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Factors Influencing the Distribution of Lung Tb Cases at Oesapa Health Center

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Abstract
Kupang City, East Nusa Tenggara, reported 1,253 TB cases in 2023, making it a significant contributor to the region's TB burden. This cross-sectional study aimed to identify TB cases and describe the factors influencing TB spread in the Oesapa Community Health Center work area. A total of 150 samples were selected using simple random sampling, and the Spearman rank test was used for analysis. The results showed no significant relationships between gender, age, education, occupation, knowledge, residential density, and availability of information with positive TB MRT results. However, significant relationships were found between positive TB MRT results and phlegm removal behavior, smoking behavior, exercise habits, cough symptoms, shortness of breath, weight loss, loss of appetite, fever, and night sweats without physical activity.These findings highlight the importance of behavioral factors in TB transmission. The study concludes that community socialization is crucial to promote better health care and encourage a clean and healthy lifestyle to prevent TB transmission. The results of this study can inform the development of effective TB prevention and control strategies in Kupang City and similar settings. By addressing the identified factors, health authorities can reduce the spread of TB and improve public health outcomes.

Keywords: Molecular Rapid Test (MRT), Tuberculosis (TB), Oesapa Health Center, Distribution of TB Cases
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1. INTRODUCTION

Tuberculosis (TB) remains a significant public health concern globally, with Indonesia ranking second in the world for the highest number of TB cases. East Nusa Tenggara Province has a low TB notification achievement, with Kupang City being the largest contributor to TB cases in the region. The Oesapa Community Health Center plays a crucial role in combating TB in its working area, supported by the availability of Molecular Rapid Test (MRT) equipment.

Nearly a quarter of the world's population is infected with TB. Tuberculosis (TB) is an infectious disease caused by the bacterium *Mycobacterium tuberculosis*, primarily affecting the lungs. TB remains the leading cause of death after HIV/AIDS and is among the top 20 causes of death worldwide. In 2022, the global number of TB-related deaths among HIV-negative patients was 1.1 million, a decrease from 1.2 million in 2021 [1]. Indonesia ranks second in the world for the highest number of TB cases, following India, accounting for 10% of new cases globally. In 2022, an estimated 10.6 million people suffered from TB worldwide [2]. TB case detection in Indonesia has increased steadily over the past three years, with 443,235 cases in 2021, rising to 724,309 cases in 2022, and further increasing to 821,200 cases in 2023. The most recent report on March 16, 2024, recorded 172,233 cases [3].

The national TB case notification target for 2023 is 90%, but East Nusa Tenggara is one of four provinces (Riau Islands, East Nusa Tenggara, Bangka Belitung Islands, and Bengkulu) that have a TB notification achievement of less than 50%. East Nusa Tenggara is also the only priority province among the eight prioritized provinces in Indonesia with a notification achievement below 50% [1]. According to data from the East Nusa Tenggara Central Statistics Agency, 9,535 confirmed pulmonary TB cases were recorded in 2023, showing a significant increase compared to 4,798 cases in the previous year. Although TB case detection

in East Nusa Tenggara Province has increased, it still falls short of the national target.

Kupang City is the largest contributor to TB cases in East Nusa Tenggara Province, with 1,253 cases reported in 2023. This increase in TB case detection is influenced by various factors, including the proactive efforts of health workers and community health volunteers in identifying and finding TB sufferers within their respective areas. Each Community Health Center (Puskesmas) refers patients to follow-up health facilities for further management.

The Oesapa Community Health Center is one of the active centers in Kupang City that plays a significant role in combating TB in its working area, supported by the availability of Molecular Rapid Test (MRT) equipment. The prevalence of TB cases at the Oesapa Community Health Center includes 48 cases distributed across five subdistricts: 20 cases in Oesapa Subdistrict, 13 in Lasiana Subdistrict, 7 in South Oesapa Subdistrict, 6 in West Oesapa Subdistrict, and 2 in Kelapa Lima Subdistrict.

