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Physical Condition of Home Sanitation in Plumonary TB Patients in the Mulyorejo Community Health Center Work Area, Surabaya City in 2025

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ABSTRACT

Background In the past three years, the number of pulmonary TB cases at Mulyorejo Public Health Center in Surabaya City had increased. The physical condition of the houses was as follows: lighting was less than 60 lux, temperature exceeded 30ºC, humidity was above 60% Rh, and ventilation was less than 10% of the floor area. **Object:** This study aimed to determine the physical sanitation conditions of houses of pulmonary TB patients in the working area of Mulyorejo Health Center, Surabaya City, in 2025. **Methods:** This study used an observational descriptive method with a case study approach. **Results:** The field findings revealed that the physical sanitation conditions of the houses of pulmonary TB patients in the Mulyorejo Health Center area were mostly categorized as poor (96.4%). The majority of the houses did not meet the required standards in several aspects: inadequate ventilation area (75%), insufficient ligh ting (78.5%), high temperature (64.2%), excessive humidity (53.5%), and overcrowding (57.1%). **Conclusion:** Most of the physical sanitation conditions in the houses of pulmonary TB patients in the Mulyorejo Health Center area did not meet the standards. It was recommended that residents develop the habit of opening ventilation or windows every morning. Households with high occupancy density were advised to rearrange sleeping spaces, and TB patients were encouraged to maintain distance from other family members.

Keywords: Pulmonary TB, Physical Sanitation of Homes

BACKGROUND

Pulmonary tuberculosis is an environmentally-based disease caused by the bacterium Mycobacterium tuberculosis, transmitted through coughing or sneezing. These bacteria spread through the air when a person with pulmonary TB coughs, sneezes, or spits, and those around them can inhale them. If the initial sputum specimen test is AFB positive, the patient is considered AFB positive. If the result is AFB negative, the patient is considered AFB negative (Waworuntu et al., 2017).

According to the 2023 East Java Provincial Health Profile, with 87,048 cases detected, 93% of pulmonary TB cases occurred in East Java. This increase in pulmonary TB case detection compared to 2022, which recorded 78,799 cases. The three regencies/cities with the highest number of pulmonary TB cases were Surabaya City (10,987 cases), Sidoarjo Regency (6,170 cases), and Jember Regency (5,603 cases). In 2023, Surabaya City ranked first in terms of pulmonary TB case detection (Asiva Noor Rachmayani, 2015).

Data obtained from the Mulyorejo Community Health Center indicates an increase in pulmonary TB cases in 2022, 2023, and 2024. In 2022, there were 17 pulmonary TB patients. In 2023, the

number of pulmonary TB patients increased to 23, while in 2024, the number of pulmonary TB patients increased to 28 (Mulyorejo Community Health Center Profile, 2024). Researchers conducted a preliminary survey in the Mulyorejo Community Health Center work area, which found that most of the homes of pulmonary TB patients did not meet health standards, such as ventilation of less than 10% of the floor area, natural lighting <60 lux, temperature >30ºC, humidity >60% Rh, and a density that did not meet the minimum standard of 9 m² per person. Furthermore, findings regarding pulmonary TB patients who were still not receiving regular treatment. TB transmission can occur if a person does not receive proper treatment. This can occur through the air from a person with TB to another person (Lam Ali et al., 2023).

Home conditions that potentially contribute to the transmission of pulmonary TB are those that allow the TB bacteria to survive longer, namely homes with insufficient sunlight, air circulation, and humidity (Rahmania Mahgfira, 2024). Factors such as indoor humidity, lack of sunlight, and poor ventilation allow these bacteria to survive and spread through the air. High occupancy density in small bedrooms occupied by more than two people and poor air quality due to inadequate ventilation further increase the risk of transmission (Fitri et al., 2022).

According to John Gordon's Triangular Theory in Najiyah (2022), a disease occurs due to an imbalance between the agent, host, and environment. Disease-causing agents can emerge through environments that support disease development. When these agents enter the host's body, they cause disease. In the epidemiological triangle, host factors encompass all human factors that influence the occurrence of a disease, including race, socioeconomic status, marital status, ancestry, and pre-existing illnesses (Indasah, 2015).

Researchers highlighted several previous studies used as references. Based on research by Putra (2024), there is a relationship between pulmonary TB cases at the Kedungkandang Community Health Center in Malang City and ventilation, lighting, humidity, and residential density. High humidity and room temperature can increase the risk of pulmonary TB transmission because they allow the Mycobacterium tuberculosis bacteria to thrive and survive. Furthermore, minimal exposure to sunlight and poor ventilation can increase the risk of pulmonary TB transmission, as droplets emitted by sufferers spread through the air. Furthermore, residential density can impact residents. A family member with pulmonary TB can easily transmit the disease to other family members.

