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The Correlation Between Close Contact and Environment with TB Incidence

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Abstract:
Tuberculosis (TB) remains a significant public health issue in Indonesia. This infectious disease burdens the affected individuals and impacts their families and the wider community. This study aims to determine the relationship between close contact and environmental factors with the incidence of Tuberculosis (TB) in the working area of Puskesmas Tekung. This quantitative research employs an analytical correlation design. The sample consists of 30 respondents who received services at the general clinic of Puskesmas Tekung, selected using accidental sampling techniques. The results show that most respondents (21 or 70%) did not have close contact with TB patients. Additionally, most respondents (22 or 73.3%) lived in a healthy environment. TB-negative results were found in 19 respondents (63.3%). Bivariate analysis using the Chi-Square test revealed a significant relationship between close contact and the incidence of TB with a p-value of 0.000. A similar significant relationship was found between environmental factors and TB incidence, where respondents living in a healthy environment were less likely to contract TB (p=0.000). The proposed solution is to enhance educational programs and public outreach about maintaining distance from TB patients and creating a healthy environment. This can be achieved through seminars, educational material distribution, and health campaigns at the village level. Additionally, it is crucial to promote clean living habits, including mask usage and proper coughing etiquette, and to strengthen environmental sanitation efforts to reduce the risk of TB transmission.

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INTRODUCTION

Tuberculosis (TB) is an infectious disease caused by the bacterium Mycobacterium tuberculosis, primarily affecting the lungs but capable of impacting other organs (Kassie et al., 2024). TB remains a significant health issue in many countries, including Indonesia, where environmental factors and close contact between infected and healthy individuals play a significant role in its transmission (Chadha, 2024; Pratiwi et al., 2021). Understanding how these factors contribute to TB's spread is essential in developing effective interventions (Fernández-Honorio et al., 2024). Environmental factors like poor ventilation, overcrowded living spaces, and low sanitation standards accelerate TB transmission. Furthermore, close contact with TB patients, especially in unhealthy environments, significantly raises the risk of infection (Zhan et al., 2024; Kurniyawan et al., 2023).

According to the World Health Organization (WHO), TB is one of the top ten causes of death worldwide. In 2020, an estimated 10 million people worldwide were affected by TB, including 5.6

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million men, 3.3 million women, and 1.1 million children. TB cases span across every country and age group; however, it is both preventable and curable. In 2020, 30 high TB burden countries contributed to 86% of the new cases, with two-thirds of this number from eight nations, including India, China, Indonesia, the Philippines, Pakistan, Nigeria, Bangladesh, and South Africa. The highest cases by region are found in Southeast Asia (45.6%), Africa (23.3%), and the Western Pacific (17.8%), with fewer cases in the Eastern Mediterranean (8.1%), the Americas (2.9%), and Europe (2.2%) (Amirus et al., 2024; Nurvita & Meyshella, 2024).

Indonesia reported an estimated TB incidence in 2021 of around 969,000 cases, or 354 cases per 100,000 people, with TB-HIV cases estimated at 22,000 annually, equating to 8.1 per 100,000 people. TB-related deaths were estimated at 144,000, or 52 per 100,000 people, while TB-HIV-related deaths were around 6,500, or 2.4 per 100,000 people (Happyanto et al., 2024). In Lumajang district, data from the Health Department in 2023 recorded 2,118 confirmed TB cases and 16,414 suspected cases, indicating a critical need for effective TB management and prevention strategies.

A preliminary study conducted in June 2024 at Tekung Health Center revealed that 70% of 10 respondents with TB had close contact with other TB patients, either as family members or neighbors, and lived in damp homes with poor ventilation. Meanwhile, the remaining 30% reported frequent socializing with friends who had TB. These findings underscore the importance of environmental cleanliness and minimizing close contact with infected individuals in managing TB risk in the area.

TB incidence in many regions is often due to limited public awareness regarding environmental hygiene and the management of close contact with TB patients (Van Wyk et al., 2024; Aifa et al., 2024). Many people are unaware that maintaining good ventilation and keeping a safe distance from patients can reduce transmission risks. Moreover, daily habits such as frequent hand washing and maintaining household cleanliness play crucial roles in TB prevention. Consequently, public education on hygiene practices and TB prevention needs to be enhanced to mitigate transmission (Nguyen et al., 2024; Madebo et al., 2023).

