

# Socioeconomic Determinants of Pulmonary Tuberculosis during Covid-19 Pandemic: Case Control Study

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## ABSTRACT

**Background:** Tuberculosis (TB) is a public health issue of paramount importance. Pakistan ranks 5th amongst the high burden TB countries globally with the prevalence, incidence and mortality per 100,000 population per year from TB being 348, 276 and 34 respectively. Socio-economic determinants like income, house, family size, ventilation, etc. play a vital role in the epidemiology of TB.

**Aim:** To analyze the socioeconomic determinants of pulmonary tuberculosis (PTB) during Covid-19 pandemic.

**Study Design:** Case study

**Methodology:** This case-control study was undertaken at Gulab Devi Hospital, Lahore, over a period of 8 months. 50 cases of confirmed Pulmonary tuberculosis and 50 controls were interviewed using a questionnaire containing demographic variables like gender, age, and socioeconomic status. Data was analyzed by using SPSS

**Results:** The sociodemographic profile of our respondents showed that 62 (62%) were males, 55 (55%) belonged to rural areas and, 52(52%) were employed. The socioeconomic determinants which were significantly associated with PTB were gender, residence, occupation, number of family members, and history of smoking.

**Practical Implementation:** Due to the emerging nature of the COVID-19 crisis, this study helped researchers investigate the role of socio-economical determinant of TB during Covid-19 pandemic infection.

**Conclusion:** Gender, residence, occupation, number of family members, and history of smoking were significantly associated with PTB. However, ventilation, family history of TB, and previous history of PTB were not found to have a statistically significant association with PTB.

**Keywords:** Pulmonary Tuberculosis, Covid-19, Incidence, Pandemic Condition and Socioeconomic Determinants.

## INTRODUCTION

Tuberculosis (TB) is a major health issue in resource limited countries<sup>1</sup>. Although it is a preventable and curable disease, it has infected an estimated 10 million people globally in 2020<sup>2</sup>. Prevailing mostly in third world countries like Pakistan, the causative agent, mycobacterium tuberculosis goes by a high incidence rate of 231/100,000 and about 420,000 new cases reported annually<sup>3</sup>. Pakistanis lack awareness of this disease. An undetected and untreated individual is the potential to transmit the disease to other healthy individuals. <sup>4</sup> According to JPMA (2016), approximately 26% of tuberculosis patients are not aware of this disease or its transmission and preventative measures. Although successful treatment for TB is available for the past 40 years, it is not enough to achieve the goal of TB elimination by the year 2035<sup>5</sup>.

Active TB cases present with symptoms like excessive cough, sometimes with blood, loss of appetite, weight loss, night sweats, fever, and chills. There is a good chance that it can be misdiagnosed as bronchitis or pneumonia<sup>6</sup>.

Tuberculosis is a droplet infection. It is curable and preventable<sup>7</sup>. Coughing, sneezing, or spitting by an infected person, results in the propulsion of germs into the air, targeting those individuals who breathe in the same air. Various determinants and risk factors play a role in maintaining high susceptibility and progression of this disease. TB is more frequent in old age, primarily due to a decrease in immunity. However, in Pakistan, this disease is observed to be more common in infants and adults. This disease affects more men than women in Pakistan. Interestingly, this pattern is consistent with the worldwide distribution of TB<sup>8</sup>.

As risk factors are statistically associated with disease outcome, socioeconomic factors like income, house, family size, poor ventilation, family history, and host-related factors like

genetics, immune response, HIV, malnutrition, smoking, and lastly environmental factors consisting of lifestyle, and education play a vital role in high incidence rate of TB. For example, in people with HIV, the risk of developing TB is 30 times greater than in people without HIV<sup>9</sup>.

Treatment for TB has become very successful for the past 40 years by the use of multi-antimicrobial drugs. However, lung injury caused by pulmonary TB is very frequent. In addition, to treat and reduce mortality, the primary goal of TB control program is to decrease the transmission of tuberculosis from infected TB cases and to reduce the exposure of risk factors responsible for causing tuberculosis<sup>10</sup>.

Covid-19 and Tuberculosis are dual detrimental pandemics. The socioeconomic determinants of both these health hazards overlap one another<sup>11</sup> It has been estimated that 2021 saw a 4.5% rise in TB cases from the prior year. An estimated 10.6 million people became ill in 2021 and nearly 1.6 million people died from TB during the Covid-19 pandemic according to the World Health Organization's 2022 Global TB report<sup>12</sup> (WHO 2022 report).

