

*THE 8TH INTERNATIONAL SYMPOSIUM OF PUBLIC HEALTH 2024***ANALYSIS OF FACTORS INFLUENCING CLEAN AND HEALTHY (PHBS) PRACTICES TO PREVENT PULMONARY TB AMONG STUDENTS AT ISLAMIC BOARDING SCHOOL PALEMBANG****Hendawati*¹, Intan Kumalasari ², Irmawartini ³ Lindawati⁴**^{1,2}*Epidemiological Surveillance study program / Palembang Ministry of Health Polytechnic, Indonesia)*^{2,3}*Environmental health study program/ Padang Ministry of Health Polytechnic, Indonesia)***Presenting author: 085896458654; E-mail (hendawati165@gmail.com)***ABSTRACT:**

Background: Indonesia ranks second in the world for tuberculosis (TB) cases, with a total of 1,060,000 cases and 134,000 deaths per year. This means that 17 people die from TB every hour. Clean and healthy living behavior (PHBS) is essential in preventing pulmonary TB. Islamic boarding schools (pesantren) may increase TB incidence if the students do not maintain personal and environmental hygiene. This study analyzes the factors influencing PHBS practices in preventing pulmonary TB among students at Zaadul Ma'ad Islamic Boarding School. **Methods:** Using a quantitative, cross-sectional method, the study involved 50 respondents selected through total sampling. A structured questionnaire was used, and data were analyzed with univariate, bivariate (chi-square test at 95% significance), and multivariate analyses. **Results and Discussions:** All respondents were male, 86% were mid-adolescents (15-17 years), 70% had normal nutritional status, and 35% had a history of smoking. Significant factors associated with PHBS practices for TB prevention included knowledge ($p=0.091$), attitudes ($p=0.006$), facility availability ($p=0.054$), resource availability ($p=0.002$), support from religious leaders (kyai) ($p=0.012$), teachers (ustadz/ustadzah) ($p=0.003$), boarding school administrators ($p=0.012$), school regulations ($p=0.006$), and healthcare workers ($p=0.003$). Attitudes ($OR=11.374$) and school regulations ($OR=9.409$) were the most influential variables. **Conclusions:** Islamic boarding schools should implement regulations mandating personal hygiene, providing students with clear guidelines for maintaining cleanliness within the boarding school environment.

Keywords: PHBS, pulmonary tuberculosis, prevention, factor analysis, Islamic boarding school

1. Introduction

Tuberculosis (TB) is a chronic infectious disease that continues to be a significant public health problem worldwide. According to the World Health Organization (Global TB Report, 2023), TB remains a critical health issue globally. TB became the second leading cause of death worldwide after COVID-19 in 2022, with over 10 million people contracting TB each year. Without treatment, TB mortality rates are high (approximately 50%). Globally, in 2022, TB caused around 130 million deaths. With WHO-recommended treatment, 85% of TB cases can be cured. The global number of newly diagnosed TB cases was 75 million in 2022. Thirty high-burden countries accounted for 87% of global TB cases in 2022, with two-thirds of the total global cases occurring in eight countries, including Indonesia (10%) (WHO, 2023).

Indonesia is one of the countries heavily burdened by this infectious disease (Puspasari et al., 2023). According to the Global TB Report 2023, Indonesia ranks second with the highest TB burden globally after India, followed by China. With an estimated 1,060,000 TB cases and 134,000 TB-related deaths annually, 17 people die from TB every hour in Indonesia. As of March 1, 2024, around 821,200 TB cases were notified, but only 88% of Drug-

Sensitive TB patients and 73% of Drug-Resistant TB patients have started treatment, leaving some confirmed TB patients untreated and potentially transmitting the disease to others.

The increasing number of TB cases poses challenges to the government's efforts in TB control in Indonesia. One of the serious problems in TB control is the suboptimal detection and management of TB cases, inadequate accessibility to healthcare facilities, and unaffordable treatment for people living in remote or suburban areas. Additionally, public knowledge and ineffective education are obstacles in TB control efforts. The number of pulmonary TB cases in South Sumatra Province has increased yearly. According to the Central Statistics Agency data, pulmonary TB cases in 2021, 2022, and 2023 were 13,514, 18,122, and 23,256, respectively, with Palembang City reporting the highest TB cases: 5,023 in 2021, 6,927 in 2022, and 7,279 in 2023 (BPS Provinsi Sumsel, 2024).

