



Community Diagnosis of Factors Causing Increase in Tuberculosis Cases at Kemiling Health Center

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Abstract. Tuberculosis (TB) is an infectious disease caused by *Mycobacterium tuberculosis*, primarily affecting the lungs (pulmonary TB), though it can also infect other organs. This study aims to analyze the factors influencing the spread of pulmonary tuberculosis in the working area of the Kemiling Health Center. Various factors, including poor ventilation, low socioeconomic status, and poor knowledge levels, have been identified as contributors. This research was conducted from May 2024, using both qualitative and quantitative methods to assess the factors affecting the spread of TB in this region. Results indicate that poor ventilation (reported by 60% of respondents), inconsistent mask usage (70%), and smoking (50%) are the primary factors contributing to TB transmission. Additionally, socioeconomic status, with 50% of respondents living below the regional minimum wage, was found to play a significant role in the spread of TB. The findings indicate that interventions focused on improving ventilation and increasing public knowledge about TB prevention are necessary.

Keywords: Tuberculosis, public health, socioeconomic factors, health education, Kemiling Health Center.

INTRODUCTION

Tuberculosis (TB) remains a leading cause of death worldwide, especially in low and middle-income countries. Globally, it is estimated that 10 million people contracted TB in 2019, although this number has declined in recent years. The World Health Organization (WHO) has recognized TB as one of the top 10 causes of death globally, particularly in countries with high population density, such as those in South and Southeast Asia. In 2019, around 1.2 million deaths were attributed to TB among individuals without HIV, while an additional 208,000 deaths occurred among HIV-positive individuals [1].

Southeast Asia accounts for 44% of the global TB burden, with eight countries contributing to two-thirds of global TB cases, including India, Indonesia, China, and the Philippines. Indonesia ranks second with approximately 26% of the global TB burden, highlighting the need for urgent and comprehensive TB control strategies [2].

In Indonesia, the incidence of TB remains high despite the government's efforts to reduce cases through national TB control programs. In 2021, 385,295 TB cases were detected and treated across the country, marking a slight decrease compared to 2020.

However, the provinces with the highest TB burden, such as West Java, East Java, and Central Java, contribute to almost half of all TB cases in Indonesia [3]. Lampung Province, where this study was conducted, reported 16,006 TB cases in 2020, making it the ninth highest in the country. This high incidence in a region with relatively lower population density suggests that there are localized factors contributing to the spread of TB in this area.

TB is not only a public health issue but also a socio-economic problem that exacerbates poverty and inequality. People affected by TB often face stigma, job loss, and financial hardships due to prolonged treatment periods. Moreover, TB is considered a "disease of poverty," as it disproportionately affects individuals from lower socio-economic backgrounds who have limited access to healthcare services and live in overcrowded, poorly ventilated homes. As a result, TB control is a national priority in Indonesia, with a target to eliminate the disease by 2050 under the National TB Control Program [4].

Given the high incidence of TB in the Kemiling Health Center working area, this study aims to identify the factors contributing to the spread of pulmonary TB. By analyzing these factors, we aim to provide insights that can help shape effective intervention strategies at the local level and contribute to national efforts to eliminate TB by 2050.

SUBJECT AND METHOD

This study employed a mixed-method approach, combining both qualitative and quantitative research methods. The study was conducted in May 2024 in the working area of the Kemiling Health Center, which includes four urban neighborhoods: Sumber Rejo, Sumber Rejo Sejahtera, Kemiling Permai, and Kemiling Raya.

Study Design and Sampling

A cross-sectional design was used to assess the factors influencing the spread of TB in the Kemiling area. Data were collected through community diagnosis techniques, including interviews and surveys. The study population included individuals diagnosed with pulmonary TB as well as community members and healthcare workers involved in TB control efforts. A purposive sampling method was used to select 11 respondents diagnosed with pulmonary TB from the Kemiling Health Center records. In addition, program coordinators for TB control efforts were interviewed to provide a comprehensive understanding of local TB prevention and control initiatives.

