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MORALITY BEFORE KNOWLEDGE

Integration of clean and healthy living behavior and home environment: A holistic approach to controlling pulmonary tuberculosis

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ABSTRACT

Background: Pulmonary tuberculosis (TB) is a contagious infectious disease that remains a major public health problem, particularly in developing countries such as Indonesia. One of the contributing factors to the high transmission rate of pulmonary TB is the low implementation of Clean and Healthy Living Behavior, as well as poor household environmental conditions that do not meet health standards. This study aimed to determine the correlation between clean and healthy living behavior and the condition of the home environment among pulmonary TB patients at Gattareng Public Health Center, Bulukumba Regency. **Methods:** This research employed a descriptive analytic design with a cross-sectional approach, involving 38 respondents selected through simple random sampling from a total population of 42 patients. Data were collected using a clean and healthy living behavior questionnaire adapted from Alpul Laely and a healthy house assessment instrument based on criteria from the Indonesian Ministry of Health. Data were analyzed using univariate and bivariate analysis with the Spearman Rho test at a significance level of $\alpha = 0.05$. **Findings:** The findings showed that most TB patients had a moderate level of clean and healthy living behavior (39.2%) and lived in unhealthy homes (57.9%). The statistical test revealed a strong correlation between clean and healthy living behavior and the condition of the home environment among TB patients ($\rho = 0.01$; $r = 0.772$). **Conclusion:** There is a significant relationship between clean and healthy living behavior and the condition of the home environment of pulmonary TB patients. Improving clean and healthy living behavior and housing conditions plays a crucial role in TB control efforts within the community. **Novelty/Originality of this article:** The novelty of this study lies in linking clean and healthy living behavior with home environment conditions among pulmonary TB patients.

KEYWORDS: pulmonary tuberculosis; clean and healthy living behavior; home environment.

1. Introduction

Health, in essence, is a fundamental human right that must be fulfilled in order for individuals to live productively and prosperously. According to Law Number 36 of 2009 concerning Health, health is defined as a state of physical, mental, spiritual, and social well-being that enables every individual to live productively both socially and economically (Yani et al., 2022). This definition aligns with the concept introduced by the World Health Organization (WHO), which emphasizes that health is not merely the absence of disease or infirmity, but rather a state of complete well-being. Therefore, when discussing communicable diseases such as pulmonary tuberculosis, health should not only be viewed from a medical standpoint but also in relation to environmental, behavioral, and social

factors. Thus, examining the relationship between Clean and Healthy Living Behavior and household environmental conditions becomes highly relevant, as both aspects are important indicators in achieving comprehensive public health (Mardianti et al., 2020).

Health is a basic necessity that cannot be separated from human life. Every individual aspires to a healthy condition because health serves as the main capital to carry out daily activities productively. Being healthy does not only mean freedom from illness, but also encompasses a complete state of physical, mental, and social well-being, enabling individuals to function optimally within society. From the perspective of national development, health serves as a crucial foundation for producing quality, competitive, and productive human resources that can support the progress of a nation. For this reason, efforts to improve public health always become a top priority in development agendas at global, national, and regional levels. However, despite the implementation of various health programs, Indonesia continues to face a high burden of communicable diseases, one of which is pulmonary tuberculosis (Seo et al., 2024).

Pulmonary tuberculosis is one of the most common infectious diseases in developing countries, including Indonesia. This disease can affect both children and adults. One of the contributing factors to the persistently high prevalence of pulmonary TB is the low level of Clean and Healthy Living Behavior among communities. Furthermore, environmental sanitation, particularly in residential areas, plays a significant role in either supporting or hindering the transmission of this disease. The condition of the home has a substantial impact on the health status of its occupants (Martinez et al., 2025). Poor sanitation can create conditions conducive to the survival of Mycobacterium tuberculosis, which is known to remain airborne for 1–2 hours and, in some cases, survive for several days or even weeks (Kininmonth et al., 2021).

The transmission of tuberculosis occurs through the air containing TB bacilli in droplets of saliva or sputum expelled by pulmonary TB patients when coughing or sneezing. Transmission happens when someone inhales air contaminated with TB bacilli, although several other factors or variables may also play a role in the incidence of pulmonary TB (Prasetya, 2020). The level of infectiousness of a patient is determined by the number of bacilli released from the lung (Kininmonth et al., 2022). The higher the positivity degree of sputum examination results, the more contagious the patient is. If sputum test results are negative (with no TB bacilli detected), the patient is considered non-infectious. The likelihood of an individual becoming infected with pulmonary TB depends on the concentration of droplets in the air and the length of exposure (Jones-López et al., 2013).