There are two groups of people at high risk of contracting TB: those who have recently been infected with TB bacteria and those with medical conditions that weaken the immune system [4]. Previous research has identified several risk factors associated with TB incidence, including residential density, knowledge, and behavior variables, which are significantly related to TB transmission. Knowledge is particularly linked to TB prevention efforts [5]. Other studies have found that gender, a family history of TB, access to information, and residential density are the most dominant factors associated with TB incidence [6]. Additionally, findings indicate that levels of knowledge, attitudes, and actions regarding TB are related to its incidence [7]. Further research has revealed a significant relationship between age, gender, education, knowledge, attitudes, and actions with TB incidence, with actions being the most influential variable [8]. This study aims to identify TB cases and describe the factors influencing the spread of TB in the Oesapa Community Health Center work area, contributing to the development of effective TB prevention and control strategies. Previous research has identified risk factors associated with TB incidence, including residential density, knowledge, and behavior variables. This study builds on existing knowledge to inform targeted interventions and improve public health outcomes.

2. LITERATURE REVIEW

Tuberculosis (TB) is a major public health concern globally, with Indonesia ranking second in the world for the highest number of TB cases [2]. The spread of TB is influenced by various factors, including demographic, behavioral, and environmental factors.

Demographic factors such as age, gender, and education level have been identified as risk factors for TB transmission [6]. A study by Anggraini and Hutabarat (2021) found that age and gender were significantly associated with TB incidence, with older adults and males being more likely to contract TB.

Behavioral factors such as smoking behavior, exercise habits, and phlegm removal behavior have also been identified as risk factors for TB transmission (Ridwan, 2019). Smoking behavior has been found to increase the risk of TB transmission by damaging the lungs and making them more susceptible to infection [7].

Environmental factors such as residential density and availability of information have also been identified as risk factors for TB transmission (Budi et al., 2018). Residential density has been found to increase the risk of TB transmission by increasing the likelihood of close contact between individuals [8].

Community-based interventions have been found to be effective in preventing TB transmission [7]. A study by Ridwan (2019) found that community-based interventions increased knowledge and attitudes towards TB among community members.

The role of healthcare systems in preventing TB transmission has also been highlighted (World Health Organization, 2023). A study by Kemenkes RI (2023) found that healthcare systems played a crucial role in detecting and treating TB cases.

In conclusion, the spread of TB is influenced by various factors, including demographic, behavioral, and environmental factors. Community-based interventions and healthcare systems play a crucial role in preventing TB transmission.

3. MATERIALS AND METHODS

Study Design

This research employed a cross-sectional study design and was conducted in the Oesapa Community Health Center working area from June to July 2024. The study population included all TB patients recorded in the Oesapa Community Health Center working area, as well as household contacts of these patients.

Participant and Sampling

The total population consisted of 384 individuals, calculated by multiplying the number of recorded TB patients (48) by the number of contacts per patient (8). Random sampling was used to select a sample size of 150 participants. The study also incorporated inclusion and exclusion criteria for selecting respondents to be included in the research sample.

Variable

The independent variables in this study included gender, age, education level, occupation, level of knowledge, attitude, behavior related to expelling phlegm, smoking, residential density, availability of information, and symptoms such as cough, shortness of breath, weight loss, decreased appetite, fever, night sweats, as well as history of diabetes mellitus (DM) and treatment dropout. The dependent variable was the result of a positive TB Rapid Molecular Test (MRT) examination conducted on the sample. Data were collected using a questionnaire and processed through editing, coding, data entry, cleaning, and analysis stages.

Data collection

Data were collected through a combination of questionnaires, medical records, and Molecular Rapid Test (MRT) results. Participants completed a self-reported questionnaire on demographic characteristics, smoking behavior, exercise habits, residential density, availability of information, and symptoms. Medical records provided data on TB diagnosis and treatment, while MRT results confirmed TB diagnosis. The questionnaire was administered by trained research assistants, and data were collected over a period of three months. Completed questionnaires and medical records were reviewed for accuracy and completeness before data analysis.

Data analysis

Data analysis included univariate analysis to describe respondent characteristics and bivariate analysis to examine the correlation between independent and dependent variables using the Spearman rank test.

Statistical analysis

Statistical analysis was performed using descriptive statistics and bivariate analysis to determine the relationships between variables and TB diagnosis. Frequency distributions and percentages were used to summarize demographic characteristics and other variables. Pearson's chi-square test and Fisher's exact test were used to examine the associations between categorical variables and TB diagnosis, while independent sample t-tests and Mann-Whitney U tests were used for continuous variables. Correlation analysis was performed using Spearman's rank correlation coefficient. Statistical significance was set at $p < 0.05$, and all analyses were conducted using SPSS software version 23.

