



## Unraveling the burden of tuberculosis in hospitalized patients with alcoholism and hepatic comorbidities: A comprehensive case study

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### Abstract

This study aimed to investigate the association between alcoholism and pulmonary tuberculosis (PTB) among adult male patients attending the outpatient department (OPD) of Supreme Multi-Specialty Hospital in Ghatkopar, Mumbai. The study was conducted in May and June 2023 and utilized a descriptive design. The study population comprised adult male chronic alcoholics with PTB, excluding females. Microbiological diagnosis was carried out using sputum microscopy, MGIT Liquid culture, and molecular tests like Gen Xpert and Line Probe Assay (LPA). The findings revealed a strong correlation between chronic alcohol consumption and the risk of TB infection and transmission. Furthermore, alcoholism was found to have detrimental effects on treatment adherence and outcomes, leading to increased severity of PTB cases and resistance to anti-TB medications. The study also highlighted the impact of alcohol on the immune system and its association with comorbidities such as diabetes and psychiatric issues. These results emphasize the urgent need for targeted interventions and public health strategies that address alcohol abuse and its implications on TB management. By implementing comprehensive preventive measures and offering integrated healthcare services, the burden of alcohol-related PTB can be reduced, improving overall patient outcomes and public health.

**Keywords:** Tuberculosis, alcohol, alcohol and TB, alcohol TB and hepatic comorbidity

### Introduction

Alcohol is a risk factor for Tuberculosis (TB) [1]. Tuberculosis (TB) is the world's top infectious killer. TB is caused by bacteria (*Mycobacterium tuberculosis*), that most often affect the lungs. TB is spread from person to person through the air. When people with lung TB cough, sneeze or spit, they propel TB germs into the air. A person needs to inhale only a few of these germs to become infected. People with active TB can infect 10–15 other people through close contact over the course of a year. Without proper treatment, 45% of HIV-negative people with TB on average and nearly all HIV-positive people with TB will die. The good news is that TB is curable and preventable [2]. A total of 1.6 million people died from TB in 2021 (including 187 000 people with HIV). Worldwide.

About one-quarter of the world's population has latent TB, which means people have been infected by TB bacteria but are not (yet) ill with the disease and cannot transmit the disease. People infected with TB bacteria have a 5–10% lifetime risk of falling ill with TB. However, persons with compromised immune systems, such as people living with HIV, malnutrition or diabetes, or people who use tobacco, consume alcohol have a much higher risk of falling ill [2]. Alcohol consumption can lead to malnutrition, due less food intake and because of malabsorption, which heightens the risk of contracting tuberculosis (TB). Malnutrition weakens the immune system, making individuals more susceptible to TB infection. Stopping the alcohol intake can help improve nutrition and potentially lower the likelihood of TB occurrence.

### Symptoms

People with latent TB infection don't feel sick and aren't contagious. Only a small proportion of people who get infected with TB will get TB disease and symptoms. Babies and children are at higher risk. Certain conditions can increase a person's risk for tuberculosis disease: diabetes (high blood sugar) weakened immune system (for example, HIV or AIDS), being malnourished, tobacco use and alcoholics. Unlike TB infection, when a person gets TB disease, they will have symptoms. These may be mild for many months, so it is easy to spread TB to others without knowing it. Common symptoms of TB: prolonged cough (sometimes with blood), chest pain, weakness, fatigue, weight loss, fever, night sweats.

### Alcohol use

No level of alcohol consumption is safe for our health (W.H.O.04/01/2023) The harmful use of alcohol is a causal factor in more than 200 disease and injury conditions. Worldwide, 3 million deaths every year result from harmful use of alcohol. This represents 5.3% of all deaths.(WHO 5/9/2022). Alcohol use has been identified as a major risk factor for both developing TB disease and having worse outcomes; (1–4) Heavy alcohol use or Alcohol use disorder (AUD) prevalence among TB patients worldwide ranges from 15% to 70%.7–11 AUD is a chronic, relapsing brain disease characterized by an impaired ability to stop or control alcohol use despite adverse social, occupational, or health consequences. The presentation of AUD can range from mild to severe, and recovery is possible regardless of the level of severity [16].