The World Health Organization reported that the estimated number of people diagnosed with pulmonary tuberculosis in 2024 reached 10.6 million cases globally, representing an increase of approximately 600,000 cases compared to 2020, when it was estimated at 10 million cases. Of the 10.6 million cases, 6.4 million (60.3%) individuals were reported and undergoing treatment, while 4.2 million (39.7%) others had not yet been detected, diagnosed, or reported (Nathavitharana et al., 2025). A preliminary study conducted on March 15, 2023, identified a total of 42 pulmonary TB patients at Gattareng Community Health Center in Bulukumba District. From interviews with 10 patients, it was found that 7 respondents did not cover their mouths when coughing, lacked a special container for sputum disposal, did not open windows and doors daily, did not regularly sun-dry bedding, and disposed of household waste using open sacks without covers. Meanwhile, 3 respondents reported covering their mouths when coughing, separating their clothing from that of other family members, exercising, and opening windows daily. These findings indicate that some pulmonary TB patients in Gattareng still maintain unhygienic habits, such as neglecting household cleanliness (Mardianti et al., 2020).

Tuberculosis can affect anyone—young or old, male or female, rich or poor—regardless of location. The most recent global TB report by World Health Organization (2019) still placed Indonesia as the fifth highest contributor to TB cases worldwide, with an estimated 429,000 new cases and 101,000 deaths annually (Ministry of Health, Republic of Indonesia, 2011). Tuberculosis remains one of the deadliest infectious diseases in the world. Each year, World Tuberculosis Day is observed to raise public awareness of the devastating health,

social, and economic consequences of TB, and to strengthen efforts to end the global TB epidemic. This commemoration marks the date in 1882 when Dr. Robert Koch announced the discovery of the bacterium that causes TB, paving the way for diagnosis and treatment. According to WHO, every day more than 4,100 people lose their lives to TB, while 28,000 others fall ill with this preventable and curable disease. Global efforts to combat TB have saved an estimated 66 million lives since 2000. However, the COVID-19 pandemic has reversed years of progress in the fight against TB. For the first time in over a decade, TB mortality increased in 2020 and continues to rise (Zaenab et al., 2025).

The transmission of pulmonary TB is closely linked to individual behaviors and environmental conditions. Clean and Healthy Living Behavior at the household level is a key strategy in preventing TB transmission. Clean and Healthy Living Behavior practices include covering the mouth when coughing, maintaining household cleanliness, practicing regular handwashing, disposing of sputum properly, and utilizing health facilities appropriately. Pulmonary TB patients who do not adopt good Clean and Healthy Living Behavior practices may serve as sources of infection for family members and surrounding communities. In addition to behavioral factors, the condition of the home environment significantly influences TB transmission. Houses with poor ventilation, inadequate lighting, high occupancy density, and poor sanitation facilitate the spread of TB bacteria. Unhealthy home environments thus create ideal conditions for the development of infectious diseases, including pulmonary TB (Emery et al., 2023).

The environment plays a crucial role in the life cycle of living organisms, and certain environmental factors directly influence the spread of tuberculosis. These include lighting, the physical condition of the house, temperature, flooring, wall humidity, and occupancy density (Budi et al., 2018). A healthy house is defined as a dwelling that meets health standards, encompassing structural components, sanitation facilities, and hygienic behaviors. This includes having a proper latrine, waste disposal facilities, clean water supply, wastewater drainage, adequate ventilation, appropriate occupancy density, and non-earthen floors. Environmental factors as risk determinants of tuberculosis transmission involve not only the physical condition of the house but also personal hygiene practices and Clean and Healthy Living Behavior applied within the household (Asfiya et al., 2021). Health interventions through the prevention of morbidity and mortality can be influenced, both directly and indirectly, by the implementation of the Clean and Healthy Living Behavior program. This program itself serves as an educational effort for individuals, families, groups, and communities to improve knowledge, attitudes, and behaviors related to healthy and hygienic living (Majuntu et al., 2018).

An unhealthy house has negative impacts on its occupants. Environmental and structural aspects of housing—such as ventilation, occupancy density, type of flooring, lighting, and humidity—that do not meet health standards may serve as risk factors for the transmission of various diseases, including pulmonary tuberculosis. One way to prevent pulmonary TB is by practicing Clean and Healthy Living Behavior, which includes maintaining personal and environmental hygiene, consuming nutritious food, allowing sunlight to enter the home, and avoiding exposure to infectious droplets from coughing. The condition of the household environment can significantly affect the incidence of tuberculosis. Poor housing conditions, such as inadequate ventilation, insufficient indoor lighting, overcrowded living spaces, and substandard building materials, increase the likelihood of TB transmission. In addition to housing conditions, the incidence of tuberculosis is also influenced by the physical, biological, and social environment. Poor quality in any of these aspects can lower health status and heighten the risk of TB occurrence (Mendelsohn et al., 2025).