Ethical Approval

This research received ethical approval from the Health Research Ethics Commission, Faculty of Public Health, Nusa Cendana University, under the number 001890/KEPK FKM UNDANA/2024.

4. RESULTS

Variable	Result of MRT		Total	Test spearman rank	
	Positive	Negative		P value	rho
Gender					
Male	26	52	78	1,000	0,000
Female	24	48	72		
Age					
Age ≤ 45 Tahun	36	78	114	0,421	-0,066
Age ≥ 46 Tahun	14	22	36		
Education					
Low	24	37	61	0,199	0,106
High	26	63	89		
Occupation					
Unemployed	32	50	82	0,106	0,133
Employed	18	50	68		
Knowledge					

Poor	3	1	4	0,074	0,146
Good	47	99	146		
Attitude					
Unsupportive	0	0	0	-	-
Supportive	50	100	150		
Plegm Removal Behavior					
Poor	22	26	48	0,026	0,182
Good	28	74	102		
Smoking Behavior					
Smoker	35	35	70	0,000	0,331
Non Smoker	15	65	80		
Exercise Habits					
Once a Week	8	28	36	0,034	-0,173
2 – 3 Times a Week	9	24	33		
Never	33	48	81		
Residential Density					
Overcrowded	16	23	39	0,239	0,097
Noncrowded	34	77	111		
Availability of Information					
Available	49	97	146	0,722	0,029
Unavailable	1	3	4		
Cough Symptoms					
Yes	50	39	89	0,000	0,585
No	0	61	61		
Symptoms of Shortness of Breath					
Yes	43	20	63	0,000	0,630
No	7	80	87		
Weight Loss					
Yes	45	21	66	0,000	0,655
No	5	79	84		
Loss of Appetite					
Yes	45	21	66	0,000	0,655
No	5	79	84		
Fever					
Yes	44	16	60	0,000	0,693
No	6	84	90		
Night Sweats Without Physical Activity					
Yes	42	19	61	0,000	0,624
No	8	81	89		

Table 1: Analysis of the Relationship Between Independent and Dependent Variables

Data in Table 1 shows that 26 male respondents tested positive for TB, while 24 female respondents also tested positive. Meanwhile, 52 male respondents tested negative for TB, as did 48 female respondents. This suggests that more TB-positive respondents were male. The statistical test results showed a p-value of 1.000 > 0.05, indicating no significant relationship between gender and positive TB MRT results in the Oesapa Community Health Center Work Area in 2024.

Among TB-positive respondents, 36 were aged ≤ 45 years, and 14 were aged ≥ 46 years. Of the 100 respondents with negative MRT results for TB, 78 were aged ≤ 45 years, and 22 were aged ≥ 46 years. Overall, most respondents were aged ≤ 45 years, regardless of their TB status. The statistical test showed a p-value of 0.421 > 0.05, indicating no significant relationship between age and positive MRT results for TB.

Next, 24 TB-positive respondents had a low

education level, while 26 had a high education level. Among TB-negative respondents, 61 had a low education level, and 89 had a high education level. The statistical test results showed a p-value of 0.199 > 0.05, concluding that there was no significant relationship between education level and positive TB MRT results.

Among the TB-positive respondents, 32 were unemployed, while 18 were employed. Among TB-negative respondents, 50 were unemployed, and 50 were employed. It was concluded that most TB-positive respondents were unemployed. The statistical test results showed a p-value of 0.106 > 0.05, indicating no significant relationship between employment status and positive MRT results for TB.

A total of 3 respondents with positive MRT results for TB had poor knowledge, while the remaining 47 had good knowledge. Among those with negative MRT results for TB, only 1 respondent had poor knowledge, while 99 had good knowledge. This indicates that nearly all respondents, whether positive or negative for TB, had good knowledge about the disease. The statistical test showed a p-value of 0.074 > 0.05, indicating no significant relationship between the level of knowledge and positive MRT results for TB.