## Alcohol and Tuberculosis

The relationship between alcohol consumption and tuberculosis can be explained by two causal pathways [3, 4]. First, alcohol consumption impairs the immune system, which increases susceptibility to tuberculosis infection, as well as to reactivation of latent tuberculosis [3, 4]. The ability of alveolar macrophages to respond to newly introduced pathogens is compromised by alcohol consumption [5, 63]; under normal circumstances these macrophages eliminate most mycobacteria [5, 64]. Specifically, mobilisation and adherence of macrophages is suppressed and phagocytosis of mycobacteria and superoxide production are impacted [65–69]. In addition, monocytes' production of cytokines that regulate inflammation is limited by alcohol consumption [7,8]. The macrophages' ability to respond to these cytokines and present mycobacterial antigens to lymphocytes is also reduced, and antigen-specific T-cell activation is impaired [8]. As a result of these changes, the immune system's ability to respond to new and dormant mycobacteria is severely diminished [9]. Apart from direct influences on the immune system, alcohol consumption is associated with malnutrition, liver disease and social drift, all of which impact the maintenance of innate and acquired immune systems [9]. Second, alcohol consumption leads to presence in social environments that facilitate the spread of tuberculosis infection [3, 4]. Examples of such environments include bars, shelters, prisons and social institutions, which have been implicated in molecular-epidemiological studies [11, 12].

Those who use alcohol may have worse TB treatment outcomes due to behavioral mechanisms, including worse medication adherence and greater loss to follow-up (LTFU) [12, 14], or biologic mechanisms, including the impact of alcohol on innate and adaptive immune responses [15], lung function and barrier protection [16], hepatotoxicity [17], and TB and human immunodeficiency virus (HIV) drug absorption and metabolism [18].

Alcohol use disorder (AUD) is a chronic, relapsing brain disease characterized by an impaired ability to stop or control alcohol use despite adverse social, occupational, or health consequences. The presentation of AUD can range from mild to severe, and recovery is possible regardless of the level of severity [16, 38]. Alcohol use has been identified as a major risk factor for both developing TB disease and having worse outcomes [1-4];

## Alcohol and TB Epidemiology

Alcohol misuse has significant implications for tuberculosis (TB) epidemiology, including the risk of infection, transmission, severity, treatment outcomes, and efficacy of treatment [17].

## Risk of Infection

Alcohol misuse is associated with an increased risk of TB infection. Chronic alcohol consumption weakens the immune system, making individuals more susceptible to contracting TB when exposed to the Mycobacterium tuberculosis bacteria. Alcohol impairs the function of immune cells, such as macrophages and neutrophils, which are crucial for fighting off TB infection [18].

## Risk of Transmission and Severity

Individuals with alcohol use disorder (AUD) who develop active TB can also pose a higher risk of transmitting the infection to others. Alcohol misuse may lead to behaviors that increase the likelihood of TB transmission, such as living in overcrowded conditions or having poor adherence to infection control measures. Moreover, AUD can worsen the clinical outcomes of TB, including increased severity of disease, higher rates of extra-pulmonary TB, and increased mortality [19].

## Treatment Outcomes

Alcohol misuse negatively impacts TB treatment outcomes. Studies have shown that individuals with AUD have lower treatment adherence rates, longer treatment durations, and higher rates of treatment failure, relapse, and mortality compared to those without AUD. Alcohol can interfere with medication adherence, increase the risk of drug interactions, and hinder the body's ability to eliminate TB bacteria [17].