According to the technical guidelines for assessing healthy housing, as stated in the Decree of the Minister of Health of the Republic of Indonesia No. 829/Menkes/SK/VII/1999, housing conditions are assessed based on several main components related to the health of its occupants. These components include: ceilings that must be sufficiently high, flat, leak-free, and capable of preventing dust and heat; walls that are sturdy, dry, and free from cracks to prevent insect and rodent entry; and floors that are impermeable, dust-free, and

easy to clean. Windows are also a crucial criterion: bedroom windows must have openings equivalent to at least 5% of the floor area, and living room windows must be at least 10% of the floor area, to ensure proper air circulation and natural lighting. A healthy house must also have permanent ventilation equal to at least 10% of the floor area to maintain air exchange, a kitchen with an exhaust outlet to prevent cooking smoke from contaminating other rooms, and adequate lighting, both natural and artificial, with a minimum intensity of 60 lux. By meeting these criteria, a house can be considered habitable, healthy, and supportive of its occupants' quality of life (Asfiya et al., 2021).

The Clean and Healthy Living Behavior development program initiated by the government has been running for about 15 years; however, its success remains far from expectations. The 2023 SKI results revealed that only 38.7% of households had practiced Clean and Healthy Living Behavior, while the Strategic Plan (Renstra) of the Ministry of Health of the Republic of Indonesia had set a target of 70% of households practicing Clean and Healthy Living Behavior. This achievement also serves as one of the Ministry of Health's Key Performance Indicators (KPI). The causative agent of tuberculosis is Mycobacterium tuberculosis, which spreads through droplets expelled during coughing or sneezing by TB patients and can infect susceptible individuals. Mycobacterium tuberculosis is capable of attacking various organs in the body, such as the pleura, meninges, skin, lymph nodes, bones, joints, intestines, and the urogenital system, although the lungs are the most commonly affected organ. The risk of tuberculosis transmission depends on the degree of infectivity, duration of exposure, and an individual's immune status (Ministry of Health RI, 2016; Noerhalimah, 2020).

In South Sulawesi, in 2023, the estimated number of tuberculosis cases was 65,182, with 52,725 identified, 3,932 pediatric TB cases, and 1,261 deaths recorded. In 2024, the estimated TB cases decreased to 2,056, with 681 identified, 5 cases of drug-resistant tuberculosis (RO) or Multiple Drug Resistance (MDR), 27 pediatric TB cases, and 10 deaths. Case detection of tuberculosis in Bulukumba Regency in 2023 was 62 patients per 100,000 population. The population in the Batur Health Center area in 2023 was 26,621. The performance achievement of the pulmonary TB program at Gattareng Health Center in 2020 was as follows: 109 suspected TB cases were found, and 15 patients were confirmed smear-positive.

The study by Rosiana (2012) found a significant relationship between floor type, wall type, lighting intensity, humidity, and the incidence of pulmonary TB. However, there was no significant relationship between bedroom occupancy density, ventilation area, and TB incidence. There was a relationship between bedroom occupancy density, temperature, humidity, lighting, type of flooring, and type of walls with pulmonary TB incidence. Household Clean and Healthy Living Behavior and TB incidence in Surabaya, identified significant variables such as handwashing habits with soap and clean water, nutritional intake, smoking and alcohol consumption, habits of opening doors and windows, exercising, and adequate rest, all of which significantly influenced TB incidence in coastal areas of Surabaya (α = 5%). This was reinforced by Noerhalimah (2020), who reported a strong positive correlation between TB case detection and household Clean and Healthy Living Behavior (p = 0.01 < 0.05; r = 0.69). Their study also showed a positive correlation between TB case detection and healthy housing coverage. Several other studies explored variables such as sun-drying bedding, opening doors and windows daily for sunlight and ventilation, smoking and alcohol habits, regular exercise, nutritious diet, washing clothes with soap and clean water, using sanitary latrines, washing hands with clean water and soap, sufficient rest cycles, and separating eating and sleeping utensils. These studies demonstrated both significant and non-significant findings depending on the variables assessed.

There are five areas of Clean and Healthy Living Behavior implementation: Clean and Healthy Living Behavior in households, educational institutions, workplaces, public spaces, and healthcare facilities. The Ministry of Health's strategic plan emphasizes household Clean and Healthy Living Behavior as the primary indicator of Clean and Healthy Living Behavior implementation success. In the Gattareng Health Center working area, the TB incidence in 2024 included 42 patients, while in Batur 1 Health Center, there were 10

patients. Among these patients, some demonstrated awareness, willingness, and ability to practice clean and healthy behaviors, while others still lacked initiative in creating a healthy environment and facilities, both for themselves as TB patients and for their families.

Clean and Healthy Living Behavior is a critical factor in TB prevention. Clean and Healthy Living Behavior is a set of behaviors based on individual, family, and community awareness to maintain personal and environmental health. Its implementation in daily life includes simple yet impactful habits, such as washing hands with soap, covering the mouth when coughing, spitting into covered containers, keeping the house clean, opening windows for better ventilation, sun-drying bedding regularly, and consuming nutritious food. If consistently practiced, Clean and Healthy Living Behavior can significantly reduce the risk of TB transmission. However, the reality shows that the level of Clean and Healthy Living Behavior implementation in Indonesian households remains relatively low.

