

**Original Research Article** 

# A COMPARATIVE STUDY OF COPD PREVALENCE IN POST-TUBERCULOSIS VS. NON-TUBERCULOSIS INDIVIDUALS

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## ABSTRACT

**Background:** Chronic obstructive pulmonary disease (COPD) is a major cause of morbidity worldwide, with emerging evidence suggesting pulmonary tuberculosis (TB) as an independent risk factor. This study aimed to compare the prevalence of COPD in individuals with and without a history of pulmonary TB.

**Materials and Methods:** A cross-sectional comparative study was conducted involving 200 adult participants—100 with prior pulmonary TB (post-TB group) and 100 without TB history (non-TB group). COPD diagnosis was established by spirometry according to GOLD criteria. Demographic, clinical, and smoking-related data were collected and analyzed.

**Results:** COPD prevalence was significantly higher in the post-TB group (38.0%) compared to the non-TB group (14.0%) (p < 0.001). Age and smoking rates were similar between groups. Within the post-TB group, COPD patients were older and had higher smoking exposure than non-COPD subjects (p < 0.05). Dyspnea severity was greater in COPD patients in both groups (p < 0.001). No significant differences were observed in demographic or clinical characteristics between COPD patients from the two groups.

**Conclusion:** Prior pulmonary tuberculosis significantly increases the risk of COPD independent of smoking. Targeted screening and management for COPD among TB survivors are warranted to reduce chronic respiratory morbidity.

**Keywords:** Chronic Obstructive Pulmonary Disease, Pulmonary Tuberculosis, Post-Tuberculosis, Lung Disease.

# **INTRODUCTION**

Chronic obstructive pulmonary disease (COPD) is a progressive respiratory disorder characterized by persistent airflow limitation and chronic inflammatory response of the airways and lungs to noxious particles or gases. It represents a major global health challenge due to its increasing prevalence, associated morbidity, mortality, and economic burden. COPD ranks as the third leading cause of death worldwide, affecting an estimated 300 million people, with significant variation in prevalence across regions. The disease is characterized by symptoms such as chronic cough, sputum production, and dyspnea, frequently resulting in impaired quality of life and progressive respiratory disability.<sup>[1]</sup>

Tuberculosis (TB), caused by *Mycobacterium tuberculosis*, remains a significant infectious disease globally, particularly in developing countries, despite substantial advances in diagnosis and treatment. The World Health Organization (WHO) estimated 10.6 million new TB cases and 1.6 million TB-related deaths worldwide in 2021. Pulmonary tuberculosis (PTB) can cause extensive lung tissue damage due to chronic infection and inflammation. Even after successful anti-tuberculosis treatment, many patients continue to suffer from sequelae such as lung fibrosis, bronchiectasis, and airway obstruction, which may predispose them to chronic respiratory diseases like COPD.<sup>[2]</sup>

Post-TB lung disease is increasingly recognized as an important cause of chronic respiratory morbidity, and COPD in post-TB patients has drawn growing attention. Several epidemiological and clinical studies have shown a higher prevalence of COPD among individuals with a history of pulmonary tuberculosis compared to those without prior TB infection. This association is believed to stem from the irreversible structural lung damage caused by TB, including parenchymal destruction, bronchial stenosis, and obliterative bronchiolitis, which can lead to airflow limitation similar to classical COPD caused by smoking or other environmental factors.<sup>[3]</sup> Understanding the prevalence and characteristics of COPD in post-TB individuals is critical for early diagnosis, appropriate management, and reducing long-term respiratory disability. However, data on the comparative prevalence of COPD in post-TB non-TB populations remain limited, versus especially from resource-limited settings where the burden of TB is high. Additionally, distinguishing COPD caused by smoking from COPD attributed to post-TB lung damage is a clinical challenge due to overlapping symptoms and spirometric findings.<sup>[4,5]</sup> Aim

To compare the prevalence of chronic obstructive pulmonary disease (COPD) in individuals with a history of pulmonary tuberculosis versus those without such history.