## METHODOLOGY

This case-control study was conducted in the setting of Gulab Devi Hospital, Lahore for duration of eight months, from April 2022 to December 2022, after taking approval from the Institutional Review Board of Al Aleem Medical College and from the Head of the Department of Pulmonology, Surgery, Ophthalmology and ENT Department of Gulab Devi Hospital, Lahore, for data collection. Our study consisted of 50 cases of confirmed tuberculosis and 50 controls. Hence, a total of 100 participants were included (case: control= 1:1)

Purposive sampling technique was used in this study. Inclusion criteria consisted of cases who were PTB positive (A person who is positive for acid-fast bacillus AFB in two out of three consecutive sputum samples) and controls were taken as those individuals who were PTB negative and presented to the Surgery, Ophthalmology, and ENT departments. PTB patients with comorbidities, those presenting with extra pulmonary TB, and

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those individuals who refused to participate, were excluded from this study.

After getting permission from Ethical Review Board, written informed consent was taken from each participant prior to the interview. A 6 feet distance was maintained with each participant, keeping in view of the Covid standard of precautions. Data from cases and controls was collected on demographic variables like gender, age, number of family members, presence of proper ventilation in the house (assessed by the interviewer on the basis of orally asked questions like number of windows and doors in the house, how often were the windows and doors opened, did the participants feel suffocation within the confines of their house etc), education status (based on the level of education the participant had received; primary, secondary, tertiary or none), outdoor environment (on the basis of presence of greenery, factories, pollution, dust, smoke, garbage, etc around the participant's area of residence), smoking status of the participant, etc. SPSS software was used for data entry and analysis and data was examined for errors and cleaned. Frequencies and proportions were calculated for categorical variables such as gender, marital status, education etc. and mean±standard deviation for continuous variables such as age was calculated. We determined the association between socioeconomic factors and pulmonary tuberculosis using Odd's Ratio and 95% Confidence Interval.

**Statistical analysis:** Data was analyzed by using SPSS software and association between socioeconomic factors and PTB was determined using Odds Ratio and 95% Confidence Intervals.

**RESULTS**

Among the 100 respondents interviewed, 62(62%) were males and 38(38%) were females. The mean age of respondents was 46±18 years. 55(55%) of the respondents belonged he rural areas and 45(45%) resided in urban areas. Regarding the socioeconomic status of respondents, 4(4%) belonged to the upper middle class, 53(53%) belonged to the lower middle class and 43(43%) belonged to the lower class. 52(52%) of the respondents were employed and 48(48%) were unemployed. Among the 100 respondents, 28(28%) were uneducated, 39(39%) had studied till the primary level, 26(26%) had studied till the secondary level and 7(7%) had studied further, after the completion of their secondary education.

Table-1 revealed that gender and residence were found to be significantly associated with (PTB). Majority of the TB infected respondents were males (94%). Moreover, majority of them were found to reside in rural areas (66%). This research was unable to find any significant association of PTB with marital status. Similarly, occupation, with an Odd's ratio of 2.6, was significantly associated with PTB and a majority of the TB respondents were employed (64%). This research was unable to establish a significant association between PTB and marital status.

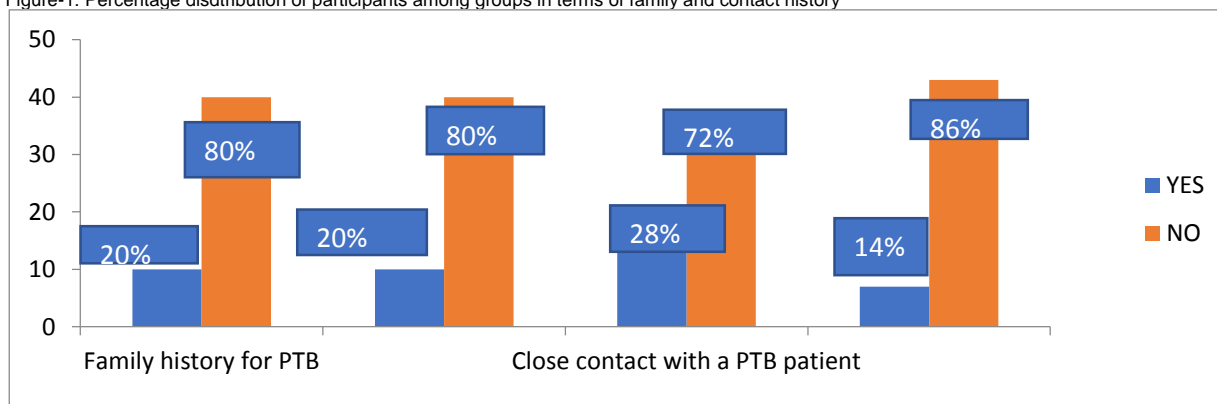
Number of family members, with an Odd's ratio of 4.3 was also significantly associated with PTB. Families consisting of less than 6 members were found to be more affected (58%). This research was unable to determine a significant association of PTB with educational status, ventilation and outdoor environment. Family history for pulmonary TB and contact history was demonstrated as Figure 1.