Several factors influence the incidence of pulmonary TB, one of which is environmental factors that play a critical role in transmission and prevalence. Previous studies have shown that the physical environment, including housing conditions, air circulation, and occupancy density, can affect the incidence of pulmonary TB (Sari & Yeni, 2024 ; Haeruddin et al., 2020 ; Wubuli et al., 2015 ; Windarti et al., 2024) In addition, the size of the room in a house was found to have a close relationship with the incidence of pulmonary TB (Haeruddin et al., 2020). Furthermore, socio-demographic factors are also associated with pulmonary TB incidence. Studies have highlighted the relationship between socio-demographic predictors and the distribution of pulmonary TB cases, emphasizing the importance of factors such as age, gender, and living conditions ((El-Masry & Muzaheed, 2022); (Hanifah et al., 2022).

The Sustainable Development Goals (SDGs) framework includes efforts to control pulmonary TB through environmental control. As an environmentally-based disease, TB bacteria require specific environmental conditions to spread. One environment with high potential for TB transmission is schools with dormitories, including Islamic boarding schools (pesantren). Although pulmonary TB cases in pesantren are rare (1 or 2 cases), the physical environmental conditions, occupancy density, humidity, and air circulation in pesantren dormitories can lead to high transmission rates from TB-infected students to others. Therefore, primary prevention efforts are needed to reduce the transmission of pulmonary TB among pesantren students through Clean and Healthy Living Behavior (PHBS) practices. Generally, pesantren caregivers acknowledge that PHBS practices have not been maximized and remain at the level of individual understanding among students. Awareness in improving understanding and behavior must be continuously nurtured and developed. Based on this data and facts, the researchers aim to understand the factors influencing PHBS practices in preventing pulmonary TB among students at Zaadul Ma'ad Islamic Boarding School, Palembang, to enhance students' openness to health information regarding pulmonary TB and improve the implementation of PHBS practices.

2. Literature Review

Tuberculosis (TB) is an infectious disease caused by *Mycobacterium tuberculosis*, which can attack various human organs, particularly the lungs (90%), as they are the most easily infected. Transmission occurs through airborne droplets or mucus from TB patients, making it easy to transmit to others. Previous studies have shown a significant relationship between environmental conditions and prevention practices with PHBS against pulmonary TB incidence. Research by Waitau et al., (2023) and Dahwan et al., (2020) demonstrated that understanding the relationship between Personal Hygiene and Behavioral Sanitation (PHBS) practices and pulmonary TB incidence is essential for developing effective prevention and control strategies. Studies by Windarti et al., (2024) and Madjid et al., (2019) have also shown a significant relationship between physical environmental conditions of the home and the risk of pulmonary TB. Factors such as ventilation, lighting, humidity, and occupancy density have been identified as significant contributors to the transmission and spread of *Mycobacterium tuberculosis* (Mawardi et al., 2019 ; Waitau et al., 2023). Additionally, behaviors such as cough/sneeze etiquette, sputum disposal practices, and contact history with TB patients have been associated with pulmonary TB incidence (Mawardi et al., 2019 ; Steffanus et al., 2021). Given the high potential for TB transmission among students in Islamic boarding schools, this study aims to explore the relationship between PHBS practices, physical environment, and individual behaviors related to pulmonary TB incidence. By synthesizing existing research findings, this article aims to contribute to the knowledge necessary for designing targeted interventions to effectively combat pulmonary TB.

