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Case Study

Modes of Tuberculosis Transmission among New Patients in Blitar District: A Case Study

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ABSTRACT
Background: Prevention efforts have been carried out massively and early through immunization. However, transmission still occurs, especially to people living in the same house as tuberculosis sufferers. This research aims to describe the mode of transmission and efforts to cure it. **Methods:** This research design is a case study to uncover the phenomenon of transmission. The participant of this study was 14 new sufferers and 17 old sufferers who were suspected as transmitters selected by purposive sampling. Data collection through in-depth interviews to uncover the phenomenon was carried out from June 2024 to April 2025. Data analysis used the Miles and Huberman model was continued with triangulation validation to program holders at the Puskesmas. **Results:** Old and new sufferers were found in childhood. New sufferers were found in 8 people including infant, when diagnosed was 18 days old. New sufferers were infected during activities in the school environment transmitted by school friends and also infected from adults in the household. The transmission that occurred was not realized by new sufferers because it could be caused by unexpected people, even those closest to them. Transmission easily occurs if individuals live in the same house as an infected person and have a weak immune system. The danger of transmission to children can lead to stigma from peers and the community. Preventive measures that everyone should maintain include healthy behaviors such as consuming nutritious food, wearing a mask, covering when coughing, and avoiding spitting carelessly. **Conclusion:** Children are highly vulnerable, and prevention efforts need to be enhanced through healthy behaviors.

INTRODUCTION

Tuberculosis is an infectious disease caused by Mycobacterium Tuberculosis, which is transmitted through the air when an infected person coughs, sneezes, or spits. A person can become infected by inhaling only a small number of bacteria (WHO, 2024). Efforts to prevent transmission have become part of the WHO Organization (WHO, 2020). Indonesia also implements preventive measures by interrupting transmission and implementing Tuberculosis (TB) preventive therapy (TPT) (Kemkes-RI, 2025), which involves the active participation of the community, cadres, health workers, and ministries. Ministries involved in preventing transmission include the Ministry of Education and Culture, the Ministry of Public Works and Public Housing, the Ministry of Social Affairs, the Ministry of Home Affairs, and the Ministry of Villages, Development of Disadvantaged Regions, and Transmigration (WHO, 2021).

Preventive measures were implemented by administering medication according to dosage. However, the risk of transmission remains, especially for individuals who are in close contact with sufferers. Such individuals are referred to as household contacts or close contacts (Kemkes-RI

2025; WHO 2019). The 2023 Indonesian Health Survey found that the prevalence of tuberculosis was 0.30% across all ages, with the proportion of transmission to household members reaching 0.2%, including children (BKPK, 2023).

Tuberculosis treatment and prevention have become global programs in Indonesia. However, transmission still occurs, particularly among individuals with high levels of contact. Transmission also occurs in children; however, few studies have explained this. This study aimed to explore the phenomenon of tuberculosis transmission.

METHODS

The research design used a case study that aimed to reveal the phenomenon of tuberculosis transmission in the Community Health Center (Puskesmas) area of the Blitar District. The participants were individuals infected with tuberculosis (new patients) and old tuberculosis patients undergoing treatment at the Talun Community Health Center, Blitar District. Fourteen infected individuals (new sufferers) and 17 patients with tuberculosis were selected by purposive sampling. The data were collected between June 2024 and April 2025. The data collection method used was In-depth interviews were conducted with individuals or families of individuals infected with tuberculosis. The interviews were conducted using a predesigned questionnaire. All participants' responses were recorded with verbal consent. The responses were subsequently transcribed in a written form. Data analysis was conducted to reduce, present, and conclude the study using the Miles and Huberman model. Further triangulation analysis aimed to validate the data obtained by tuberculosis program holders at the Talun Community Health Center in the Blitar District. Ethical eligibility was granted by the Health Research Ethics Committee of Malang Health Polytechnic Number DP.04.03/F.XXI.31/0341/2024, dated April 25th, 2024.

RESULTS

The characteristics of sufferers and individuals infected with tuberculosis are presented in Table 1, and information from new sufferers was written descriptively, which was then used as a theme.