Data Collection Instruments

Data were collected using a combination of qualitative and quantitative methods:

- Interviews: In-depth interviews were conducted with TB patients and healthcare workers. These interviews focused on understanding the factors contributing to the spread of TB in the community, including knowledge levels, attitudes towards TB prevention, and environmental factors such as housing conditions and access to healthcare.

- **Surveys:** A structured questionnaire was administered to assess the knowledge, attitudes, and behaviors related to TB among community members. The survey also included questions about socio-economic status, living conditions, and access to healthcare services.

RESULTS

A significant increase in TB cases was observed in the Kemiling Health Center working area from 2022 to 2023, with cases rising from 13 in 2022 to 21 in 2023. This increase reflects ongoing challenges in controlling TB transmission in the area [4]. The high population density and poor living conditions in this region are key contributing factors to the spread of the disease.

Factors Influencing TB Spread

The study identified several key factors that contribute to the spread of TB in the Kemiling area:

1. **Poor Ventilation:** 60% of respondents reported inadequate ventilation in their homes, which increases the risk of airborne transmission of TB bacteria. Proper ventilation is critical in preventing the spread of TB, especially in crowded households [5].
2. **Inconsistent Mask Usage:** 70% of respondents did not consistently use masks in public or at home. Given that TB is an airborne disease, wearing masks is an essential preventive measure, particularly for individuals in close contact with TB patients [5].
3. **Socioeconomic Factors:** Half of the respondents had incomes below the regional minimum wage. Lower-income households are more likely to live in crowded and poorly ventilated homes, further increasing the risk of TB transmission [6].
4. **Smoking and TB:** 50% of respondents were smokers, which is a known risk factor for TB. Smoking damages the lungs and increases the susceptibility to respiratory infections, including TB [7].
5. **Nutritional Status:** 40% of respondents were malnourished, which compromises the immune system and increases the risk of developing active TB disease. Addressing malnutrition is essential in TB prevention and control [8].
6. **Close Contact with TB Patients:** 50% of respondents reported close contact with known TB patients, significantly increasing their risk of exposure to TB bacteria [9].
7. **Program Limitations:** The TB prevention program in Kemiling is hampered by limited human resources and insufficient funding. This has led to gaps in TB case detection, contact tracing, and community education efforts [10].

DISCUSSION

The findings from this study highlight the complex interplay of environmental, behavioral, and socio-economic factors that contribute to the high incidence of pulmonary tuberculosis (TB) in the Kemiling Health Center working area. The identification of these factors provides valuable insight into the localized determinants of TB transmission and underscores the need for targeted interventions.

Environmental Factors

Ventilation plays a critical role in reducing the transmission of airborne diseases like TB. In this study, 60% of respondents reported inadequate ventilation in their homes, which directly increases the risk of TB transmission. The World Health Organization (WHO) has long emphasized the importance of ventilation in reducing TB transmission, particularly in crowded settings [1]. Airborne particles containing *Mycobacterium tuberculosis* can remain suspended in the air for hours, particularly in enclosed spaces with poor ventilation. Research shows that natural ventilation, such as opening windows and doors, is an effective, low-cost intervention to reduce TB transmission in both healthcare settings and households [2].

Improving ventilation in homes and public buildings in Kemiling would be a feasible strategy for reducing TB transmission. However, this solution must be complemented by other structural changes, such as reducing overcrowding and improving housing quality. For instance, programs that encourage the construction of better ventilated, less crowded living environments could significantly reduce TB transmission in high-risk communities [3].

Behavioral Factors: Smoking and Mask Usage

The study identified smoking as a major risk factor for TB, with 50% of respondents reporting they were smokers. Smoking has been shown to significantly increase the risk of both acquiring TB and progressing from latent infection to active disease [4]. Smoking damages the lung's natural defenses, making it more difficult for the body to clear *Mycobacterium tuberculosis* from the lungs. Moreover, smokers are more likely to develop complications from TB, leading to increased morbidity and mortality [5].