Research by Rosiana (2020) showed that ventilation, lighting, temperature, and humidity are components associated with pulmonary TB. Lack of ventilation can reduce indoor oxygen levels and increase humidity, while lack of lighting can contribute to the transmission of pulmonary TB. Furthermore, high humidity and temperature can accelerate the growth of Mycobacterium tuberculosis bacteria. Furthermore, windows that are not regularly opened can contribute to humidity in the home (Putri et al., 2022).

The purpose of this study was to determine the physical sanitation conditions of homes for pulmonary TB patients in the Mulyorejo Community Health Center, Surabaya City, in 2025.

RESEARCH METHODS

The research methodology used was an observational approach with a descriptive approach and a case study design. Data were acquired through empirical measurement techniques and direct observation of the physical attributes of residential sanitation. The target population consisted of 28 residential units housing pulmonary TB patients, which

served as the total sample. Investigative variables included ventilation, temperature, humidity, illumination, and occupant density. The obtained data were processed using a descriptive approach to delineate the spatial sanitation reality of residential areas housing pulmonary TB patients in the area. This study used hygrometers, luxmeters, measuring tapes, interviews, and observation sheets.

RESULTS AND DISCUSSION

The results of the physical sanitation assessment of homes for pulmonary TB patients include ventilation, lighting, temperature, humidity, and occupancy density. The results can be seen in the following tables:

Ventilation

The study showed that in 2025, most of the 28 homes of pulmonary TB patients in the Mulyorejo Community Health Center work area did not meet the ventilation requirements. The results can be seen in

Table 1.

Ventilation for homes of pulmonary tuberculosis patients in the Mulyorejo Community Health Center Work

No	Category	House	Percentage
1.	Eligle	7	25%
2.	No Eligle	21	75%
	Total	28	100%

Based on Table 1, most of the ventilation conditions did not meet the required standards (75%) out of 21 houses. The average measurement of inadequate ventilation ranged between 0.4% and 9.6%. According to the Regulation of the Minister of Health (Permenkes) No. 2 of 2023, the standard ventilation area should be 10% of the floor area. The research results show that the ventilation area is less than 10% of the required standard. This is because some houses have windows but they are rarely or never opened, preventing fresh air from entering the house, especially in the bedrooms. This condition allows *Mycobacterium tuberculosis* bacteria to survive and thrive. Moreover, closed windows also block sunlight, which acts as a natural disinfectant against bacteria.

This finding is supported by Rosiana (2020), who stated that houses with ventilation covering less than 10% of the floor area are a risk factor for pulmonary tuberculosis (TB). Similarly, Fitri (2022) found a correlation between ventilation area and the incidence of pulmonary TB. Such conditions cause indoor humidity to become stagnant, creating an environment conducive to the growth of *Mycobacterium tuberculosis* (Gulo et al., 2021). Inadequate ventilation increases the risk of TB transmission among household members, especially when there is no proper air exchange within the room (Rahmania Mahgfira, 2024). Therefore, it is recommended that houses be equipped with adequate ventilation to ensure air circulation, allowing indoor air to be replaced with fresh air and preventing dampness and stuffiness.

Lighting

The study results show that the majority of the 28 homes of TB patients in the Mulyorejo Community Health Center work area did not meet stand ards in 2025. The results are shown in Table 2.

Table 2.

Lihting for homes of pulmonary tuberculosis patients in the Mulyorejo Community Health Center Work Area in 2025

No	Category	House	Percentage
1.	Eligle	6	21,4%
2.	No Eligle	22	78,5%
	Total	28	100%

Based on Table 2, most of the lighting conditions did not meet the required standards (78.5%) out of 22 houses. The measurement of inadequate lighting ranged from 14.4 lux to 52 lux. This is because the lighting level, especially in the bedrooms of TB patients, was below the minimum threshold set by the Regulation of the Minister of Health (Permenkes) No. 2 of 2023, which is 60 lux. It was also found that several patients' rooms had no windows or glass tiles, causing the rooms to become completely dark when the lights were turned off due to the absence of natural lighting. In addition, some houses had windows that were never opened, preventing natural light from entering. The close proximity of houses, often built side by side, also blocked sunlight due to walls and roofs, resulting in insufficient lighting conditions.

This finding is supported by the study of Zuraidah & Ali (2020), which stated that natural lighting is one of the risk factors for pulmonary tuberculosis (TB). Another study conducted by Fitri (2022) also found a correlation between lighting and the incidence of pulmonary TB. Poor lighting conditions can worsen the health of TB patients. The risk of contracting pulmonary TB increases when there is no lighting or no access to sunlight (Pralambang & Setiawan, 2021). Sunlight plays a very important role in killing *Mycobacterium tuberculosis* bacteria. Houses that are not exposed to sunlight are more susceptible to TB bacteria, which can survive and die when exposed to sunlight; the risk of TB transmission is three to seven times higher in such houses compared to those that receive sunlight (Hidayatullah et al., 2021). Therefore, it is recommended that houses install glass roof tiles or make it a habit to open windows every morning, as this is an important factor in preventing pulmonary TB (Siregar et al., 2023).