Table 1. Characteristics of old and new tuberculosis sufferers

Participant characteristics	Old sufferers of tuberculosis		New sufferers of tuberculosis	
	n	%	n	%
Age				
infant and < 1 year old	0	0.00	1	7.14
1 – 3 years old	2	11.76	2	14.29
4 – 5 years old	0	0.00	0	0.00
6 – 7 years old	3	17.65	5	35.71
Young (< 18 years old)	0	0.00	1	7.14
Adults (≥ 18 years old)	12	70.59	5	28.57
Gender				
Male	14	82.35	4	28.57
Female	3	17.65	10	71.43

In Table 1, all old patients with tuberculosis and individuals infected with tuberculosis (new patients) have been undergoing treatment since their positive diagnosis. One patient was 18 days old (categorized as an infant) when diagnosed with tuberculosis by a doctor at the Community Health Center (Puskesmas). Adult sufferers or parents collect medication from Puskesmas for children. Medication collection at Puskesmas every 28 d Adult family members supervised medication administration for adolescents and adults, while parents were responsible for administering medication to children. Although children and adults are old tuberculosis sufferers, they are not infectious agents because they live in different areas and never transmit to new sufferers. The old tuberculosis patients were already in their fourth month of treatment at the time of data collection, and the adult patients had a history of recovery and treatment failure. One

patient who had recovered and was currently undergoing treatment transmitted the infection to a 2-3 years-old child because she was a grandmother and caregiver.

The initial question asked to the parents of children aged up to 7 years old as new tuberculosis sufferers, was "Who transmitted the tuberculosis?" The answers obtained from the participants are described.

Mother of an infant (P1): "... I do not know, my infant is not even a month old yet. I am confused, who did he get from? ... Maybe a neighbor who visited our house had tuberculosis'."

Mothers of children aged 2–3 years (P2 and P3): "... I did not suspect that the person who infected my child was the one who cared for and was with my child every day'."

Mothers of school-age children (P4, 5, 6, 7, and 8):' I do not know, there are many children coughing at school. There are no tests available for children with persistent cough.

Meanwhile, one adolescent stated, " I do not know. However, I often hang out with my friends, especially in the afternoons and evenings. Coffee was drank from the same cup.

A new adult patient said,' I have experience working in Kalimantan for three years at a timber company. Perhaps, there are other workers who have been sick but have not sought treatment. I returned home (to Blitar) because of persistent cough. My neighbor in Kalimantan has been diagnosed with tuberculosis, and I often communicate with him in my spare time."

Follow-up questions aimed to identify the symptoms experienced and the efforts taken by the families of individuals infected with tuberculosis. Information obtained from participants

Mother of an infant (P1): "… He was still a baby and had already had a cough. The family advised him to visit the community health center for a checkup. After being interviewed by a health worker, a sputum test was recommended and the result was positive for tuberculosis. …"

Mother of 2-to 3-year-old children (P2 and P3): "… I thought my child was underweight, even though he was getting enough food and nutrition, but he sometimes coughed. I took the initiative to visit the community health center and was advised to undergo a sputum test. Two days after the sputum test, I was told the result was positive for tuberculosis. Well, what else could I do? I just gave up and finally sought treatment, and they said it would take at least 6 months. …"

Mother of school-aged children (P4, 5, 6, 7, and 8): "… My child looked thin and often coughed in the afternoon. A sputum test was initiated and the patient was diagnosed with tuberculosis. …"

Next, they were asked about their family's efforts to identify the source of tuberculosis transmission. The information obtained is outlined as follows:

Mother of an infant (P1): "… My husband and I underwent a sputum test and the results were negative. I was confused and asked my own questions: Who infected me? Did I get it from someone who visited my baby after returning from childbirth? …"

Mother of a 2–3-year-old child (P2 and P3): "… I thought maybe my baby's caregiver infected me. After being examined by the Community Health Center, it turned out that my child's grandmother was a tuberculosis patient who had been declared cured of tuberculosis treatment long ago. …"

Mother of a school-aged child (P4, 5, 6, 7, and 8): "… I thought maybe I got it from my child's school friends because there were no other patients in my family or neighborhood who were suspected of having tuberculosis. I told the Community Health Center health workers to test my children's friends at school. …"

Information from participants about efforts made by the family other than treatment from the Community Health Center was as follows:

The mother of an infant (P1): "… I restrict others from seeing my baby, especially if they want to hold him. He continues to breastfeed to ensure that his nutritional needs are met and I have not given him any additional food. I wear a mask at all times, especially near my baby, to avoid infection. …"