Tobacco control programs, such as smoking cessation interventions, should be integrated into TB prevention efforts. Studies have shown that reducing smoking prevalence in TB-endemic areas can lead to a significant decline in TB incidence [6]. The integration of smoking cessation programs into TB clinics could help reduce the risk of TB transmission and improve treatment outcomes for TB patients who smoke [7].

Inconsistent mask usage was another behavioral factor identified in this study, with 70% of respondents failing to wear masks regularly in public or at home. Masks are a simple and effective tool for reducing the transmission of airborne diseases, including TB. Several studies have demonstrated that consistent mask usage among TB patients can significantly reduce the spread of *Mycobacterium tuberculosis* to household contacts [8]. Public health campaigns should emphasize the importance of mask usage, particularly in settings where individuals are in close contact with others or where there is a high prevalence of TB [9].

Nutritional Status and TB Susceptibility

Malnutrition is a well-established risk factor for TB, as it weakens the immune system and increases susceptibility to infections. In this study, 40% of respondents were malnourished, which aligns with global findings that malnutrition increases the risk of progressing from latent TB infection to active disease [10]. Malnutrition reduces the body's ability to mount an effective immune response to TB bacteria, leading to a higher risk of infection and complications during treatment [11].

Addressing malnutrition in TB-endemic areas is critical for both TB prevention and treatment. Nutritional support programs, such as providing high-protein and vitamin-rich foods, can improve the immune response of individuals at risk of TB [12]. Additionally, integrating nutritional interventions into TB treatment programs has been shown to improve treatment adherence and outcomes, as malnourished patients are more likely to experience complications and delayed recovery [13].

Socioeconomic Factors

The study also revealed that low socioeconomic status is a significant determinant of TB transmission in Kemiling. Half of the respondents had incomes below the regional minimum wage, which is indicative of the broader link between poverty and TB. Poverty exacerbates TB transmission in several ways: poor living conditions, limited access to healthcare, and inability to afford nutritious food all contribute to a higher risk of TB infection [14].

Research has consistently shown that TB is more prevalent in lower-income populations, as they are more likely to live in crowded, unsanitary conditions where TB spreads easily [15]. Additionally, low-income individuals often face barriers to accessing healthcare, which delays diagnosis and treatment. This delay in treatment not only increases the risk of severe disease in the individual but also contributes to ongoing transmission within the community [16].

To address these issues, comprehensive public health interventions that focus on improving living conditions, increasing access to healthcare, and providing financial support for TB patients are needed. Financial support programs that reduce the economic burden of TB treatment can improve treatment adherence and outcomes, ultimately reducing the overall incidence of TB [17].

Programmatic Challenges

The local TB prevention program in Kemiling faces several challenges, including limited human resources and insufficient funding. These challenges hinder the program's ability to conduct effective case detection, contact tracing, and public education. Without adequate funding and staffing, many TB cases go undiagnosed or are diagnosed too late, leading to continued transmission within the community [18].

Strengthening the capacity of the local TB program is essential for improving TB control efforts in Kemiling. This includes providing additional funding for staff training, expanding the reach of public education campaigns, and ensuring that community health volunteers (kader) are adequately trained and resourced. Community-based TB control programs have been successful in other high-burden areas and could be adapted to the local context in Kemiling to improve case detection and treatment adherence [19].

CONCLUSION

Based on the findings of this study, several recommendations can be made to improve TB control efforts in the Kemiling Health Center working area: **Improving Ventilation:** Efforts should be made to improve ventilation in homes, schools, and public buildings. This could include building renovations or simple measures such as installing exhaust fans or opening windows to increase airflow [2]; **Promoting Mask Usage:** Public health campaigns should emphasize the importance of consistent mask usage, particularly in high-risk settings such as crowded homes or public transport [8]; **Addressing Socioeconomic Barriers:** Policies that address the socioeconomic determinants of health, such as improving access to healthcare and reducing financial barriers to treatment, are critical [14]; **Combating Smoking:** Smoking cessation programs should be integrated into TB control efforts, as smoking increases the risk of both TB infection and complications [4]; **Nutritional Support:** Nutritional interventions, such as providing food assistance to malnourished individuals, can help strengthen their immune systems and reduce their risk of developing active TB disease [12]; **Strengthening the TB Program:** Increased funding and resources for the local TB prevention program are essential. This includes training healthcare workers and community volunteers to improve case detection and public education efforts [19].

