmonary Tuberculosis** | | | |
| 10. | Present | 41 | 41 |
| 11. | **Absent** | **59** | **59** |
| **Occupation** | | | |
| 12. | **Vendor/Shopkeeper** | **33** | **33** |
| 13. | Housewife | 26 | 26 |
| 14. | Farmer | 14 | 14 |
| 15. | Labour/Gardener/Rickshaw Puller | 14 | 14 |
| 16. | Electrician/carpenter/driver/plumber | 07 | 7 |
| 17. | Service (teacher/nurse etc) | 03 | 3 |
| 18. | Others | 03 | 3 |

**Table 2. Distribution of study participants according to COPD Assessment and MMRC grading (n=100).**

| S No. | Group | Frequency | %age |
|---|---|---|---|
| **COPD Assessment Test Score** | | | |
| 1. | Low | 11 | 11% |
| 2. | **Medium** | **65** | **65%** |
| 3. | High | 23 | 23% |
| 4. | Very high | 01 | 1% |
| **MMRC Grading** | | | |
| 5. | Grade 0 | 16 | 16% |
| 6. | **Grade 1** | **27** | **27%** |
| 7. | Grade 2 | 23 | 23% |
| 8. | **Grade 3** | **27** | **27%** |
| 9. | Grade 4 | 07 | 7% |

**Table 3. Characteristics of study participants over various assessment scores and grading (n=100).**

| S No. | Assessment/Score/Grading | Mean value | SD | Std error of mean |
|---|---|---|---|---|
| 1. | Chronic Obstructive Pulmonary Disease (COPD) Assessment score | 16.20 | 5.96 | 0.597 |
| 2. | MMRC (Modified Medical Research Council) Grading | 1.82 | 1.201 | 0.120 |
| 3. | FEV1 (Forced Expiratory Volume in One Second) | 66.79% | 15.10 | 1.51 |
| 4. | FVC (Forced Expiratory Capacity) | 72.77% | 13.02 | 1.3 |
| 5. | Forced Expiratory Volume in One Second / Forced Expiratory Capacity (FEV1/FVC) | 66.79% | 3.84 | 0.38 |
| 6. | Pack years in current smokers | 17.23 | 8.728 | 1.59 |
| 7. | Pack years in past smokers | 11.38 | 5.11 | 1.003 |
| 8. | Pulmonary Tuberculosis (PTB) treated in past (years back) | 9.71 | 7.24 | 1.131 |

**Table 4. Association of Psychiatric illnesses with sociodemographic and clinical profile (n=100).**

| **Anxiety** | | | | | |
|---|---|---|---|---|---|
| **S No.** | **Sociodemographic factor** | | **Anxiety** | | **Significance** |
| | | | **Present** | **Absent** | |
| 1. | Sex | Male | **12 (57.14%)** | 61 (77.22%) | Chi-square-3.391 p=0.066 |
| | | Female | 09 (42.86%) | **18 (22.78%)** | |
| 2. | Current Smoker | Yes | 09 (42.86%) | 22 (27.85%) | Chi-square-1.747, p=0.288 |
| | | No | **12 (57.14%)**) | **57 (72.15%)** | |
| 3. | History of Pulmonary Tuberculosis (PTB) | Yes | 08 (38.1%) | 33 (41.77%) | Chi-square-0.093, p=0.761 |
| | | No | **13 (61.9%)** | **46 (58.23%)** | |
| **Depression** | | | | | |
| **S No.** | **Sociodemographic factor** | | **Depression** | | **Significance** |
| | | | **Present** | **Absent** | |
| 1. | Sex | Male | **17 (56.67%)** | **56 (80%)** | **Chi-square-5.801 p=0.016** |
| | | Female | 13 (43.33) | 14 (20%) | |
| 2. | Current Smoker | Yes | 12 (40%) | 19 (27.14%) | Chi-square-1.623, p=0.203 |
| | | No | **18 (60%)** | **51 (72.86%)** | |
| 3. | History of Pulmonary Tuberculosis (PTB) | Yes | 10 (33.33) | 31 (44.28%) | Chi-square-1.104, p=0.308 |
| | | No | **20 (66.67)** | **39 (55.72%)** | |

**Table 5. Association of Psychiatric illnesses with COPD and Post TB COPD status.**

| **Anxiety** | | | | | |
|---|---|---|---|---|---|
| **S No.** | **Sociodemographic factor** | | **Anxiety** | | **Significance** |
| | | | **Present** | **Absent** | |
| 1. | Chronic Obstructive Pulmonary Disease (COPD) Status (CAT Score) (N=100) [CAT-COPD assessment tests] | High (CAT 3,4) | **13 (61.9%)** | 11 (13.93%) | **Chi-square-20.939, p<<<0.05** |
| | | Low (CAT 1,2) | 08 (38.1%) | **68 (86.07%)** | |
| 2. | COPD with History of PTB (n=41) | Present (CAT 2,3,4) | **07 (87.5%)** | 01 (3.03%) | **Fisher's exact p<<<0.05** |
| | | Absent (CAT 1) | 01 (12.5%) | **32 (96.97%)** | |
| **Depression** | | | | | |
| **S No.** | **Sociodemographic factor** | | **Depression** | | **Significance** |
| | | | **Present** | **Absent** | |
| 1. | COPD Status (CAT Score) | High (CAT 3,4) | 11 (36.67%) | 13 (18.57%) | Chi-square-3.77, p=0.052 |
| | | Low (CAT 1,2) | **19 (63.33%)** | **57 (81.43)** | |
| 2. | COPD with History of PTB | Present (CAT 3,4) | 04 (40%) | 04 (12.9%) | **Fisher's exact p<<<0.05** |
| | | Absent (CAT 1,2) | **06 (60%)** | **27 (87.1%)** | |

**Table 6. Association between COPD severity and the prevalence of anxiety and depression.**

| **COPD Severity** | **N (Total)** | **Anxiety Present** | **Anxiety Absent** | **Depression Present** | **Depression Absent** |
|---|---|---|---|---|---|
| Low (CAT 1) | 11 | 0 | 11 | 2 | 9 |
| Medium (CAT 2) | 65 | 8 | 57 | 19 | 46 |
| High (CAT 3) | 23 | 13 | 10 | 7 | 16 |
| Very High (CAT 4) | 1 | 0 | 1 | 0 | 1 |

{CAT- COPD assessment tests, COPD- Chronic Obstructive Pulmonary Disease}

-P-Value for Anxiety vs. COPD Severity: 2.97 ×10-5 (or 0.0000297), indicating a highly significant correlation between COPD severity and anxiety prevalence.

-P-Value for Depression vs. COPD Severity: 0.7937, suggesting that there was no significant correlation between COPD severity and depression prevalence