The mother of a 2–3-year-old child (P2 and P3): "… My babysitter has been dismissed. I teach him to cover his cough with his hands and wash his hands immediately. I have improved his nutrition and have received milk from the community health center. However, my child always refused to wear a mask when going out because he saw his friends not wearing masks. …"

Mothers of school-age children (P4, 5, 6, 7, and 8): "… Before going to school, my child must have breakfast, bring food from home, is not given pocket money to prevent him from buying snacks, and wear a mask while at school. I am disappointed with my child's school; they say that the community health center staff are not allowed to screen for tuberculosis. At home, my child follows the advice of his parents. …"

Teenager: "… I have to take responsibility for myself. I am embarrassed if many people know, so I take my medication regularly, rarely hang out with my peers, often wear a mask, especially when I am with others, and eat a healthy diet."

Adult patient:' I was shocked to be diagnosed with tuberculosis. What else can I do? I will take my medication diligently and take care of myself, so I do not infect others."

Based on the results of the data collection, the following themes of transmission can be formulated: (1) children are at-risk individuals, (2) transmission occurs due to the intensity of contact, and (3) the individual who is infected is unaware. Themes related to the symptoms felt by the sufferer are as follows: (1) the family feels changes and (2) confirms with the health workers. Themes related to the source of transmission were unexpectedly found to be those close to them. Themes related to the efforts made are: (1) treatment according to recommendations, (2) other actions to maintain fitness, and (3) protecting oneself from infecting others.

DISCUSSION

Table 1 shows the high incidence of tuberculosis in children, and one new patient was diagnosed with tuberculosis when he was 18 days old. In line with the global confirmed incidence of tuberculosis in children in 2023, approximately 12% of cases occur in children aged 0-14 years, and the majority (88%) occur in adults aged 15 years and above. Although the proportion of tuberculosis cases in children is smaller, it is significant, and the case notification rate is lower than in adults due to challenges in diagnosis and under-reporting (Tobin & Tristram, 2024; WHO, 2024). In Indonesia, approximately 18% of children and 82% of adults suffer from tuberculosis. However, under-reporting of tuberculosis in children in Indonesia remains high. This is due to regional variability in Indonesia, which has fluctuated in recent years. Tuberculosis in children is caused by exposure of households to adult TB cases (Irnawati et al., 2021; Tobing et al., 2023).

The high prevalence of tuberculosis infection in children in Indonesia is attributed to adult tuberculosis sufferers frequently spitting in random places, housing that does not meet health requirements, inadequate prevention efforts, and unhealthy behavior among tuberculosis sufferers. Parents often go unnoticed due to the risk of transmission to infants and children. In Indonesia, visiting newborns is a tradition and culture, without individuals being aware of their tuberculosis. Furthermore, childcare tends to be carried out by individuals with close family ties and frequent visits, and those who have been declared cured assume that tuberculosis sufferers do not relapse. Nurses and health workers should provide health education to sufferers and their families. The goal is to prevent transmission as a result of the healthy behavior of sufferers and their families (Jaya et al., 2024; Majid et al., 2024).

The main factors causing the transmission of tuberculosis in children include (CDC, 2025b; Heemskerk et al., 2015; Khairunnisa, 2024; Setyoningrum et al., 2024; Siddalingaiah et al., 2023; Walakandou et al., 2010), namely (1) Close contact with adults suffering from active pulmonary TB whose sputum smear results are positive and who live in the same house, because adults are the main source of infection for children; (2) Exposure to smoke, including tobacco smoke, which increases susceptibility to infection due to respiratory system disorders; (3) Excessive and high population density in residential areas, which facilitates the spread of TB bacilli through the air, thereby increasing the risk of transmission; (4) Poor household conditions, low socioeconomic status, poverty, and poor ventilation; (5) Malnutrition in children which weakens the immune system and makes them susceptible to tuberculosis infection; (6) Age under 5 years, is a significant risk factor because the immune system is not yet mature so that children are more susceptible to infection and development into active tuberculosis sufferers; (7) Not receiving BCG vaccination; and (Debulpaep et al., 2020) Poor air circulation and limited ventilation which facilitates the spread of infectious droplets containing mycobacterium tuberculosis. These factors collectively contribute to the increased vulnerability of children to tuberculosis transmission, particularly in environments with active adult cases and less supportive living conditions. Early interventions to prevent transmission to children include improving home ventilation and reducing overcrowding.