Respondents with either positive or negative MRT results for TB exhibited a supportive attitude towards TB prevention, as all respondents had a positive attitude. There were no respondents with an unsupportive attitude, regardless of their TB status, indicating a universally supportive stance towards TB prevention among the study participants.

Among the TB-positive respondents, 22 had poor phlegm-removal behavior, while 28 exhibited good behavior. In the TB-negative group, 26 respondents had poor behavior, while 74 demonstrated good phlegm-removal practices. Both TB-positive and TB-negative respondents more frequently exhibited good behavior. The statistical test showed a p-value of 0.026 < 0.05, with rho = 0.182 and r = 3.31%, indicating a weak positive relationship between poor phlegm removal behavior and a 3.31% variation in increased positive MRT results for TB.

Among respondents with positive MRT results for TB, 35 had smoking habits, while 15 did not smoke. In contrast, among those with negative MRT results, 35 were smokers, and 65 were non-smokers. This indicates that the majority of TB-positive respondents had smoking habits, while the majority of TB-negative respondents were non-smokers. Statistical test results showed a p-value of 0.000 < 0.05, rho = 0.331, and r = 10.95%, indicating a weak positive relationship between smoking behavior and positive MRT results for pulmonary TB, with a 10.95% increase in smoking associated with positive MRT results.

Among TB-positive respondents, 8 exercised once a week, 9 exercised 2-3 times a week, and 33 had no exercise habits. For TB-negative respondents, 28 exercised once a week, 24 exercised 2-3 times a week, and 48 never exercised. More TB-positive respondents did not exercise, similar to TB-negative respondents. Statistical test results showed a p-value of 0.034 < 0.05, rho = -0.173, and r = 2.99%, indicating a very weak negative relationship between exercise habits and a 2.99% reduction in positive MRT results for TB.

Among TB-positive respondents, 16 lived in overcrowded homes, while 34 lived in non-crowded homes. Among TB-negative respondents, 23 lived in overcrowded homes, and 77 lived in non-crowded homes. It was concluded that most TB-positive and TB-negative respondents lived in non-crowded housing. The statistical test results showed a p-value of 0.239 > 0.05, indicating no significant relationship between residential density and positive MRT results for TB.

There were 49 TB-positive respondents who received information about TB from the health facilities they visited, while 1 TB-positive respondent did not receive any information. Among TB-negative respondents, 97 received information, and 3 did not. This suggests that nearly all respondents had access to TB-related information from health facilities. Statistical testing on the availability of information variable showed a p-value of 0.722 > 0.05, indicating no significant relationship between information availability and positive MRT results for TB.

A total of 89 respondents had cough symptoms, including 50 who were positive for TB and 39 who were negative. Sixty-one respondents without cough symptoms had negative MRT results. The statistical test results showed a p-value of 0.000 < 0.05, rho = 0.585, and r = 34.22%, suggesting a moderate positive relationship between cough symptoms and

positive TB MRT results. This implies that the increase in cough symptoms among respondents corresponded with a 34.22% increase in positive MRT results for TB.

Among TB-positive respondents, 43 had symptoms of shortness of breath, while 7 did not. In the TB-negative group, 20 had symptoms of shortness of breath, and 80 did not. Statistical testing showed a p-value of 0.000 < 0.05, rho = 0.630, and r = 39.69%, indicating a moderate positive relationship between shortness of breath symptoms and positive TB MRT results, with a relationship variation of 39.69%.

Sixty-six respondents reported symptoms of weight loss, including 45 TB-positive and 21 TB-negative respondents. Of the 84 respondents without weight loss symptoms, 5 were positive for TB, and 79 were negative. Statistical testing showed a p-value of 0.000 < 0.05, rho = 0.655, and r = 42.90%, indicating a moderate positive relationship between weight loss symptoms and positive MRT results for TB, with a relationship variation of 42.90%.

A total of 66 respondents had symptoms of decreased appetite; 45 of them were positive for TB, while the remaining 21 were negative. Among 84 respondents without decreased appetite, 5 were positive for TB, and 79 were negative. The statistical test results showed a p-value of 0.000 < 0.05, rho = 0.655, and r = 42.90%, indicating a moderate positive relationship between decreased appetite and positive TB MRT results, with a relationship variation of 42.90%.