## Objectives

- 1. To estimate the prevalence of COPD in individuals with a history of treated pulmonary tuberculosis.
- 2. To estimate the prevalence of COPD in individuals without a history of tuberculosis.
- 3. To compare the demographic and clinical characteristics associated with COPD in post-TB and non-TB individuals.

# **MATERIALS AND METHODS**

#### Source of Data

The data for this study were collected from patients attending the outpatient pulmonary and general medicine departments at Dr. Ulhas Patil Medical College, Jalgaon. The participants included adults who consented to participate and met the study criteria.

#### **Study Design**

This was a cross-sectional comparative study designed to evaluate and compare the prevalence of COPD in two groups: individuals with prior history of pulmonary tuberculosis (post-TB group) and individuals without any history of tuberculosis (non-TB group).

#### **Study Location**

The study was conducted at a tertiary care teaching hospital, which serves as a tertiary referral center for respiratory diseases and general medical conditions.

# Study Duration

The study was carried out over a period of 12 months.

#### Sample Size

The total sample size was 200 individuals, with 100 participants in the post-TB group and 100 participants in the non-TB group. The sample size was calculated based on previous prevalence data and statistical power to detect differences between groups.

#### **Inclusion Criteria**

- Adults aged 18 years and above.
- Patients with documented history of pulmonary tuberculosis completed treatment at least one year prior (for post-TB group).
- Individuals without any history of tuberculosis or symptoms suggestive of active TB (for non-TB group).
- Patients willing to provide informed consent and undergo spirometry.

#### **Exclusion Criteria**

- Patients with active pulmonary tuberculosis or currently undergoing anti-tubercular therapy.
- Individuals with other significant respiratory diseases such as bronchial asthma, interstitial lung disease, or lung malignancy.
- Patients with severe comorbidities limiting spirometry performance.
- Pregnant women.

#### **Procedure and Methodology**

Participants were recruited consecutively from the outpatient department after screening for eligibility. A structured questionnaire was administered to collect demographic data, detailed medical history including TB treatment history, smoking status, occupational and environmental exposures, and respiratory symptoms.

All participants underwent spirometry testing according to American Thoracic Society (ATS) guidelines using a calibrated spirometer. Spirometry was performed by trained technicians, measuring Forced Expiratory Volume in 1 second (FEV1), Forced Vital Capacity (FVC), and FEV1/FVC ratio. COPD diagnosis was established based on postbronchodilator FEV1/FVC < 0.70, consistent with GOLD criteria <sup>[1]</sup>.

Additional clinical evaluation included physical examination, chest X-rays, and oxygen saturation measurement by pulse oximetry. Participants with abnormal findings suggestive of other pulmonary pathology were further evaluated and excluded if necessary.

#### **Sample Processing**

Spirometric data were reviewed for quality and reproducibility. The best of three acceptable maneuvers was taken for analysis. Chest radiographs were interpreted by experienced radiologists blinded to the clinical data to confirm absence of active disease.

# Statistical Methods

Data were entered into Microsoft Excel and analyzed using SPSS version 24.0. Descriptive statistics such as mean, standard deviation, and proportions were calculated. The prevalence of COPD was expressed as percentage with 95% confidence intervals.

Comparisons between groups were done using chisquare test for categorical variables and independent t-test for continuous variables. Logistic regression analysis was performed to identify factors associated with COPD after adjusting for confounders such as age, gender, and smoking. A p-value < 0.05 was considered statistically significant. **Data Collection** 

Data collection was performed using a pre-designed proforma capturing demographic variables, clinical history, spirometry results, and radiological findings. Data were collected by trained research assistants under supervision of the principal investigator to ensure accuracy and completeness.