The trend of transmission among children and adults has not changed, and the number of new cases is increasing. Contributing factors include patients' lack of awareness that they can infect others as well as unhealthy behaviors by families in managing the environment in which they live. Nurses at community health centers, as educators, should increase their efforts to promote healthy living for patients and their families. The goal is to prevent further drastic transmission.

Globally, tuberculosis affects more men than women (Table 1). Globally, the number of adult male tuberculosis sufferers is around 56-57% and that of adult females is around 33-34%, with the remainder being children. The ratio of male to female tuberculosis incidence varies by age group and region but is generally higher in men. Men also tend to have more severe diseases and poorer treatment outcomes (Humayun et al., 2022; Peer et al., 2023; TB-DIAH, 2021; WHO, 2025b).

A tuberculosis transmitter is a positive patient under treatment, a patient who is not under treatment, or a patient who has recovered from treatment, where the patient's condition is not recognized by the new patient or his family. Transmission from patients is caused by saliva droplets from coughing or talking (CDC, 2025a; Tobin & Tristram, 2024). It is also caused by the bad habits of tuberculosis sufferers, namely not covering their mouths when coughing or talking (Kalsum et al., 2024), even though every tuberculosis patient has been given health education by health workers at the beginning of treatment. Even as emphasized by the WHO, education must discuss tuberculosis as a disease, its treatment, and the services received by patients. The education provided several times during treatment aims to remind patients and provide specific information regarding changes in treatment that may occur. In education, counselling is also provided regarding (1) the right to be treated with respect and dignity, (2) the right to information, and (3) the right to confidentiality(WHO, 2025a). Transmission is also supported by individual perceptions that anyone who does not use personal protective, such as masks, is considered healthy and not at risk of transmitting the disease.

The potential dangers faced by new tuberculosis sufferers include stigma and negative perceptions of the community, which can impact their psychological well-being and behavior in seeking treatment. Stigma can lead to social isolation, discrimination in employment and social interactions, and feelings of shame and awkwardness. Stigma experienced by new sufferers can cause them to hide their illness, worsen their condition, delay treatment, and delay diagnosis owing to fear of discrimination. Stigma in women and young people can worsen the condition of new tuberculosis sufferers (Cahyani & Dew, 2025; Machavariani et al., 2023; Mohammedhussein et al., 2020; Sekandi et al., 2024; Suprajitno et al., 2015; Thabit et al., 2025; Yadav, 2024). Efforts by new sufferers and their families are crucial to reducing the impact of stigma by improving the

early detection of transmission risks, treatment adherence, and reintegrating sufferers into their daily communities through healthy behaviors.

The potential implications of the increase in tuberculosis cases include increased healthcare costs, an increase in the number of people at risk, a decline in the Human Development Index, and a decline in the population's well-being. To prevent these implications, a Pentahelix approach is needed, comprising Government, Academia, the Business, the Community, and the Media, all of which, in accordance with their respective roles and functions, promote the prevention of tuberculosis transmission. Healthy behaviors that need to be practiced by the community of sufferers include wearing masks, avoiding spitting carelessly, covering the mouth when coughing, and maintaining adequate nutrition. Healthy behaviors are preventive measures.

An identifiable limitation of this study is that new tuberculosis patients were reluctant to identify their transmitters, as both infected and healthy individuals exhibited similar behaviors; they did not cover their mouths when coughing and sharing their mouths with others in everyday conversations. They maintained their respect and family ties. Furthermore, this study was conducted at only one Puskesma site because of the lengthy time required for in-depth interviews. Participants also avoided community stigma during their participation.

The research was conducted over a wide area and compared between regions. We also added predictor variables that influenced tuberculosis transmission.

CONCLUSION

Tuberculosis can occur at any age (infants, children, and adults). Tuberculosis is easily transmitted to individuals living in the same household as the infected person through various means, including children who are highly susceptible. The easiest mode of transmission is household contact with an infected person, which can be transmitted through droplets, inhaled air containing Mycobacterium tuberculosis, and high-intensity contact between previously and newly infected individuals.

Healthy behaviors are crucial for tuberculosis patients, everyone living in the same household, and the family, including adequate nutrition and preventive measures from infancy.

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