Temprature

The results of the study indicate that the majority of the 28 homes of TB patients in the Mulyorejo Community Health Center's work area did not meet the required temperature in 2025. The results are shown in Table 3.

Table 3.

Temprature for homes of pulmonary tuberculosis patients in the Mulyorejo Community Health Center Work Area in 2025

No	Category	House	Percentage
1.	Eligle	10	35,7%
2.	No Eligle	18	64,2%

No	Category	House	Percentage
	Total	28	100%

Based on Table 3, most of the indoor temperatures in the houses did not meet the required standards (64.2%) out of 18 houses, showing results exceeding 30ºC. This is due to inadequate physical conditions of the houses, such as the absence of ventilation and windows that are rarely opened, resulting in poor air circulation indoors. Consequently, the indoor temperature exceeded the standard set by the Regulation of the Minister of Health (Permenkes) No. 2 of 2023, which specifies an acceptable temperature range of 18ºC–30ºC. According to Gould and Brooker, as cited in Kenedyanti & Sulistyorini (2020), *Mycobacterium tuberculosis* bacteria have an optimal temperature range that allows them to reproduce rapidly, growing best between 31ºC and 37ºC. The bacteria can survive in the air for several months and grow slowly over a period of 2–60 days (Fitri et al., 2022).

This finding is supported by Zulaikhah (2020), who stated that indoor temperatures above 30ºC pose a greater risk for the occurrence of pulmonary tuberculosis (TB). Another study by Fitri (2022) also found a correlation between temperature and pulmonary TB. Indoor temperatures above 30ºC tend to increase due to poor air circulation, which contributes to heat buildup. In such environments, *Mycobacterium tuberculosis* bacteria can multiply, and when inhaled by household members, they can lead to TB transmission (Siregar et al., 2023). Therefore, it is recommended that houses be equipped with ventilation or windows, and that residents develop the habit of opening windows in the morning to allow natural light and air to enter the rooms—especially bedrooms— to help maintain a comfortable and healthy indoor temperature.

Humidity

The results of the study indicate that the humidity levels of most of the 28 homes of TB patients in the Mulyorejo Community Health Center work area did not meet the standards in 2025. The results are shown in Table 4.

Table 4.

Humidity for Homes of Pulmonary Tuberculosis Patients in the Mulyorejo Community Health Center Work Area in 2025

No	Category	House	Percentage
1.	Eligle	13	46,4%
2.	No Eligle	15	53,5%
	Total	28	100%

Based on Table 4, most of the humidity levels did not meet the required standards (53.5%) out of 15 houses, with measurements ranging between 60.5% and 75% relative humidity (Rh). This occurred because the houses lacked adequate ventilation, and the windows were rarely opened, resulting in poor air circulation and limited access to natural light, especially in the bedrooms of TB patients. As a result, indoor humidity levels exceeded 60% Rh. Such environments have the potential to become high-risk areas for disease transmission. According to Bawole, as cited

in Kenedyanti & Sulistyorini (2020), humidity supports the growth of bacteria such as *Mycobacterium tuberculosis*. Due to the lack of sunlight entering the house, which makes the environment dark and damp, TB bacteria can survive indoors for days or even months, thereby increasing the risk of pulmonary tuberculosis (Kenedyanti & Sulistyorini, 2020).

This finding is supported by Putri (2022), who stated that houses with high humidity levels have a greater risk of TB transmission. Another study by Fitri (2022) also found that pulmonary TB is associated with humidity. Such conditions increase the risk of TB transmission, as *Mycobacterium tuberculosis* thrives in dark and humid environments, which promotes the spread of the disease (Siregar et al., 2023). In addition, houses with many occupants can negatively affect indoor air quality because moisture from breathing increases humidity levels as the number of people in the room rises. Such damp conditions provide an ideal environment for bacterial growth, including *Mycobacterium tuberculosis* (Romadhan et al., 2020).

Therefore, it is recommended that houses be equipped with proper ventilation or windows, and that residents develop the habit of opening windows in the morning to allow natural light and fresh air to enter the rooms—especially bedrooms—in order to maintain optimal humidity levels and prevent the spread of pulmonary tuberculosis.

Residential Density

The study results show that in 2025, most of the 28 homes of TB patients in the Mulyorejo Community Health Center work area did not meet the required density requirements. The results are shown in Table 5.

Table 5.