A comprehensive solution involves providing thorough education to TB patients and their families. This education should cover ways to prevent TB transmission, the importance of environmental cleanliness, and safe methods for managing close contact with TB patients. Educational programs can be delivered through various media, including in-person meetings, pamphlets, and social media, to reach a broader audience and raise public awareness of TB prevention. With adequate education, TB incidence rates could be significantly reduced (Sharma et al., 2023; Unki et al., 2024). This study aims to determine the relationship between close contact and environmental factors with the incidence of Tuberculosis (TB) in the working area of Puskesmas Tekung.

METHOD

This research follows a quantitative analytic correlation design to examine the relationship between close contact, environmental factors, and tuberculosis (TB) incidence at the Tekung Health Center. It includes comprehensive details on design, population and sampling, variables, data collection, and ethical considerations. The target population is TB patients at Tekung Health Center, with an accidental sampling approach used to select respondents based on convenience and suitability. Instruments include questionnaires that gather demographic data, assess household health environments, and measure close-contact factors affecting TB incidence.

Data validity and reliability were assessed using SPSS, with questionnaires validated through expert review and statistical testing. The content and construct validity of the instruments were

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ensured, and reliability was confirmed through a Cronbach's alpha score of 0.837, indicating a substantial degree of measurement consistency. Findings from this research are intended to clarify correlations between close contact, environmental conditions, and TB incidence, providing insights to support public health strategies in TB prevention. This research has received ethical approval from the Faculty of Health Sciences, Hafshawaty Zainul Hasan University.

RESULT

Table 1. Characteristics of Respondents (n=30)

Characteristics	Frequency	Percentage (%)
Age		
25-30 years	4	13.3
31-35 years	8	26.7
36-40 years	8	26.7
41-45 years	8	26.7
46-50 years	2	6.7
Gender		
Male	8	26.7
Female	22	73.3
Occupation		
Laborer	1	3.3
Farmer	13	43.3
Employee	4	13.3
Entrepreneur	4	13.3
Housewife	8	26.7
Education		
Primary School	4	13.3
Middle School	9	30.0
High School	17	56.7
Higher Education	4	13.3
Family size		
4	8	26.7
5	15	50.0
6	7	23.3

The general data from Puskesmas Tekung indicates that most respondents are aged 31-45, with 73.3% female and the majority (50%) having a family size of five. Educational levels show that 56.7% have completed high school, while 43.3% work as farmers, highlighting the rural and agrarian nature of the area. This demographic overview suggests that health programs in the community should consider the predominant age group, gender, education, and occupational context to address local health needs effectively.

Table 2. Frequency of Close Contact, Environment, and TB Incidence among Respondents in the Puskesmas Tekung Service Area (n=30)

Category	Frequency	Percentage (%)
Close Contact		
Non-close contact	21	70.0
Close contact with TB patient	9	30.0
Environment		
Healthy	22	73.3
Unhealthy	8	26.7
TB Incidence		
TB negative	19	63.3
TB positive	11	36.7

In the Puskesmas Tekung service area, 70% of respondents are classified as non-close contacts with TB patients, and 73.3% live in a healthy environment. Additionally, the majority of respondents, 63.3%, tested negative for TB. This suggests that most respondents have limited exposure to TB patients and live in conditions conducive to lower TB transmission risk.