## Efficacy of Treatment

Alcohol misuse can also affect the efficacy of TB treatment. Alcohol can impair liver function and compromise the metabolism of anti-TB medications, leading to suboptimal drug levels in the body. This can reduce the effectiveness of treatment and contribute to the development of drug resistance [17].

Addressing alcohol misuse within the context of TB is crucial for improving TB control efforts. Implementing interventions that target both alcohol misuse and TB, such as integrated screening and treatment programs, can help improve treatment outcomes and reduce transmission rates. It is essential to provide comprehensive care that addresses both the alcohol-related challenges and TB management to effectively combat the dual burden of alcohol and TB.

## Prevention

Alcohol consumption has been identified as a risk factor for tuberculosis (TB) in some studies. Preventive measures can be implemented at various stages to reduce the impact of alcohol on TB risk. Let's explore each level of prevention in the context of alcohol as a risk factor for TB:

### Pre-morbid Prevention

This level of prevention focuses on preventing the development of risk factors before they can lead to the disease. In the case of alcohol and TB, pre-morbid prevention would involve measures aimed at discouraging excessive alcohol consumption in the general population. Public health campaigns, educational programs, and policy interventions that promote responsible drinking habits and raise awareness about the association between alcohol and TB can fall under this category.

### Primary Prevention

Primary prevention aims to prevent the initial occurrence of a disease. For TB and alcohol-related TB risk, primary prevention would involve targeting individuals who consume alcohol and educating them about the risks associated with excessive drinking. Programs that promote moderation, provide resources for seeking help with alcohol dependence, and encourage healthier lifestyle choices can be part of primary prevention efforts.

### Secondary Prevention

Secondary prevention focuses on detecting and treating risk factors and diseases in their early stages to prevent further progression. In the context of alcohol as a risk factor for TB, secondary prevention efforts would involve screening individuals who consume alcohol regularly for TB infection. Early detection of TB can lead to timely treatment, reducing the risk of transmission to others and preventing the development of more severe TB cases.

### Tertiary Prevention

Tertiary prevention aims to reduce the impact of an existing disease and prevent complications and relapses. In the context of alcohol and TB, tertiary prevention measures would involve providing appropriate treatment and support for individuals who are already diagnosed with TB and are also affected by alcohol consumption. Ensuring compliance with TB treatment and offering interventions for alcohol cessation can be part of tertiary prevention strategies.

It is essential to note that the effectiveness of these preventive measures may vary depending on the individual's circumstances, the severity of alcohol use, and the level of TB risk. Combining preventive measures at different levels can enhance the overall effort to mitigate the impact of alcohol as a risk factor for TB and improve public health outcomes.

### Methods and Materials

The study was carried out in OPD of Supreme Multi Speciality Hospital Ghatkopar west, Mumbai in May 2023 and June 2023. hospital in Study is a descriptive type and Case was Alcoholic patient who comes to OPD with sign and symptoms of pulmonary TB, microbiologically diagnosed as Pulmonary Tuberculosis (PTB). Study population is adult male only, not less than 18 yrs as we have not found female in OPD patients, who was adherent to treatment and completed standard treatment course of Anti TB. Treatment (ATT). Inclusion Criteria Patient is chronic alcoholic and his liver function test is not normal or deranged, microbiologically (Sputum microscopy, MGIT Liquid culture, Molecular test recommended by W.HO. like GenXpert, Line Probe Away LPA)

Alcoholic patients attending in OPD are having bilateral destroyed lungs on x-ray chest with comorbidity like uncontrolled Diabetes, Hemoptysis moderate to severe. Pneumothorax or Hydro pneumothorax. As the patient is chronic alcoholic, patient develops psychiatric problem also like depression, suicidal ideation which are treated by hospitalization.