Sixty respondents had fever symptoms, with 44 testing positive for TB and 16 testing negative. Ninety respondents did not have fever symptoms; among them, 6 were positive for TB, and 84 were negative. The statistical test showed a p-value of 0.000 < 0.05, rho = 0.693, and r = 48.02%, suggesting a moderate positive relationship between fever symptoms and positive TB MRT results, with a 48.02% variation in the relationship.

There were 61 respondents who experienced night sweats without physical activity; of these, 42 were positive for TB and 19 were negative. Among 89 respondents without night sweats, 8 were positive for TB, and 81 were negative. Statistical testing found a p-value of 0.000 < 0.05, rho = 0.624, and r = 38.93%, indicating a moderate positive relationship between night sweats without physical activity and positive TB MRT results, with a 38.93% relationship variation.

5. DISCUSSION

Gender and Positive MRT Results for TB

The results of this study show that more male respondents tested positive for TB based on MRT examination compared to female respondents. This aligns with the findings of Sunarmi and Kurniawaty (2022), who reported that pulmonary tuberculosis is more prevalent in men than in women. Women are generally more attentive to their health, making them less likely to suffer from pulmonary tuberculosis [9]. Similarly, other research found that 65.22% of TB cases occurred in men compared to women [10]. A multivariate analysis of gender by Faris Muaz (2014) reported an OR of 4.772 (CI: 2.260-10.076), indicating that male respondents were 3.8 times more likely to develop pulmonary TB than female respondents [11]. A screening study conducted among the homeless population in Korea found that gender influenced TB incidence, with a risk factor of 0.65 times in women [12]. However, this differs from the current study, which found no statistically significant influence of gender on TB incidence, despite the higher percentage of cases in men. Men are often outside the home due to work demands, increasing their potential exposure to TB when interacting with diverse groups of people. Additionally, men are more likely to engage in risky behaviors, such as smoking, alcohol consumption, and frequently staying up late, which can weaken the immune system. A weakened immune system increases susceptibility to disease transmission, particularly TB.

Age and Positive MRT Results for TB

This study found that the majority of TB-positive respondents were aged ≤ 25 years and 26–35 years, which corresponds to the productive age range. Individuals in this age group are often actively engaged in work outside the home. Heavy work demands, if not counterbalanced by a healthy diet and regular exercise, can lead to decreased body resilience. This finding is consistent with other research indicating that the majority of TB cases occur within the productive age group, specifically 20-30 years old [13]. Pulmonary tuberculosis is frequently observed in economically active individuals aged 15-49 years [14]. A cohort study in England also revealed a relationship between age and TB incidence (MacPherson et al., 2016), and another study found a significant relationship between age and TB (p = 0.003) [15]. However, the results of this research conducted in the Oesapa Community Health

Center working area differ, as it found no significant relationship between age and positive TB MRT examination results.

Educational Level and Positive MRT Results for TB

The findings indicate that most respondents have achieved a relatively high level of education. However, the majority of TB-positive respondents were at the higher education levels, ranging from high school graduates to college graduates. This is consistent with other research, which found the largest number of TB respondents at the high school education level, accounting for 52.7% [16]. Another study also reported that a significant proportion of TB patients had relatively high education levels, with 82.9% having completed high school or higher [17]. Bivariate analysis found no significant relationship between educational level and positive TB MRT results. The discrepancy between theoretical expectations and field conditions may be attributed to various regional factors that significantly impact disease transmission. The community's inability to maintain a clean and healthy lifestyle, coupled with the relatively dense residential conditions in the Oesapa area, likely facilitates the spread of TB.

Occupation and Positive TB MRT Results

The study results reveal no significant relationship between occupation and positive TB MRT results in the Oesapa Community Health Center working area for 2024. This finding aligns with previous research, which found no significant influence of occupational factors on TB diagnosis in Indramayu Regency in 2022 [18]. The results suggest that occupation does not significantly contribute to TB spread, as other factors, such as maintaining a stable immune system, play a more critical role in preventing TB transmission.