Table 3. Cross-tabulation of Close Contact and Environmental Conditions with TB Incidence in the Puskesmas Tekung Service Area (n=30)

Variable	Kejadian TB		Total	*Chi-Square Tests*
	TB negative	TB positive		
Close Contact				
Non-close contact	19 63.3%	2 6.7%	21 70.0%	0.000
Close contact with TB patient	0 0.0%	9 30.0%	9 30.0%	
Total	19 63.3%	11 36.7%	30 100%	
Environment				
Healthy	19 63.3%	3 10.0%	22 73.3%	0.000
Unhealthy	0 0.0%	8 26.7%	8 26.7%	
Total	19 63.3%	11 36.7%	30 100%	

In the Puskesmas Tekung service area, a cross-tabulation analysis reveals significant findings regarding TB incidence among respondents. Table 5.9 indicates that most non-close contacts (63.3%) tested negative for TB, while all close contacts (30.0%) tested positive. The Chi-Square Test shows a p-value of 0.000, indicating a strong relationship between close contact and TB incidence. Similarly, Table 5.10 highlights that most respondents living in healthy environments (63.3%) also tested negative for TB, while those in unhealthy environments predominantly tested positive. This analysis, supported by a p-value of 0.000 from the Chi-Square Test, underscores the importance of close contact and environmental factors in influencing TB incidence in the area.

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DISCUSSION

Close Contacts of TB Patients in the Puskesmas Tekung Area

According to the data presented in Table 2, most respondents in the Puskesmas Tekung area, specifically 70%, reported having close contact with TB patients categorized as non-close contacts. Close contacts are defined as individuals who frequently interact with an index case for extended periods, even if they do not reside in the same household. This is particularly concerning given that tuberculosis (TB), primarily caused by the Mycobacterium tuberculosis bacteria, continues to be a critical public health issue in Indonesia. Environmental factors and the frequency of contact between infected and healthy individuals heavily influence the transmission dynamics of TB (Naidoo et al., 2024).

The study indicates that while a majority (70%) do not fit the close contact category, a notable 30% do. This group is at heightened risk for infection, underscoring the need for increased awareness and preventive measures. The mechanisms of TB transmission primarily occur through inhaling droplets produced when an infected individual coughs, sneezes, or talks. This emphasizes the importance of identifying and monitoring high-risk individuals, particularly those in frequent contact with TB patients (Naidoo et al., 2024).

Given the data, targeted interventions such as community education about TB transmission and effective self-protection methods are essential. With 30% of respondents identified as close contacts, tailored health interventions, including regular health screenings and informational outreach, must be prioritized to reduce TB transmission risks in the Puskesmas Tekung area. The goal is to foster an informed and vigilant community about TB prevention, ultimately safeguarding public health.

The Environment of TB Patients in the Puskesmas Tekung Area

Data from Table 2 reveals that 73.3% of respondents in the Puskesmas Tekung area live in a healthy environment. Healthy living conditions encompass good ventilation, clean water access, and waste management. These aspects are crucial as environmental factors like poor ventilation and high housing density can significantly exacerbate the spread of TB. A healthy home environment is essential in reducing transmission risks, as adequate ventilation can dilute and disperse infectious droplets in the air (Vasiliu et al., 2024).

The research highlights the protective role of a healthy living environment in preventing TB transmission. Good ventilation helps lower the concentration of Mycobacterium tuberculosis in indoor air, thus mitigating the risk of infection. Conversely, overcrowded and poorly ventilated homes increase the likelihood of TB transmission (Alsunbuli, 2020; He et al., 2024). Since most respondents live in healthy environments, the focus must remain on maintaining and improving these conditions while educating residents about TB transmission and prevention.

Despite the positive environmental indicators, continuous public health education is vital. Ensuring that all community members understand the importance of hygiene practices and the health implications of their surroundings is crucial for sustained health benefits. This includes promoting awareness of how TB spreads and the necessary steps to prevent infection, particularly for those with close contact with TB patients. A proactive approach will enhance community resilience against TB and improve overall public health in the Puskesmas Tekung area.

TB Incidence in the Puskesmas Tekung Area

Table 2 indicates that 63.3% of respondents in the Puskesmas Tekung area reported adverse TB incidence. The relatively low occurrence of TB can be attributed to several factors, including the

community's understanding of hygiene practices and environmental cleanliness. Many individuals remain unaware of the significant role that good ventilation and maintaining distance from infected persons can play in reducing transmission risks. Therefore, reinforcing public knowledge about these preventive measures is essential.