Various studies have shown a significant association between Clean and Healthy Living Behavior and the incidence of communicable diseases, including TB. Data from the Ministry of Health of Indonesia indicated that only a small proportion of households consistently practiced Clean and Healthy Living Behavior, which poses a major obstacle to TB control at the community level. For example, a study conducted in the Gattareng Health Center area found that, out of 10 TB patients interviewed, most did not practice Clean and Healthy Living Behavior properly. The majority did not cover their mouth when coughing, did not dispose of sputum in designated containers, rarely sun-dried bedding, and did not separate clothing or eating utensils from other family members. These findings demonstrate the low level of awareness and healthy practices among TB patients, ultimately increasing the potential for household and community transmission.

Besides behavior, housing conditions also play an important role in determining health outcomes. A healthy home should provide physical protection, psychological comfort, and support for a healthy social life. According to the Indonesian Ministry of Health guidelines, a healthy home must have adequate ventilation, sufficient lighting, impermeable flooring, permanent walls, and basic sanitation facilities. However, in reality, many houses in both rural and urban communities lack adequate ventilation, have non-permanent walls, earthen floors, and no sanitary latrines or closed waste disposal systems. Such conditions not only reduce quality of life but also increase the risk of communicable diseases, including TB.

The living environment is one of the key determinants of public health. According to healthy environment theory, human health is not only influenced by biological factors but also by housing and environmental conditions. A healthy house must meet health standards, including adequate ventilation, proper lighting, permanent walls and flooring, access to clean water, adequate sanitation, and proper occupancy density. Unhealthy housing increases the risk of communicable diseases, including pulmonary TB. Dark, damp, and poorly ventilated homes allow Mycobacterium tuberculosis bacteria to survive longer in the air, thereby increasing transmission to family members. This shows that health interventions should not only focus on providing medication to patients but also address the living environment.

In addition to the environment, community behavior plays an essential role in disease prevention. Health behaviors are determined by an individual's perceptions of disease. A person will engage in healthy behaviors if they feel vulnerable to disease, perceive it as serious, believe preventive actions are beneficial, and feel that barriers to healthy behaviors can be overcome. In the context of pulmonary TB, patients who understand transmission risks and believe that cleanliness prevents spread are more likely to practice Clean and Healthy Living Behavior, such as covering their mouth when coughing, spitting into containers, washing hands, and opening windows daily for ventilation. This theory supports findings that Clean and Healthy Living Behavior is an important factor associated with TB patients' housing conditions.

Furthermore, the Germ Theory, developed by Louis Pasteur and Robert Koch, provides a fundamental understanding of infectious diseases. In 1882, Robert Koch identified Mycobacterium tuberculosis as the causative agent of tuberculosis. This theory explains that TB transmission occurs through droplets containing bacteria, expelled when a patient

coughs or sneezes. Unhealthy housing conditions, such as poor ventilation and high humidity, allow bacteria to survive longer in the air, thereby increasing transmission risk. This highlights the importance of TB prevention strategies that not only focus on treatment but also involve improving community health behaviors and housing conditions.

The concept of a healthy home is also central in TB prevention. According to the Decree of the Minister of Health of the Republic of Indonesia No. 829/Menkes/SK/VII/1999, a healthy home is one that meets health standards in terms of structure, sanitation facilities, and occupants' behaviors. Criteria include a leak-free roof, dry walls, dust-free floors, ventilation of at least 10% of the floor area, adequate natural or artificial lighting, and basic sanitation facilities. A healthy home should also have clean water, a sanitary latrine, a covered waste disposal system, and a drainage system. Homes that fail to meet these standards place residents at greater risk of communicable diseases, including pulmonary TB. This theory highlights the strong link between housing conditions and health outcomes, underscoring the importance of studying TB patients' housing environments.

Meanwhile, Clean and Healthy Living Behavior remains one of the Indonesian government's main strategies for improving public health. Clean and Healthy Living Behavior is a set of conscious health practices that empower individuals, families, and communities to care for themselves and actively participate in public health improvement. Five areas of Clean and Healthy Living Behavior: households, schools, workplaces, public spaces, and healthcare facilities. In this study's context, household Clean and Healthy Living Behavior is most relevant, as it directly relates to TB patients' daily habits in maintaining personal and environmental hygiene. Examples include covering the mouth when coughing, disposing of sputum properly, opening windows daily, sun-drying bedding, and maintaining overall household cleanliness. When these practices are not observed, the risk of TB transmission rises significantly.