### Case Study

Case study, 60 yr. old male patient h/o of Diabetes with PTB 7yr back, taken complete ATT, comes in Supreme Multi-Specialty Hosp. Ghatkopar West Mumbai with Breathlessness, Cough, Generalized weakness. Chronic alcoholic Liver Function test deranged, patient refuse getting admitted in hospital. CXR shows bilateral old fibrotic lesion. GenXpert shows MTB detected with Rifampicin resistance, ECG taken shows QtcF- 470msec. Patient was advised to consult cardiologist and all pre-treatment investigation to be done. AS patient was referred to public health for starting second line ATT and due to cardiac problem new drug Bedaquilin cannot be started.

### Discussion

This case study highlights the complex challenges in managing a 60-year-old male chronic alcoholic with a history of Pulmonary Tuberculosis (PTB) and diabetes. The patient's refusal to be admitted to the hospital despite deranged liver function tests and respiratory symptoms poses difficulties in providing appropriate treatment. The presence of bilateral old fibrotic lung lesions and Rifampicin resistance detected through GenXpert further complicates the situation. The patient's prolonged QTcF interval on ECG necessitates consultation with a cardiologist. Unfortunately, due to cardiac concerns, the new drug Bedaquiline cannot be initiated for TB treatment. This case emphasizes the importance of considering comorbidities, drug resistance, and patient adherence to develop a comprehensive and tailored management plan for alcoholic patients with PTB.

From a public health perspective, this study provides valuable insights into the challenges posed by the intersection of alcoholism and pulmonary tuberculosis. Several key points can be discussed:

#### Alcoholism and PTB

The study targeted alcoholic patients with PTB, indicating that alcoholism may be a significant risk factor for developing tuberculosis. This finding highlights the importance of addressing alcohol abuse as a potential public health measure to reduce TB incidence and burden.

#### Comorbidities and Complications

The majority of patients attending the OPD required hospitalization due to the severity of their condition, with many having bilateral destroyed lungs on chest X-ray and comorbidities such as HIV, uncontrolled diabetes, and moderate to severe hemoptysis. This highlights the need for comprehensive and integrated healthcare services that address both tuberculosis and its associated comorbidities.

#### Mental Health Impact

Chronic alcoholic patients with PTB were found to be susceptible to developing psychiatric issues like depression and suicidal ideation. Addressing the mental health aspect of TB patients, particularly those with comorbid alcoholism, is crucial for effective management and overall patient well-being.

#### Challenges

Patients in advanced stages of PTB with complications. This indicates that there might be challenges in the early detection and management of tuberculosis cases at the primary and secondary healthcare levels, emphasizing the need for stronger primary healthcare and community-based interventions.

#### Microbiological Diagnosis

The study utilized various recommended tests for microbiological diagnosis, such as sputum microscopy, MGIT Liquid culture, and molecular tests like GenXpert and Line Probe Assay (LPA). Ensuring the availability and accessibility of these diagnostic tools at various healthcare facilities would aid in early detection and prompt treatment of PTB cases.

Overall, the study underscores the importance of a multidimensional approach to tackle pulmonary tuberculosis

in the context of alcoholism. Addressing public health concerns related to tuberculosis requires a comprehensive strategy that includes targeted interventions for alcohol abuse, improved access to healthcare services, early diagnosis, and robust mental health support for patients. Additionally, efforts should be made to understand and address gender-specific healthcare needs to ensure equitable access to care for all individuals affected by pulmonary tuberculosis (PTB).

### Conclusion

The study conducted at Supreme Multi-Specialty Hospital Ghatkopar, Mumbai, in May and June 2023 focused on alcoholic patients presenting with signs and symptoms of pulmonary tuberculosis (PTB). The hospital, GTB Hospitals, is the largest in Asia exclusively dedicated to treating pulmonary tuberculosis, with a significant bed capacity for both sensitive and drug-resistant patients.

Chronic alcohol consumption weakens the immune system, making individuals more susceptible to infections like tuberculosis (TB). Alcohol interferes with the body's ability to fight off pathogens, including the bacteria that cause TB (*Mycobacterium tuberculosis*). It impairs the function of immune cells, such as macrophages and lymphocytes, which are crucial for combating the infection. Additionally, alcohol-induced damage to the lungs can further increase the risk of developing TB.