Table 1: Socioeconomic determinants of pulmonary TB

Variables	Cases	Controls	OR(95C.I)
<b>Gender</b>			
Male	47(94%)	15(30%)	36[9-136]
Female	3(6%)	35(70%)	
<b>Residence</b>			
Rural	46(92%)	41(82%)	2.5[0.7-8.8]
Urban	4(8%)	9(18%)	
<b>Marital status</b>			
Married	46(92%)	41(82%)	2.5[0.7-8.8]
Unmarried	4(8%)	9(18%)	
<b>Occupation</b>			
Worker	32(64%)	20(40)	2.6[1.1-5.9]
Non worker	18(36%)	30(60)	
<b>Ventilation</b>			
Adequate	42(84%)	41(82%)	1.1[0.4-3.2]
Inadequate	8(16%)	9(18%)	
<b>Educational status</b>			
Illiterate	12(24%)	16(32%)	0.671[0.27-1.61]
Literate	38(76%)	34(64%)	
<b>Number of family members*</b>			
Less than 6	29(58%)	12(24%)	4.3[1.8-10.3]
6 or more	21(42%)	38(76%)	
<b>Outdoor environment</b>			
Clean	32(64%)	41(82%)	0.39[0.15-0.98]
Dusty	18(36%)	9(18%)	
<b>Previous history of PTB</b>			
Yes	9(18%)	4(8%)	2.5[0.72-8.81]
No	41(82%)	46(92%)	
<b>Smoker*</b>			
Yes	18(36%)	4(8%)	6.4[2-20]
No	32(64%)	46(92%)	
<b>Drug Addiction</b>			
Yes	1(2%)	1(2%)	
No	49(98%)	49(98%)	

Similarly, family history, previous history of PTB, and close contact with a TB-infected person, all these variables were found to not have any statistically significant association with PTB. Smoking, with an Odd's ratio of 6.4, was found to have a statistically significant association with PTB. Among the cases, 36% were found to have a history of smoking. Our research was unable to determine a statistically significant association between PTB and drug addiction and the outdoor environment.

Figure-1: Percentage disdistribution of participants among groups in terms of family and contact history



## DISCUSSION

Quantitative Statistical analysis was conducted to evaluate the association of various socioeconomic determinants among patients presenting with Pulmonary Tuberculosis. The variables included were gender, family size, education, occupation, residence, smoking, drug addiction, and marital status.

The results which emerged from our study stated that gender, residence, occupation, family size, and smoking were found to be significantly associated with PTB. However, our research was unable to establish a significant association of PTB with other variables like marital status, ventilation, education, outdoor environment, previous family history of PTB, close contact with a PTB patient, and drug addiction.

Holmes et Al (1998)<sup>13</sup> reported that the prevalence of PTB was similar in males and females. Another study carried out by Yap Boum et Al<sup>14</sup> reported that male gender was independently associated with Pulmonary Tuberculosis. Our research showed similar results as 94% of males and only 6% of females suffered from PTB indicating that the male gender had a statistically significant association with PTB.

Hassmilar 2014<sup>15</sup> conducted a research on the association of smoking with pulmonary TB. Smoking was found to have a high association with Mycobacterium tuberculosis. Our research yielded similar results.

In Africa, Lienhard et Al 2005<sup>16</sup> found marital status to be associated with Pulmonary Tuberculosis. While our research was unable to find a significant association of PTB with marital status.

Hnzidi E Murray 2009<sup>17</sup> depicts the association of dusty environment in mines with PTB in South Africa. In our research, environment, whether dusty or clean, was unable to establish any significant results.

Jafer Kezali Hassen et al<sup>18</sup> carried out a study to analyze the determinates of PTB in public places. This research was conducted in 2019, during the initial stages of the Covid-19 pandemic. According to this study, cigarette smoking, patients' educational status and contact history with PTB patient were associated with PTB. Our study, also carried out during the Covid-19 pandemic, showed that cigarette smoking had a statistically significant association with PTB. Patients' educational status and contact history with PTB patient, however, did not.

Another study conducted by R. Duarte et Al 2021<sup>19</sup> found out that alcohol consumption malnutrition, drug consumption, smoking comorbidities (e.g., HIV/AIDS, diabetes, mental disease), smoking and incarceration seem to increase the likelihood of PTB infection. Our study also proved smoking to have a significant association with PTB.

**Limitations of study:** This study was only done on a limited population, so in order to extrapolate the findings to wider populations, a larger study needs to be done. Economical restrictions, a lack of genetic testing, and lengthy follow-ups are some of the constraints.

## CONCLUSION

In conclusion, among the 100 respondents interviewed, 50 cases and 50 control, 62% were males and 38% were females. 55% of our respondents belonged to rural areas and 45% belonged to urban areas. 52% comprised of those who were presently employed and 48% were unemployed. The socioeconomic determinants which were significantly associated with PTB were gender, residence, occupation, number of family members and history of smoking. Our study was unable to establish a statistically significant association of PTB with other variables like ventilation,

outdoor environment, family history of PTB and previous history of PTB.

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