From an epidemiological perspective, TB transmission can be explained through the host-agent-environment model, or the epidemiological triangle. The disease agent is Mycobacterium tuberculosis; the host is the patient or susceptible individual; and the environment is the living condition that either facilitates or inhibits transmission. Controlling one of these three components can break the TB transmission chain. For instance, if patients practice Clean and Healthy Living Behavior properly, they prevent droplets from spreading. Similarly, a healthy home environment prevents TB bacteria from surviving long in the air. Thus, environmental epidemiology strongly supports the view that Clean and Healthy Living Behavior and housing conditions are interrelated factors in preventing pulmonary TB.

In conclusion, individual, environmental, and social factors interact to determine health outcomes. Pulmonary TB, as one of the most dangerous communicable diseases, cannot be prevented solely through medical treatment but must also be addressed through improving community health behaviors and ensuring healthy housing environments. Therefore, research on the correlation between Clean and Healthy Living Behavior and housing conditions among pulmonary TB patients at Gattareng Health Center, Bulukumba Regency, is essential to provide empirical evidence on how behaviors and housing environments contribute to TB prevention at the community level.

2. Methods

This study employed a descriptive analytic design with a cross-sectional approach. This design was chosen because it allows for the depiction of the relationship between the independent variable, namely Clean and Healthy Living Behavior and the dependent variable, namely the home environmental conditions of pulmonary TB patients, which were measured simultaneously at one point in time without any intervention from the researcher. The study was conducted at Gattareng Health Center, Bulukumba Regency, from June 31 to July 20, 2025. This location was selected because it has a relatively high number of pulmonary TB cases, making it relevant for investigation (Notoadmojo, 2018).

The study population consisted of all pulmonary TB patients registered at Gattareng Health Center, totaling 42 individuals. The sample size was determined using a probability sampling technique through a simple random sampling approach, ensuring that each population member had an equal chance of being selected. Using Slovin's formula with a 5% margin of error, a sample size of 38 respondents was obtained. The inclusion criteria were pulmonary TB patients undergoing treatment during the study period and willing to participate by signing informed consent. The exclusion criteria included patients who were absent during data collection or withdrew during the study (Rahmadi, 2018).

The independent variable in this study was Clean and Healthy Living Behavior, measured using a closed-ended questionnaire modified from Alpul Laely (2020), consisting of 15 items covering aspects of personal hygiene, use of sanitary latrines, clean water management, and household waste management. The dependent variable was the home environmental condition, assessed using the healthy housing assessment instrument. This instrument evaluated housing components (ventilation, lighting, flooring, and walls), sanitation facilities (clean water, latrines, wastewater drainage, and garbage disposal), as well as residents' behavior in maintaining household cleanliness.

The data collection procedure began with obtaining ethical and administrative approval, followed by coordination with the health center. Respondents were given explanations regarding the study's objectives and benefits, and then asked to provide consent through informed consent forms. Next, the researcher distributed the Clean and Healthy Living Behavior questionnaire to respondents and conducted direct observations of the home environment using a healthy housing checklist (Hikmawati, 2020).

The collected data from the questionnaire and checklist underwent editing to ensure completeness, coding by assigning numerical values to each response, processing by inputting data into software, and cleaning to ensure no errors or duplicate entries (Sudigdo, 2018). Data analysis was performed in two stages: univariate analysis to describe respondents' characteristics and the distribution of each variable, and bivariate analysis to examine the relationship between Clean and Healthy Living Behavior and home environmental conditions. The statistical test used was Spearman's Rho, as the data obtained were ordinal in scale. All analyses were conducted using SPSS version 23 with a significance level of $\alpha = 0.05$. Results were considered statistically significant if the p-value was less than 0.05 (Syapitri et al., 2021).

3. Results and Discussion

Based on the results presented in Table 1 regarding Clean and Healthy Living Behavior, it was found that out of a total of 38 respondents, the majority fell into the "moderate" category, namely 15 people (39.2%). This indicates that most respondents had already practiced Clean and Healthy Living Behavior in their daily lives, although its implementation was not yet optimal. Meanwhile, 13 respondents (34.2%) were categorized as "poor."

Table 1. Characteristics of respondents based on clean and healthy living behavior

Clean and healthy living behavior level	Frequency (f)	Percentage (%)
Poor (15-19)	13	34.2
Fair (20-24)	15	39.2
Good (25-30)	10	26.3
Total	38	100

This percentage shows that more than one-third of the respondents had not implemented Clean and Healthy Living Behavior adequately, making this group a key concern in efforts to improve public health. Furthermore, only 10 respondents (26.3%) were classified as "good." This suggests that only about a quarter of the respondents had been consistent and appropriate in practicing Clean and Healthy Living Behavior. Overall, the study results illustrate that respondents' Clean and Healthy Living Behavior levels tended to fall into the "moderate" category. However, the relatively high proportion of

respondents in the "poor" category and the low percentage in the "good" category indicate the need for interventions or health education programs to raise awareness and improve Clean and Healthy Living Behavior practices, so that more community members can reach the "good" category.