3. Research Method

This research employs a quantitative descriptive approach with a cross-sectional design. The study population consisted of all students residing in Zaadul Ma'ad Islamic Boarding School, totaling 50 students from grades X and XI, with three dormitory rooms. The sampling technique was total sampling based on inclusion and exclusion criteria, including active students at Zaadul Ma'ad Islamic Boarding School willing to be respondents, residing in the dormitory, and not currently undergoing pulmonary TB treatment. Respondents were aged 15 years or older. The dependent variables studied were respondent characteristics, physical environment factors, individual factors, and enabling factors. The independent variable was the practice of PHBS to prevent pulmonary TB transmission. Data collection tools included a 4-in-1 environmental level meter, instruments, and observation sheets designed by reviewing textbooks, articles, guidelines, and literature. The questionnaires were tested for validity and reliability. Univariate analysis was conducted to understand respondent characteristics, including age, gender, education level, occupation, smoking habits, nutritional status, socioeconomic conditions, duration of residence, behavioral factors, physical environment factors, and prevention practices. Bivariate analysis was used to analyze the risk factors for PHBS practices in TB prevention using a chi-square test, while multivariate analysis was used to determine the most dominant risk factors. Data were analyzed using SPSS 25 software. This study received ethical approval from the Ethics Committee of Poltekkes Kemenkes Palembang (No. 0550/KEPK/Adm2/III/2024).

4. Results and Discussion

Characteristics of the Respondents:

Univariate analysis was conducted to understand the distribution of each variable in this study. Table 1 shows that the majority of respondents were mid-adolescents (15-17 years) at 86%, with a normal Body Mass Index (BMI) status for most of them. Most parents had completed high school (76%), and a majority of the parents were employed in the informal sector (67%). Over half of the respondents possessed good knowledge, 78% had a positive attitude, and 67% were already practicing Clean and Healthy Living Behavior (PHBS). The table also reveals that 10% of the respondents had a history of pulmonary TB, and 38% had a history of smoking. Furthermore, most facilities were adequate, with available resources, support from boarding school administrators, ustadz/ustadzah (teachers), school regulations, peer support, and healthcare workers.

Table 1. Characteristics of Respondents (n=50)

Variable	n	%
Age (mean; SD; min-max)		
Mid Adolescents (15-17 years)	43	86
Late Adolescents (18-21 years)	7	14
Parental Education		
Junior High School	2	4
High School	38	76
Diploma	5	10
Bachelor's Degree	5	10
Parental Occupation		
Formal	15	33.3
Informal	35	66.7
Nutritional Status (mean; SD; min-max)		
Underweight	12	24
Normal	35	70
Overweight	3	6
Knowledge		
Good	29	58
Poor	21	42
Attitude		
Positive	39	78
Negative	11	22
PHBS Behavior		
Good	35	67
Poor	15	33.3
History of TB		
Yes	5	10

No	45	90
TB Risk		
Yes (having >1 primary symptom)	10	20
No	40	80
Smoking History		
Yes	19	38
No	31	62
Availability of Facilities		
Adequate	36	72
Inadequate	14	28
Resource Availability		
Adequate	25	50
Inadequate	25	50
Support from Kyai (Religious Leaders)		
Yes	16	32
No	34	68
Support from Boarding School Administrators		
Yes	16	32
No	34	68
Support from Ustadz/Ustadzah		
Yes	29	58
No	21	42
Boarding School Regulations		
Yes	28	56
No	22	44
Peer Support		
Yes	41	82
No	9	18
Support from Healthcare Workers		
Yes	29	58
No	21	42

Source : primary data, 2024

Relationship of Risk Factors

The bivariate analysis in Table 2 identified several variables that do not have a significant relationship with the practice of Clean and Healthy Living Behavior (PHBS) in preventing Pulmonary Tuberculosis (TB) among students at Za'adul Ma'ad Islamic Boarding School, Palembang. The analysis shows no significant relationship between the respondent's age and PHBS practices in TB prevention ($p = 0.328$). This indicates that age differences (mid-adolescents 15-17 years and late adolescents 18-21 years) do not affect PHBS practices in this boarding school. This is consistent with Maharani et al. (2022), who found that age differences do not always significantly impact health behavior if similar environmental factors, such as collective settings and regulations in an educational institution like a boarding school, are present. No significant relationship was found between parental education and PHBS practices ($p = 0.440$). Although parental education can influence health behavior in some contexts, its influence seems less significant in the boarding school environment. As a community that emphasizes collective care and uniform rule enforcement, differences in parental education levels are less relevant to the daily behavior of the students (El-Masry & Muzaheed, 2022).