# RESULTS

Table 1: Comparison of COPD Prevalence in Post-TB vs. Non-TB Individuals (n=200)								
Parameter	Post-TB (n=100)	Group	Non-TB (n=100)	Group	Test Statistic ( $\chi^2$	95% CI for Difference	P- value	
COPD Prevalence, n (%)	38 (38.0%)		14 (14.0%)		$\chi^2 = 16.72$	13.1% to 36.9%	<0.001	
Age (years), Mean (SD)	52.7 (11.8)		50.3 (12.2)		t = 1.53	-1.0 to 6.1	0.13	
Male Gender, n (%)	62 (62.0%)		58 (58.0%)		$\chi^2 = 0.33$	-11.7% to 19.7%	0.56	
Current Smokers, n (%)	41 (41.0%)		36 (36.0%)		$\chi^2 = 0.51$	-9.8% to 19.8%	0.47	
Mean Pack-Years (Smokers only)	22.3 (7.5)		20.1 (6.9)		t = 1.46	-0.8 to 4.8	0.15	

In this study comparing chronic obstructive pulmonary disease (COPD) prevalence and related characteristics between individuals with and without a history of pulmonary tuberculosis (TB), the overall prevalence of COPD was significantly higher in the post-TB group at 38.0% compared to 14.0% in the non-TB group ( $\chi^2 = 16.72$ , p < 0.001), with a 95% confidence interval for the difference ranging from 13.1% to 36.9%. The mean age of participants in the post-TB group was slightly higher

(52.7 ± 11.8 years) than the non-TB group (50.3 ± 12.2 years), but this difference was not statistically significant (t = 1.53, p = 0.13). Gender distribution was similar between groups, with males comprising 62.0% and 58.0% respectively ( $\chi^2 = 0.33$ , p = 0.56). Smoking prevalence and intensity also showed no significant difference, with current smokers representing 41.0% of the post-TB group versus 36.0% of the non-TB group ( $\chi^2 = 0.51$ , p = 0.47), and mean pack-years among smokers were comparable (22.3 ± 7.5 vs. 20.1 ± 6.9, p = 0.15).

Table 2: Prevalence and Characteristics of COPD in Post-TB Individuals (n=100)									
Parameter	COPD	Present	COPD	Absent	Test Statistic (χ <sup>2</sup>	95% CI for	Р-		
	(n=38)		(n=62)		/ t)	Difference	value		
Age (years), Mean (SD)	56.3 (10.2)		50.4 (12.3)		t = 2.50	1.3 to 10.5	0.014		
Male Gender, n (%)	27 (71.1%)		35 (56.5%)		$\chi^2 = 1.85$	-1.7% to 31.5%	0.17		
Current Smokers, n (%)	20 (52.6%)		21 (33.9%)		$\chi^2 = 3.33$	0.8% to 38.1%	0.068		
Mean Pack-Years (Smokers only)	24.7 (6.8)		20.2 (7.6)		t = 2.66	1.5 to 7.9	0.010		
Dyspnea (mMRC $\geq$ 2), n (%)	29 (76.3%)		18 (29.0%)		$\chi^2 = 25.89$	34.1% to 65.9%	< 0.001		

Focusing on the post-TB group, those with COPD were significantly older (56.3  $\pm$  10.2 years) than those without COPD (50.4  $\pm$  12.3 years, t = 2.50, p = 0.014). While the proportion of males was higher among COPD patients (71.1%) compared to non-COPD individuals (56.5%), this was not statistically significant ( $\chi^2$  = 1.85, p = 0.17). Current smoking was more frequent among COPD patients (52.6%) than those without COPD (33.9%), approaching

statistical significance ( $\chi^2 = 3.33$ , p = 0.068). Importantly, smokers with COPD had significantly higher mean pack-years (24.7 ± 6.8) than smokers without COPD (20.2 ± 7.6, p = 0.010). Dyspnea severity, defined as modified Medical Research Council (mMRC) grade  $\geq 2$ , was markedly more prevalent in the COPD subgroup (76.3%) versus non-COPD (29.0%) with a strong statistical association ( $\chi^2 = 25.89$ , p < 0.001).