Table 1 shows that among 38 respondents, based on Clean and Healthy Living Behavior, 15 respondents (39.2%) practiced Clean and Healthy Living Behavior at a moderate level, 13 respondents (34.2%) were in the poor category, and 10 respondents (26.3%) were in the good category. The results of this study indicate that several pulmonary TB patients practiced Clean and Healthy Living Behavior at a moderate level. Clean and Healthy Living Behavior is a set of behaviors that must be cultivated from an early age to establish a healthy paradigm within individuals, which can then be applied in family and community life (Zulaikhah et al., 2019).

Clean and Healthy Living Behavior is defined as a collection of health-related behaviors practiced consciously as a result of learning, enabling individuals, families, groups, or communities to become self-reliant in the field of health and actively contribute to public health, particularly in disease prevention, control, and environmental sanitation. Health education activities, correct handwashing practices, and health talk shows are among the strategies used to transfer knowledge on Clean and Healthy Living Behavior to participants, thereby improving awareness, attitudes, and the practice of Clean and Healthy Living Behavior. The ultimate goal is behavioral change at the individual, family, and community levels to foster and maintain healthy habits and a healthy environment, and to actively contribute to the achievement of optimal health (Zulaikhah et al., 2019).

There are several factors influencing Clean and Healthy Living Behavior, including education and knowledge. Cross-tabulation results between Clean and Healthy Living Behavior and educational background revealed that 15 respondents (42.9%) with senior high school education demonstrated moderate Clean and Healthy Living Behavior practices. This is consistent with the study by Zaraz (2017), which indicated that education level plays a vital role in public health. Low levels of education make it difficult for respondents to understand the importance of personal hygiene and environmental sanitation. According to L. Green's theory, education is a predisposing factor that shapes behavior. Education serves as an important means of community organization to increase knowledge, including health knowledge. Based on the researcher's assumption, the higher the educational level, the better the understanding of health, including the application of Clean and Healthy Living Behavior principles.

Based on the results presented in Table 2 regarding home environmental conditions, it was found that out of 38 respondents, the majority lived in unhealthy houses, totaling 22 people (57.9%). This indicates that more than half of the respondents were still residing in home environments that did not meet health criteria, in terms of cleanliness, lighting, ventilation, and sanitation. Meanwhile, 16 respondents (42.1%) lived in healthy houses. This percentage shows that less than half of the respondents had living environments that complied with health standards. Overall, the study results demonstrate that the respondents' home environmental conditions were still predominantly categorized as unhealthy. Such conditions may increase the risk of health problems, as unhealthy housing can become a breeding ground for disease vectors, have poor air circulation, inadequate lighting, and insufficient sanitation. Therefore, improvement efforts and interventions are needed from individuals, communities, and relevant stakeholders to increase the number of healthy homes.

Table 2. Characteristics of respondents based on home environment conditions

Home environment	Frequency (f)	Percentage (%)
Unhealthy house	22	57.9
Healthy house	16	42.1
Total	38	100

Table 2 shows that out of 38 respondents, 22 (57.9%) lived in unhealthy homes, while 16 (42.1%) lived in healthy homes. The findings of this study indicate that the majority of respondents lived in unhealthy houses. The condition of the home environment is one of the significant determinants of health status. Environmental sanitation encompasses aspects such as housing, waste disposal, provision of clean water, and more.

The study revealed a significant relationship between home environment conditions and respondents' Clean and Healthy Living Behavior. Among the 22 respondents living in unhealthy homes, most were categorized as poor Clean and Healthy Living Behavior (59.1%) and moderate Clean and Healthy Living Behavior (40.9%), while none achieved the good category. Conversely, among the 16 respondents living in healthy homes, the majority demonstrated good Clean and Healthy Living Behavior (62.5%), with the remainder in the moderate category (37.5%), and none in the poor category. Spearman's rho test results showed a p-value = 0.01 with a correlation coefficient r = 0.772, indicating a very strong and positive correlation between home environmental conditions and Clean and Healthy Living Behavior. This implies that the better the home environment conditions, the better the implementation of Clean and Healthy Living Behavior among respondents.

From interviews, it was found that of the 13 respondents who scored poorly in Clean and Healthy Living Behavior despite having healthy homes, most did not turn their face away when coughing or sneezing, did not dispose of sputum in a designated container, did not sun-dry bedding daily, did not separate their clothes from those of other family members, and did not separate eating utensils from the rest of the household. This was attributed to patients not being accustomed to these practices and, in some cases, simply due to negligence or lack of motivation.

Based on the research conducted in the working area of Gattareng Health Center, Bulukumba Regency, it was found that Clean and Healthy Living Behavior among pulmonary TB patients was still largely at a moderate level (39.2%). This indicates that although some patients have attempted to adopt certain Clean and Healthy Living Behavior indicators, consistency and coverage in implementing healthy practices remain suboptimal. Some patients had started to cover their mouth when coughing, maintain household cleanliness, and open windows for ventilation. However, others were still not accustomed to simple practices such as sun-drying bedding, separating eating utensils, or disposing of sputum in closed containers. This suggests that the awareness and motivation of TB patients in adopting Clean and Healthy Living Behavior require continuous guidance, particularly since Clean and Healthy Living Behavior plays a crucial role in preventing TB transmission to family members and the surrounding community.