The analysis results also show that the parents' occupation, whether formal or informal, does not have a significant relationship with PHBS practices ($p=0.736$). This may be due to the similar environmental conditions in the boarding school, reducing behavioral differences that might arise from variations in parental occupation. Perdana & Putra, (2020) support these findings, noting that in tightly regulated communities such as boarding schools, parental occupation does not significantly affect children's health behaviors. Respondents' nutritional status, whether normal or abnormal, did not show a significant relationship with PHBS practices ($p = 0.092$). This could be because of similar eating arrangements and nutritional monitoring in the boarding school, so differences in nutritional status do not directly affect PHBS behaviors. According to Ginting & Andrico Napolin Lumbantobing, (2021), nutritional status often does not significantly influence health behavior if the individual is in an environment with consistent health oversight and intervention.

Knowledge about TB and PHBS also does not have a significant relationship with PHBS practices ($p = 0.091$). Although knowledge is often considered an important factor in influencing health behavior, this study shows that knowledge alone is insufficient to guarantee good PHBS practices. Warasti & Wulandari, (2023) mentions that although health knowledge is essential, attitudes and motivation influenced by social support and a conducive environment play a more dominant role in determining an individual's health behavior. There is no

significant relationship between TB history ($p = 0.607$) and TB risk ($p = 1.000$) with PHBS practices. This can be interpreted that students with a history of TB or who are at risk of TB do not show different PHBS behaviors compared to students without a history or risk of TB. According to a study by Zhang et al., (2022), in a controlled environment like a boarding school, differences in health history do not always significantly affect health behavior due to the strict regulations that apply equally to all students.

Smoking history does not show a significant relationship with PHBS practices ($p = 0.849$). Although smoking is often associated with worse health risks, these results show that smoking history does not directly affect PHBS practices among students. This may be due to strict smoking bans in the boarding school and effective health education about the dangers of smoking, so smoking history does not determine PHBS behavior (Chiang et al., 2014). The availability of facilities such as clean water and adequate sanitation does not show a significant relationship with PHBS practices ($p = 0.054$). Although the p -value is close to the significance threshold, these results indicate that the existence of facilities alone is not enough to ensure good PHBS practices. A study by Budi et al., (2018) emphasizes that while physical facilities are important, their effectiveness largely depends on supervision, regulatory support, and individual motivation to utilize the facilities correctly.

Peer support does not show a significant relationship with PHBS practices ($p = 0.810$). This may be because, in the boarding school environment, behavior is more heavily influenced by institutional authority and rules than by peer influence (Mawardi et al., 2019). Moreover, because students live in a highly structured environment, peer influence may be minimized by stronger control from the boarding school administrators and religious leaders.

Based on the bivariate analysis, several variables were also found to have a significant relationship with the practice of Clean and Healthy Living Behavior (PHBS) in preventing Pulmonary Tuberculosis (TB) among students at Za'adul Ma'ad Islamic Boarding School, Palembang, including: A positive attitude towards PHBS has a significant relationship with PHBS practices ($p = 0.006$). About 79.5% of respondents with a positive attitude tend to practice PHBS well. A positive attitude influences a person's actions because it reflects readiness and willingness to act according to the knowledge they possess (Effendy et al., 2023). In the context of boarding schools, an educational approach that focuses not only on knowledge but also on fostering a positive attitude through spiritual and moral motivation from teachers and boarding school administrators helps strengthen students' adherence to PHBS (Haradanhalli et al., 2019).

There is a significant relationship between resource availability and PHBS practices ($p = 0.002$). About 77.3% of respondents who stated that resources were adequate tended to apply PHBS practices well. The availability of resources, such as health facilities, clean water, and proper sanitation, is very important in supporting PHBS practices because it facilitates students in maintaining clean and healthy living habits (Madjid et al., 2019). According to Waitau et al., (2023), adequate facilities in the boarding school or school environment can facilitate effective PHBS implementation and prevent the transmission of pulmonary TB.