Table 3: Prevalence and Characteristics of COPD in Non-TB Individuals (n=100)								
Parameter	COPD	Present	COPD	Absent	Test Statistic (χ <sup>2</sup> /	95% CI 1	for	Р-
	(n=14)		(n=86)		t)	Difference		value
Age (years), Mean (SD)	54.1 (11.0)		49.4 (12.5)		t = 1.50	-0.9 to 9.6		0.14
Male Gender, n (%)	9 (64.3%)		49 (57.0%)		$\chi^2 = 0.27$	-17.2% to 31.8%		0.61
Current Smokers, n (%)	10 (71.4%)		26 (30.2%)		$\chi^2 = 11.45$	21.4% to 59.4%		0.001
Mean Pack-Years (Smokers only)	28.4 (5.9)		18.7 (6.5)		t = 4.79	6.7 to 14.4		< 0.001

Dyspnea (mMRC $\geq$ 2), n (%)	11 (78.6%)	
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Among the non-TB group, the age difference between COPD and non-COPD subjects was not significant (54.1  $\pm$  11.0 vs. 49.4  $\pm$  12.5 years, p = 0.14). Gender distribution also showed no significant variation (64.3% vs. 57.0%, p = 0.61). However, current smoking was significantly more common in the COPD subgroup (71.4%) compared to the non-COPD subgroup (30.2%), with a robust statistical difference ( $\chi^2 = 11.45$ , p = 0.001). Moreover, mean pack-years were substantially higher in COPD patients ( $28.4 \pm 5.9$ ) than in non-COPD individuals ( $18.7 \pm 6.5$ , p < 0.001). Dyspnea severity (mMRC  $\geq 2$ ) was significantly more frequent in COPD patients (78.6%) compared to non-COPD (29.1%) with a highly significant association ( $\chi^2 = 13.87$ , p < 0.001).

25.3% to 67.2%

< 0.001

Table 4: Comparison of Demographic and Clinical Characteristics in COPD Patients: Post-TB vs. Non-TB (n=52)								
Parameter	Post-TB (n=38)	COPD	Non-TB (n=14)	COPD	Test Statistic ( $\chi^2$ / t)	95% CI Difference	for	P- value
Age (years), Mean (SD)	56.3 (10.2)		54.1 (11.0)		t = 0.70	-6.1 to 10.5		0.49
Male Gender, n (%)	27 (71.1%)		9 (64.3%)		$\chi^2 = 0.22$	-22.7% to 36.3%		0.64
Current Smokers, n (%)	20 (52.6%)		10 (71.4%)		$\chi^2 = 1.78$	-46.6% to 8.6%		0.18
Mean Pack-Years (Smokers only)	24.7 (6.8)		28.4 (5.9)		t = 1.90	-0.5 to 8.7		0.06
Dyspnea (mMRC $\geq$ 2), n (%)	29 (76.3%)		11 (78.6%)		$\chi^2 = 0.04$	-24.3% to 20.7%		0.85

25 (29.1%)

 $\gamma^2 = 13.87$ 

When comparing COPD patients from both groups, no significant differences were observed in age (56.3  $\pm$  10.2 years post-TB vs. 54.1  $\pm$  11.0 years non-TB, p = 0.49), gender distribution (71.1% vs. 64.3%, p = 0.64), current smoking rates (52.6% vs. 71.4%, p = 0.18), or mean pack-years (24.7  $\pm$  6.8 vs. 28.4  $\pm$  5.9, p = 0.06). Likewise, the prevalence of moderate to severe dyspnea (mMRC  $\geq$  2) was similar (76.3% post-TB vs. 78.6% non-TB, p = 0.85). These findings suggest that while COPD is more prevalent in individuals with prior TB, the demographic and clinical profile of COPD patients is broadly comparable regardless of TB history.

## DISCUSSION

The present study highlights a significantly higher prevalence of chronic obstructive pulmonary disease (COPD) in individuals with a history of pulmonary tuberculosis (post-TB group) compared to those group). without prior tuberculosis (non-TB Specifically, 38.0% of the post-TB group had COPD versus 14.0% in the non-TB group, a difference that was statistically significant ( $\chi^2 = 16.72$ , p < 0.001). This finding aligns with previous research that demonstrated a strong association between prior pulmonary TB and subsequent development of COPD. Alene KA et al.(2021),<sup>[6]</sup> reported that a history of TB increased the odds of airflow obstruction by 2- to 3-fold, consistent with the results of the current study. Similarly, Faverio P et al.(2021),<sup>[7]</sup> described a distinct phenotype of post-TB COPD characterized by extensive lung damage.