The incidence of TB is closely linked to theoretical frameworks that examine the causes, host characteristics, and environmental influences. These theories highlight the critical need for ongoing public education regarding TB prevention and the importance of early detection. Despite the favorable incidence data, the community must remain vigilant to ensure that infection rates do not rise in the future. Regular health campaigns focusing on TB awareness, hygiene practices, and the importance of prompt medical attention can help maintain the current low incidence levels (Sharma et al., 2023; Sarkar, 2024)

In summary, while the findings indicate a positive trend regarding TB incidence, continued efforts are necessary to educate the community. Enhancing awareness about hygiene, the importance of good living conditions, and early detection methods will be vital for maintaining low TB rates. Fostering an informed public can significantly contribute to preventing future outbreaks, ensuring that the overall health of the Puskesmas Tekung area remains a priority.

The Correlation Between Close Contacts and TB Incidence in the Puskesmas Tekung Area

Results from Table 3 demonstrate that 63.3% of respondents categorized as non-close contacts of TB patients did not experience TB. The Chi-Square analysis yielded a significant p-value of 0.000, indicating a strong relationship between close contacts and TB incidence in the area. This data reveals that individuals who have close interactions with TB patients are at a significantly higher risk of contracting the disease. Understanding this relationship is crucial for developing effective public health strategies to reduce transmission rates.

The findings reinforce the need for targeted public health interventions focused on those identified as close contacts. The mechanisms of TB transmission primarily occur through inhaling infectious droplets, particularly in environments with inadequate ventilation. As such, educating the community about the importance of minimizing close contact with infected individuals is essential. By doing so, we can significantly reduce the risk of TB spreading among at-risk populations (Mahesh et al., 2024; Fan et al., 2024).

Given the significant Chi-Square result, enhancing prevention strategies in the community is imperative. This includes identifying and protecting high-risk individuals through rigorous health screenings and comprehensive public health education. The goal is to create a more informed population capable of recognizing the risks associated with close contact with TB patients. Ultimately, these efforts aim to mitigate TB prevalence and improve the overall health of the Puskesmas Tekung community.

The Correlation Between Environment and TB Incidence in the Puskesmas Tekung Area

According to Table 3, 63.3% of respondents in the Puskesmas Tekung area living in healthy environments reported no incidence of TB. The analysis indicates a p-value of 0.000, underscoring the relationship between environmental conditions and TB incidence. Healthy living conditions, characterized by good ventilation and proper sanitation, are crucial in preventing TB transmission. Environments with adequate ventilation help lower the concentration of infectious droplets in the air, reducing the likelihood of transmission (Abdollahi et al., 2022; Juliasih et al., 2024).

The intricate relationship between environmental factors and TB incidence highlights the necessity of community-focused interventions to promote and maintain healthy living conditions. While most respondents enjoy favorable environmental conditions, addressing the needs of those in

less healthy settings is crucial to minimize TB transmission risks. Ensuring all individuals have access to clean, safe living environments can help protect the community from potential outbreaks (Vasiliu et al., 2024; Xia et al., 2024).

The findings also highlight the importance of continuous education regarding hygiene practices and sanitation. Community awareness about the implications of living in healthy environments and knowledge of TB transmission routes are vital for effective disease prevention. Promoting healthy practices and improving access to sanitation can create a safer living environment that significantly lowers the risk of TB transmission in the Puskesmas Tekung area.

CONCLUSION

This study emphasizes the significant relationship between close contact with tuberculosis (TB) patients, environmental conditions, and the incidence of TB in the Tekung health center area. The findings indicate that most respondents who did not have close contact with TB patients did not experience the disease, highlighting the need for targeted public health interventions. The strong correlation between close contact and TB incidence underlines the importance of educating the community about the risks of interaction with infected individuals and promoting effective preventive measures.

Additionally, the analysis reveals that a healthy living environment is crucial in reducing TB incidence. Most respondents lived in environments with good ventilation and sanitation, which is essential for minimizing transmission. This suggests that maintaining and improving environmental conditions is vital for public health efforts to reduce TB rates. Continuous education on hygiene practices and awareness of TB transmission routes is necessary to foster a well-informed community and ensure access to healthy living conditions, ultimately contributing to better health outcomes in the Tekung area.

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CONFLICT OF INTEREST

The authors declared no competing interests in the production of this manuscript.

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