Support from religious leaders has a significant relationship with PHBS practices ($p = 0.012$). Respondents receiving support from religious leaders are 93.8% more likely to practice PHBS well. Religious leaders, as central figures in the boarding school, play a key role in guiding student behavior through religious and spiritual approaches (Muslimin, 2020). The involvement of religious leaders in supporting PHBS can increase students' awareness of the importance of maintaining health as part of religious responsibility. Support from boarding school administrators shows a significant relationship with PHBS practices ($p = 0.012$). This support includes strict supervision and control of the cleanliness of the boarding school environment and motivation for students to implement PHBS. A study by Selviana, (2019) shows that support from boarding school administrators, in the form of providing adequate sanitation facilities and regular monitoring of dormitory cleanliness, is very important in enhancing PHBS behavior among students.

Support from teachers has a significant relationship with PHBS practices ($p = 0.003$). Teachers often serve as role models for students and have a significant influence in teaching and supervising the implementation of PHBS. They also play a role in providing health education that is relevant to the cultural and religious context of the boarding school Windarti et al., (2024). According to a study by Sahadewa et al., (2019), intensive interaction and continuous education from teachers to students have been proven effective in promoting healthy living behavior in boarding schools. The presence of boarding school regulations also shows a significant relationship with PHBS practices ($p = 0.006$). Islamic boarding schools with regulations related to PHBS tend to be more successful in controlling cleanliness and health practices among students. Research by Maharani et al., (2022) emphasizes that clear and firm institutional regulations can create an environment conducive to PHBS implementation and the prevention of infectious diseases like pulmonary TB.

Support from health workers is also significantly related to PHBS practices ($p = 0.003$). Health workers involved in counseling, routine check-ups, and health follow-ups for students can increase awareness and adherence to PHBS practices. According to Ginting & Lumbantobing, (2021) the role of health workers in

providing direct education and medical interventions to vulnerable populations, such as students, can improve the adoption of healthy living behaviors and reduce the risk of infectious diseases.

Table 2. Bivariate Analysis of Risk Factors

Faktor risiko	PHBS Behavior				p-value
	Good		Poor		
	n	%	n	%	
Age (mean; SD; min-max)					
Mid Adolescence (15-17 years)	29	67,4	14	32,6	0,328
Late Adolescence (18-21 years)	6	85,7	1	14,3	
Parental Education					
Middle	27	67,5	13	32,5	0.440
High	8	80	2	20	
Parental Occupation					
Formal	10	66,7	5	33,3	0,736
Informal	25	71,4	10	28,5	
Nutritional Status					
Normal	22	62,9	13	37,1	0,092
Not Normal	13	86,7	2	13,3	
Knowledge					
Good	23	79,3	6	20,7	0,091
Poor	12	57,1	9	42,9	
Attitude					
Positive	31	79,5	8	20,5	0,006
Negative	4	36,4	7	63,6	
TB History					
Yes	4	80	1	20	0,607
No	31	68,9	14	31,1	
TB Risk					
Yes (Has >1 primary signs/symptoms)	7	70	3	30	1
No	28	70	12	30	
Smoking History					
Yes	13	68,4	6	31,6	0,849
No	22	71	9	29	
Facility Availability					
Adequate	28	77,8	8	22,2	0,054
Not Adequate	7	50	7	50	
Resource Availability					
Adequate	34	77,3	10	22,7	0,002
Not Adequate	1	16,7	5	83,3	
Support from Religious Leaders					
Yes	15	93,8	1	6,2	0,012
No	20	58,8	14	41,2	
Support from Boarding School Admin					
Yes	15	93,8	1	6,2	0,012
No	20	58,8	14	41,2	
Support from Teachers (Ustadz/Ustadzah)					
Yes	25	86,2	4	13,8	0,003
No	10	47,6	10	52,4	
Boarding School Regulations					
Yes	24	85,7	4	14,3	0,006
No	11	50	11	50	
Peer Support					
Available	29	70,7	12	29,3	0,81
Not Available	6	66,7	3	33,3	
Support from Health Workers					
Yes	25	86,2	4	13,8	0.003
Tidak	10	47,6	11	52,4	