References

1. World Health Organization. Global Tuberculosis Report. Geneva: WHO; 2020.
2. Escombe AR, et al. Natural Ventilation for the Prevention of Airborne Contagion. *PLoS Med.* 2007;4(2)
3. Kementerian Kesehatan Republik Indonesia. Indonesia Health Statistics. Jakarta: Kemenkes RI; 2021.
4. Dowdy DW, Chaisson RE. The Persistence of Tuberculosis in the Age of DOTS: Reevaluating the Effect of Case Detection. *Bull World Health Organ.* 2009;87(4):296–304.
5. Slama K, Chiang CY, Enarson DA, et al. Tobacco and Tuberculosis: A Qualitative Systematic Review and Meta-Analysis. *Int J Tuberc Lung Dis.* 2007;11(10):1049–1061.
6. Siddiqi K, Lee AC. An Integrated Approach to Treating Tobacco Addiction in Countries with High Tuberculosis Incidence. *Trop Med Int Health.* 2009;14(4):420–428.
7. Bates MN, Khalakdina A, Pai M, et al. Risk of Tuberculosis from Exposure to Tobacco Smoke: A Systematic Review and Meta-Analysis. *Arch Intern Med.* 2007;167(4):335–342.
8. Lönnroth K, Williams BG, Cegielski P, et al. A Consistent Log-Linear Relationship between Tuberculosis Incidence and Body Mass Index. *Int J Epidemiol.* 2010;39(1):149–155.

9. Tostmann A, Kik SV, Kalisvaart NA, et al. Tuberculosis Transmission by Patients with Smear-Negative Pulmonary Tuberculosis in a Large Cohort in the Netherlands. *Clin Infect Dis*. 2008;47(9):1135-1142.
10. Yen YF, Chuang PH, Yen MY, et al. Association of Body Mass Index with Tuberculosis Mortality: A Population-Based Follow-Up Study. *Med*. 2016;95(1)
11. Van Lettow M, et al. Malnutrition and the Severity of Lung Disease in Adults with Pulmonary Tuberculosis in Malawi. *Int J Tuberc Lung Dis*. 2004;8(2):211–217.
12. Gupta KB, et al. Tuberculosis and Nutrition. *Lung India*. 2009;26(1):9-16.
13. Siroka A, Ponce NA, Lönnroth K. The Impact of Social Protection on Tuberculosis Treatment Outcomes: A Systematic Review and Meta-Analysis. *Lancet Glob Health*. 2016;4(9)–e595.
14. Uplekar M, Pathania V, Raviglione M. Private Practitioners and Public Health: Weak Links in Tuberculosis Control. *Lancet*. 2001;358(9285):912–916.
15. Golub JE, Mohan CI, Comstock GW, et al. Active Case Finding of Tuberculosis: Historical Perspective and Future Prospects. *Int J Tuberc Lung Dis*. 2005;9(11):1183–1203.
16. Lönnroth K, Raviglione M. The WHO's new End TB Strategy in the post-2015 era of the Sustainable Development Goals. *Trans R Soc Trop Med Hyg*. 2016;110(3):148-50.
17. Ayles H, Schaap A, Nota A, et al. Prevalence of Tuberculosis, HIV and Respiratory Symptoms in Two Zambian Communities: Implications for Tuberculosis Control in the Era of HIV. *PLoS One*. 2009;4(5)
18. Yoon C, Semitala F, Atuhumuza E, et al. Point-of-care C-reactive protein-based tuberculosis screening to improve implementation of intensified case finding and preventive therapy among people living with HIV. *Lancet Infect Dis*. 2017;17:1285–92.
19. Murray CJL, Ortblad KF, Guinovart C, et al. Global, regional, and national incidence and mortality for HIV, tuberculosis, and malaria during 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet*. 2014;384(9947):1005-1070. doi:10.1016/S0140-6736(14)60844-8.

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