The mean age and gender distribution were comparable between the two groups (p > 0.05), indicating that age and sex were unlikely confounders of the increased COPD prevalence in post-TB individuals. Smoking rates and intensity (mean pack-years) also showed no significant difference between groups, suggesting that the observed excess COPD prevalence in the post-TB group was not merely attributable to smoking exposure. This supports the notion that TB itself is an independent risk factor for chronic airway obstruction Huang HY et al.(2020).<sup>[8]</sup>

Within the post-TB cohort, individuals with COPD were significantly older than those without COPD (56.3 vs. 50.4 years, p = 0.014) and had a higher smoking burden, as reflected by increased mean pack-years (24.7 vs. 20.2, p = 0.010). Although smoking prevalence tended to be higher in the COPD subgroup (52.6% vs. 33.9%, p = 0.068), this did not reach conventional significance, possibly due to sample size limitations. Notably, dyspnea severity (mMRC grade  $\geq 2$ ) was much more common in post-TB individuals with COPD (76.3%) compared to those without (29.0%), confirming the clinical impact of airflow obstruction in this population.

These findings parallel those of Romanowski K et al.(2023),<sup>[9]</sup> who observed that post-TB patients with airflow obstruction had worse respiratory symptoms and reduced lung function. The elevated dyspnea burden emphasizes the need for targeted clinical evaluation and management in this subgroup.

Among the non-TB group, COPD prevalence was lower (14.0%) but those with COPD had significantly higher smoking exposure (71.4% current smokers; mean pack-years 28.4) compared to non-COPD subjects (30.2% smokers; mean packyears 18.7), both differences being statistically significant (p = 0.001 and p < 0.001, respectively). This reinforces smoking as the primary risk factor for COPD in individuals without TB history, consistent with the classical understanding of COPD pathogenesis Moon SM et al.(2023).<sup>[10]</sup>

Interestingly, despite the lower prevalence, dyspnea severity remained significantly higher in the COPD subgroup of non-TB individuals (78.6% vs. 29.1%, p < 0.001), underscoring the symptomatic burden of COPD irrespective of TB history.

When comparing COPD patients from post-TB and non-TB groups directly, no significant differences were found in age, sex distribution, smoking status, smoking intensity, or dyspnea severity. This suggests that although the etiological pathways may differ—with TB-related structural lung damage contributing in one group and smoking-related airway inflammation in the other—the clinical characteristics of established COPD are broadly similar. Similar observations have been reported by Basham CA et al.(2021),<sup>[11]</sup> who noted convergent clinical phenotypes despite distinct origins

## CONCLUSION

The study demonstrates that individuals with a of pulmonary tuberculosis have a history higher prevalence significantly of chronic obstructive pulmonary disease compared to those without prior tuberculosis. This elevated risk persists even after accounting for smoking and other demographic factors, suggesting that pulmonary tuberculosis itself contributes independently to the development of COPD. Post-TB COPD patients exhibit similar clinical characteristics to COPD patients without TB history, highlighting the need for targeted screening and management strategies for TB survivors to mitigate long-term respiratory morbidity. Early identification and intervention in this high-risk population are essential to improve respiratory health outcomes.

#### Limitations of Study

This study has several limitations. The crosssectional design restricts the ability to establish causal relationships between prior tuberculosis and COPD development. The sample size, while adequate for prevalence estimation, may limit subgroup analyses and the detection of smaller effect sizes. Smoking exposure was self-reported and may be subject to recall bias. Potential confounding factors such as biomass fuel exposure, occupational hazards, and HIV status were not comprehensively assessed. Additionally, the study was conducted at a single tertiary care center, which may limit the generalizability of the findings to broader populations. Longitudinal and multicenter studies are recommended to further validate these findings.

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