Residential Density for Homes of Pulmonary Tuberculosis Patients in the Mulyorejo Community Health Center Work Area in 2025

No	Category	House	Percentage
1.	Eligle	12	42,8%
2.	No Eligle	16	57,1%
	Total	28	100%

Based on Table 5, most of the housing density conditions did not meet the required standards (57.1%) out of 16 houses, with measurements ranging between 3 m² and 8.3 m² per person. According to the Regulation of the Minister of Health (Permenkes) No. 2 of 2023, the standard for residential density based on basic human activity inside a house is 9 m² per person. The results of this study show that the housing density in most cases was below the required 9 m² standard. This is because many houses of pulmonary tuberculosis (TB) patients are located in narrow alleys with closely built structures, often in rented houses or boarding rooms (*kos-kosan*). Such cramped and adjacent housing conditions limit movement and result in poor air circulation. The situation is worsened by a large number of occupants living in a single room, which decreases oxygen levels and increases indoor humidity.

This finding is supported by Putri (2022), who stated that housing density that does not meet the standard increases the risk of pulmonary TB transmission. Another study by Fitri (2022) also found a correlation between housing density and the risk of developing pulmonary TB.

Houses with high occupancy density are more likely to experience transmission. If several untreated TB patients live in the same house, other family members are at greater risk of infection. In homes where there are many occupants, the amount of oxygen in the room decreases as the number of residents increases (Oktavia et al., 2020). Overcrowded living conditions that do not meet health standards can indirectly contribute to the spread of pulmonary TB.

Furthermore, high housing density increases the likelihood of direct contact between TB patients and other family members, leading to faster transmission of the disease (Romadhan et al., 2020). Therefore, it is recommended that TB patients always wear masks, avoid spitting carelessly, and maintain a safe distance from other household members to prevent transmission within the home. Residents living in crowded conditions should also rearrange sleeping spaces and ensure that TB patients maintain a safe distance from others in the family to reduce the risk of infection.

Physical Sanitation Conditions of Homes of Pulmonary TB Patients

Research results show that 28 homes of pulmonary TB patients in the Mulyorejo Community Health Center work area were in the poor category in 2025. The results are shown in Table 6.

Table 6.

Physical sanitation conditions of homes of pulmonary TB patients for homes of pulmonary tuberculosis patients in the Mulyorejo Community Health Center work area in 2025

No	Category	House	Percentage
1.	Good	0	0%
2.	Enough	1	3,5%
3	Less	27	96,4%
	Total	28	100%

Based on Table 6, the physical sanitation conditions of houses belonging to pulmonary tuberculosis (TB) patients in the working area of Mulyorejo Health Center fall into the "poor" category. This is because most of the physical conditions of the houses did not meet health standards. According to John Gordon's epidemiological triangle theory, this imbalance between the agent, host, and environment contributes to disease occurrence. The substandard physical conditions of the houses include ventilation areas of less than 10% of the floor space, and the behavior of occupants who rarely or never open windows or vents, resulting in indoor temperatures exceeding 30ºC and humidity levels above 60% Rh.

The lack of natural lighting inside the house—particularly in the bedrooms of TB patients—is also caused by this behavior of keeping windows and vents closed. In addition, the housing density exceeds the standard of 9 m² per person, as many homes are small and occupied by more than two people, leading to overcrowding. Such conditions promote the growth of *Mycobacterium tuberculosis* bacteria and increase the risk of pulmonary TB transmission, allowing the disease to spread more easily and rapidly.

This finding is supported by Rahmania (2024), who reported a

relationship between the occurrence of pulmonary TB cases and the physical sanitation conditions of houses. Inadequate physical housing conditions—such as insufficient ventilation area, poor lighting, high temperature, high humidity, and overcrowding—can encourage the growth of *Mycobacterium tuberculosis* and raise the risk of TB transmission. Houses categorized as "poor" can negatively affect the health status of TB patients, worsening their condition.

Therefore, it is recommended that household members develop awareness and good habits, such as opening windows and ventilation every morning to maintain optimal indoor temperature and humidity. Allowing natural light to enter the house can also help prevent the transmission of pulmonary tuberculosis.

CONCLUSION

Based on the results of a study of 28 homes of pulmonary TB patients in the Mulyorejo Community Health Center (Puskesmas) in Surabaya City in 2025, it was found that the physical sanitation conditions of most homes did not meet standards and were categorized as inadequate. This finding indicates that most homes of pulmonary TB patients in the area are at high risk of spreading pulmonary TB due to unhealthy environmental conditions. Therefore, the community is encouraged to make it a habit to regularly open the vents and windows in their homes in the morning, improve the physical condition of their homes by installing vents or glass roof tiles, and residents of homes with high occupancy rates should rearrange the use of bedrooms, and TB patients should maintain distance from other family members.

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