Source : Chi-Square Test Results

Dominant Influencing Factors

Based on the multivariate analysis results in Table 4, two variables were found to have a significant relationship with the practice of Clean and Healthy Living Behavior (PHBS) in preventing Pulmonary Tuberculosis (TB) among students at Za'adul Ma'ad Islamic Boarding School, Palembang: the variables of students' attitudes and boarding school regulations. The multivariate analysis showed that students' attitudes towards PHBS had a highly significant relationship with PHBS practices in preventing TB ($p = 0.009$) with an odds ratio (OR) of 11.374. This means that students with a positive attitude towards PHBS are 11.374 times more likely to practice PHBS compared to students with a negative attitude. A positive attitude is crucial in determining health behavior because it reflects an individual's beliefs and motivation to act. According to Effendy et al., (2023), a positive attitude towards health practices increases individual adherence to behaviors that promote health, including PHBS. In the boarding school environment, students' attitudes are often influenced by health education and spiritual motivation provided by religious leaders, teachers, and boarding school administrators. Emphasizing the importance of health as part of religious and moral responsibility tends to foster a positive attitude among students towards PHBS (Haradanhalli et al., 2019).

In the context of a boarding school, fostering a positive attitude can be achieved through education integrated with religious values. A study by Manurung & Tambunan, (2022), showed that health education programs incorporating spiritual and moral elements are more effective in changing students' attitudes towards health behavior. Therefore, interventions focusing on developing a positive attitude towards health and PHBS will be very effective in improving TB prevention behavior in boarding schools.

Boarding school regulations also show a significant relationship with PHBS practices ($p = 0.009$) with an odds ratio (OR) of 9.409. This indicates that boarding schools with regulations related to PHBS are 9.409 times more likely to implement PHBS practices compared to those without clear regulations. The existence of boarding school regulations governing PHBS provides clear guidelines and standards for students in maintaining health behavior. Research by Maharani et al., (2022) emphasizes that clear and strict regulations in institutional settings, such as boarding schools, are vital to ensuring compliance with health behaviors. These regulations not only serve as guidelines but also as tools for enforcing discipline and motivating students to follow PHBS practices.

Boarding schools that strictly enforce PHBS regulations can create a more conducive environment for preventing infectious diseases such as TB. This is also supported by a study by Jannah et al., (2023), which shows that the existence of strict cleanliness and health regulations in educational institutions can increase compliance with health behaviors among students. With strong regulations, boarding schools can establish a sustainable health culture and encourage students to consistently implement PHBS practices.

Table 3. Results of Analysis of Factors Related to PHBS Practices

Variable	p-value	Description
Knowledge	0.091	No relationship
Nutritional Status	0.092	No relationship
Facility Availability	0.054	No relationship
Resource Availability	0.002	Significant relationship
Support from Religious Leaders	0.012	Significant relationship
Support from Boarding School Admin	0.012	Significant relationship
Support from Teachers (Ustadz/Ustadzah)	0.003	Significant relationship
Boarding School Regulations	0.006	Significant relationship
Support from Health Workers	0.003	Significant relationship

Table 4. Multivariate Analysis of Factors Influencing PHBS Practices for TB Prevention among Students

Variable	B	SE	Wald	df	Sig.	Exp (B)	95% CI for Exp (B)
						Lower	Upper
Boarding School Regulations	2.242	0.852	6.923	1	0.009	9.409	1.772
Students' Attitude	2.431	0.927	6.877	1	0.009	11.374	1.848
Constant	-2.695	0.776	12.064	1	0.001	0.068	

Source : Logistic Regression Analysis Results

2. Conclusion and Implications

Based on the results of this study, it can be concluded that students' attitudes and boarding school regulations are two key factors in enhancing the practice of Clean and Healthy Living Behavior (PHBS) in Islamic boarding schools. The implications that can be drawn are: Strengthening Positive Attitude Education: The boarding school should continually strengthen education that promotes a positive attitude toward PHBS by integrating health education with religious values. This can be done through regular lectures, group discussions, or health campaigns that actively involve students. Strict Enforcement of Regulations: The boarding school must ensure that regulations regarding PHBS are implemented consistently and strictly. This may involve imposing penalties for violations, providing incentives for compliant students, and conducting regular monitoring by school administrators or health workers. By optimizing these two factors, Islamic boarding schools can be more effective in preventing the spread of pulmonary TB through better implementation of PHBS practices among students.

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