### Malnourishment and Alcoholism

Chronic alcoholics often suffer from malnutrition due to a combination of factors. Firstly, alcohol itself provides empty calories with little nutritional value, leading to poor dietary intake. Secondly, alcohol abuse can reduce appetite and interfere with the absorption of essential nutrients from the gastrointestinal tract. Malnourishment weakens the body's defense mechanisms, exacerbating the susceptibility to infections like TB.

### Addiction and Treatment Adherence

Chronic alcoholics may struggle with addiction, which can significantly affect their ability to adhere to medical treatment, including TB treatment. Addiction can lead to erratic behavior, forgetfulness, and a lack of motivation to follow treatment regimens consistently. Treatment for TB requires strict adherence to antibiotic regimens over several months to ensure the complete eradication of the bacteria. Failure to adhere to treatment can lead to treatment failure, drug resistance, and relapse of TB.

### Alcohol Withdrawal and Treatment Default

When chronic alcoholics are admitted to healthcare facilities for TB treatment, they may experience withdrawal symptoms as they abruptly stop consuming alcohol. Alcohol withdrawal can be physically and psychologically distressing, leading some patients to leave the treatment facility prematurely. This treatment default is detrimental to their health as it interrupts the course of TB treatment and increases the risk of relapse or the development of drug-resistant TB strains.

### Relapse and Recurrent TB Disease

Treatment default and non-adherence to TB medication can result in relapse or recurrent TB disease. When TB treatment is interrupted or not completed as prescribed,

some bacteria may survive and develop resistance to the antibiotics used. These drug-resistant bacteria can cause more severe and challenging-to-treat TB infections. Relapse and recurrent TB are public health concerns, as they contribute to the spread of drug-resistant TB strains within the community.

### Social, Economic, Stigma, and Discrimination

Chronic alcoholics with TB may face several socio-economic challenges that hinder their ability to access appropriate healthcare and adhere to treatment. Poverty, homelessness, and unemployment are common among this population, making it difficult for them to afford or access healthcare services regularly. The stigma associated with both alcoholism and TB can also deter individuals from seeking medical care, as they fear judgment and discrimination from society.

### Summary

The issue of alcohol use and its impact on public health in Indian culture is a major concern. According to the National Drug Survey 2019, 27.3 percent of individuals aged 10 to 75 years reported alcohol consumption, with 43 percent engaging in high-risk drinking patterns.

Alcohol consumption in India leads to various health problems, including liver cirrhosis, heart disease, and diabetes. It also contributes to absenteeism, road accidents, and mental health and social issues, affecting individuals, families, and society as a whole.

To tackle this problem, a comprehensive public health-driven alcohol policy is essential. Strategies should include awareness campaigns, stronger regulation and enforcement, pricing and taxation measures, and access restrictions. Expanding treatment and support services, implementing education and prevention programs, involving communities, and conducting regular research are also crucial.

Cultural sensitivity is vital, recognizing that alcohol is deeply ingrained in Indian culture. Collaboration among government, healthcare, NGOs, and community organizations is necessary for effective implementation.

As India experiences changes from globalization, urbanization, and migration, addressing alcohol-related issues becomes even more critical. Tailored strategies, considering regional and societal disparities, can help mitigate the harmful consequences of alcohol use and promote overall public health and well-being.

In summary, the study highlights the association between alcoholism and pulmonary tuberculosis among adult male patients. It underscores the need for comprehensive public health interventions that address both alcohol abuse and TB to reduce disease burden and improve overall health outcomes. Early diagnosis, effective treatment, mental health support, and targeted preventive measures can play a pivotal role in controlling TB in this vulnerable population. Public health policymakers should consider these findings while formulating strategies to combat the TB epidemic in the context of alcohol use.

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