In addition, the majority of TB patients' homes in the study area were categorized as unhealthy, with a prevalence of 55.7%. This reflects that the physical aspects of housing, such as ventilation, lighting, humidity, type of flooring, and availability of basic sanitation facilities, often did not meet the Ministry of Health's standards for healthy housing. Many homes had limited ventilation, poor natural lighting, and high humidity, creating conditions conducive to the survival of Mycobacterium tuberculosis. This situation was exacerbated by inadequate waste disposal facilities, open sacks used as garbage containers, and poor habits in maintaining yard cleanliness. Such conditions not only diminish quality of life but also represent a significant risk factor for the spread of communicable diseases, particularly pulmonary TB.

Another important finding of this study is the significant relationship between Clean and Healthy Living Behavior and the home environment conditions of pulmonary TB patients at Gattareng Health Center, Bulukumba Regency ($\alpha = 0.01$). This proves that individual and family behavior in maintaining cleanliness and health within the household greatly affects the quality of the home environment. Patients who consistently practiced Clean and Healthy Living Behavior were more likely to live in healthy housing conditions, whereas those with poor tended to live in homes with poor sanitation and ventilation. This reinforces the notion that Clean and Healthy Living Behavior not only affects individual health but also indirectly contributes to creating a livable and healthy home environment.

In other words, Clean and Healthy Living Behavior and home conditions are closely interrelated, mutually supporting efforts in the prevention and control of pulmonary TB.

Table 3. The relationship between clean and healthy living behavior and home environment of pulmonary TB patients

Home environment condition	Poor		Fair		Good		Total	
	f	%	f	%	f	%	n	%
Unhealthy house	13	59.1	9	40.9	0	0	22	100
Healthy house	0	0	6	37.5	10	62.5	16	100
Total	13	34.2	15	39.5	10	26.3	38	100

Spearman's Rho Statistical Test Result: ρ = 0.01, r = 0.772

Based on the results presented in the table on the relationship between Clean and Healthy Living Behavior and home environmental conditions, it was found that among the 22 respondents living in unhealthy houses, the majority were categorized as having poor Clean and Healthy Living Behavior (59.1%) and moderate Clean and Healthy Living Behavior (40.9%), with none classified as good. Conversely, among the 16 respondents living in healthy houses, most demonstrated good Clean and Healthy Living Behavior (62.5%), while the rest fell into the moderate category (37.5%), and none were in the poor category. Statistical testing using Spearman's rho showed a p-value of 0.01 ($p < 0.05$) with a correlation coefficient of r = 0.772. This indicates a significant and very strong relationship between home environmental conditions and Clean and Healthy Living Behavior. The positive correlation suggests that the better the home environment, the better the Clean and Healthy Living Behavior practices of the respondents. Thus, it can be concluded that healthy housing conditions contribute to improved clean and healthy living behavior, while unhealthy housing is associated with lower implementation of Clean and Healthy Living Behavior. These findings highlight the importance of improving home environments—such as ventilation, lighting, sanitation, and overall cleanliness—in order to support the achievement of clean and healthy living behavior within the community.

The overall findings of this study highlight the need for comprehensive health interventions, not only focusing on medical treatment of TB patients but also encompassing behavioral change and environmental improvement. Efforts to eradicate TB in the community will be difficult to achieve optimally if patients continue to practice unhealthy habits and reside in housing conditions that do not support health (Suharno et al., 2019). Therefore, a more holistic approach is needed, involving intensive education, patient and family knowledge enhancement, and assistance in creating homes that meet health standards. Furthermore, cross-sectoral collaboration between health workers, local government, and the community is also essential in realizing a healthy environment and reducing TB incidence in the Gattareng Health Center working area (Selvam et al., 2017).

Thus, it can be emphasized that the success of pulmonary TB control is not solely dependent on the availability of medicines and healthcare services but also on the extent to which patients and their families consistently practice and improve their housing and environmental conditions. The findings of this study are expected to serve as a foundation for public health programs in Bulukumba Regency, particularly in strengthening household and environment-based TB prevention strategies (Wulandari, 2022). This finding is consistent with the theory that housing is a crucial determinant of community health. A healthy home is not only a place to live but also serves as protection from disease risks. A healthy home is characterized by sufficient ventilation and lighting, access to clean water, adequate sanitation, and a clean surrounding environment. When these factors are not fulfilled, residents become more vulnerable to health problems and find it difficult to consistently implement Clean and Healthy Living Behavior (Mandal, 2022).

The study further demonstrates that healthy housing environments encourage the practice of Clean and Healthy Living Behavior, such as proper handwashing, use of sanitary latrines, and management of waste and clean water. Conversely, the lack of facilities in unhealthy homes creates major barriers to Clean and Healthy Living Behavior

implementation, even among residents who are aware of its importance. This is consistent with previous research showing a positive correlation between housing quality and Clean and Healthy Living Behavior among families (Martinez et al., 2025). Overall, this study confirms that improvements in community Clean and Healthy Living Behavior cannot be achieved solely through education but must also be supported by healthy physical housing conditions. Therefore, public health interventions must be integrated, including improving housing quality through better ventilation, provision of clean water, construction of proper sanitation, and household waste management. With a supportive housing environment, communities will find it easier and more consistent to practice Clean and Healthy Living Behavior, thereby improving family and community health levels. (Asfiya et al., 2021). According to WHO, a home is a physical structure that provides shelter and an environment conducive to physical, mental, and social health for both individuals and families. A healthy home, therefore, is not only a place for shelter and rest but also a means of fostering a healthy lifestyle, enabling family members to be physically, mentally, and socially productive. Conversely, homes that fail to meet health criteria can become a source of disease. Poor household sanitation significantly impacts household Clean and Healthy Living Behavior and community health (Magfirah & Nurlaely, 2022).

From the results of this study, one of the stronger indicators of healthy housing was permanent house walls. The majority of pulmonary TB patients lived in houses with permanent walls (brick). This aligns with (Quan et al., 2024), who stated that walls made of plastered brick are healthier, as they are easier to clean compared to bamboo or wooden walls, which tend to collect dust and become breeding grounds for bacteria (Sriratih et al., 2021). According to the Decree of the Minister of Health of the Republic of Indonesia No. 829/SK/VII/1999, access to clean water must meet the minimum standard of 60 liters/day/person, with clean water that is odorless, colorless, and clear. Based on the researcher's observations, pulmonary TB patients' access to clean water met these requirements because they had access to government-supplied water (Noerhalimah, 2020).

Most pulmonary TB patients also had permanent private sanitary latrines equipped with septic tanks. According to the same Ministry of Health Decree, every household should have its own latrine, which must be clean, odorless, and built with a water-sealed design. The researcher assumed that TB patients' latrines were healthy, as they were privately owned, equipped with septic tanks, and did not discharge waste into rivers (Hasir et al., 2022). However, one weakness found was in daily cleaning and ventilation practices. Most respondents only occasionally cleaned their houses and opened windows, reducing air circulation. According to the Ministry of Health guidelines (1999) in Bao et al. (2022) inadequate ventilation leads to reduced oxygen levels, increased carbon dioxide, musty odors, and higher indoor temperatures. Poor ventilation also increases humidity, creating favorable conditions for microorganisms to thrive.

For waste disposal, the majority of respondents used open sacks without covers, and some even disposed of garbage into rivers. The Ministry of Health guidelines state that garbage containers should not remain open for more than 24 hours to avoid attracting flies and rodents. The use of open sacks without covers, as observed among respondents, can easily become a breeding ground for germs and pests. The findings confirm that housing conditions in the Gantarang subdistrict remain largely below healthy home standards. Many residents lacked knowledge of what constitutes a healthy home and still perceived their living conditions as comfortable and acceptable despite failing to meet health criteria (Luies & Preez, 2020). TB is an infectious disease primarily attacking the lungs (90%), which makes it easily transmissible to others and potentially fatal. This is consistent with (Iruedo & Pather, 2023), who emphasized that one of the key problems leading to high TB incidence is the low level of Clean and Healthy Living Behavior among communities. The persistence of TB cases is evidence that public awareness of environmental hygiene and personal health remains low. Through promotion and improved healthcare services, it is hoped that communicable diseases, which are prevalent in developing countries including Indonesia, can be reduced as much as possible (Zulaikhah et al., 2019).

This study is in line with Luo et al. (2022), who found a significant relationship between Clean and Healthy Living Behavior and housing conditions among pulmonary TB patients. Individual attitudes and behaviors play an important role in TB transmission, while environmental factors also significantly contribute to TB incidence. Housing conditions directly impact the health status of residents. The researcher assumes that a clean and healthy environment can reduce disease transmission through air pollution. One of the diseases that can result from an unclean environment is respiratory illness. Furthermore, human behaviors themselves often exacerbate problems in relation to the environment.

4. Conclusions

Pulmonary TB patients at Gattareng Public Health Center, Bulukumba Regency, generally demonstrated a fair level of Clean and Healthy Living Behavior, accounting for 39.2% of respondents. The majority of pulmonary TB patients at Gattareng Public Health Center, Bulukumba Regency, lived in unhealthy homes (55.7%). There is a significant relationship (α = 0.01) between Clean and Healthy Living Behavior and the home environment condition of pulmonary TB patients at Gattareng Public Health Center, Bulukumba Regency.

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