Knowledge and Positive TB MRT Results

Most respondents demonstrated good knowledge of tuberculosis, as evidenced by the research data: 94.0% of TB-positive respondents had good knowledge about TB, while 6.0% had poor knowledge. Among the misconceptions, 6.0% of respondents incorrectly identified TB as a disease caused by a lack of blood, and 38.0% mistakenly believed it was caused by cigarette smoke. Previous studies have highlighted similar knowledge gaps in various communities, such as those in pastoral areas in Ethiopia, where significant misunderstandings about TB's causes, signs, symptoms, transmission, prevention, and treatment were observed [19]. Consistent findings were reported in rural Uganda, where misconceptions included heredity, heavy work, sharing utensils, and smoking as causes of TB [20].

Statistical analysis found no significant relationship between knowledge and positive TB MRT results in the Oesapa Community Health Center working area. This contrasts with previous research, which identified a significant relationship between knowledge and the incidence of pulmonary TB transmission. For example, in the Bandarharjo Health Center Semarang area, respondents with poor knowledge were found to be 5.13 times more likely to contract pulmonary TB compared to those with good knowledge [21].

Attitudes and Positive TB MRT Results

Overall, respondents displayed a positive attitude towards TB prevention, likely influenced by their personal experiences, particularly those who had contact with TB patients. Other research, such as a study at the Sukaraja Community Health Center in 2021, found that although respondents generally had poor attitudes, they exhibited good TB prevention behavior (61.5%) [22]. This study suggests that a supportive attitude towards TB prevention does not necessarily correlate with effective prevention behavior. Despite many respondents having a positive attitude towards TB prevention, TB cases remain high, indicating that supportive attitudes alone are insufficient without corresponding preventative actions. Good knowledge about TB likely contributes to these positive attitudes and perceptions.

Phlegm Removal Behavior and Positive TB MRT Results

Inhalation of dried and evaporated sputum or phlegm from TB sufferers by others can contribute to the transmission of pulmonary TB [23]. Disposing of phlegm or spit in inappropriate places can further spread TB bacteria, as TB can survive and potentially spread when phlegm or spit is not disposed of properly (Yigibalom et al., 2019; Hidayat et al., 2017; Habsah, 2012). The findings of this study reveal that 48 respondents still discard phlegm in random places rather than following proper disposal guidelines, with 22 of these individuals testing positive for TB. Conversely, most respondents now adhere to proper phlegm disposal practices. These findings align with previous research that reported a higher percentage of good phlegm removal behavior, at 76.0% [23]. However, research conducted in Papua found that a majority of TB sufferers exhibited poor phlegm removal behavior [24]. Additionally, other studies indicate that a significant proportion of TB sufferers (69.8%) still engage in poor TB prevention behavior [27]. The results also show a significant, though very

weak, relationship between sputum expelling behavior and positive TB Molecular Rapid Test results, with a correlation coefficient of r=0.182r = 0.182r=0.182 and an effect size of 3.31%. This is consistent with findings from Papua, where indiscriminate phlegm disposal was associated with increased TB incidence [24].

Smoking Behavior and Positive TB MRT Results

Nicotine in cigarettes can impair immune function by reducing the production of TNF-α, which is crucial for activating macrophages and CD4+ lymphocytes, thus weakening the immune response. This impairment results in reduced mucosal secretions, diminished phagocytic ability of alveolar macrophages, and a lowered immune response, making it easier for TB bacteria to colonize (Silva et al., 2018 in Rahmani, 2020). In this study, 70 respondents were identified as active smokers, with 35 of them testing positive for TB. Previous research reported that 51.6% of respondents were active smokers [28]. Another study found that among pulmonary TB sufferers, 73.1% were smokers, with a bivariate analysis indicating that smokers had a 3.701 times greater risk of contracting pulmonary TB compared to non-smokers [29]. This aligns with our findings, which show a significant relationship between smoking behavior and positive TB Molecular Rapid Test results, with a weak correlation coefficient of r=0.331r = 0.331r=0.331. This positive correlation indicates that smoking behavior is associated with an increased rate of TB diagnoses in the Oesapa Community Health Center working area. Smoking habits also increase the risk of developing pulmonary TB by 5.156 times. Smokers are more likely to experience worsening health conditions, which can lead to recurrence and treatment failure in TB patients [30]. Additionally, other research found a significant influence of smoking on TB patients compared to a control group, with multivariate analysis showing a significant effect of family smoking history on TB cases (OR 2.8, 95% CI: 1.1-8.4) and a history of smoking for over 10 years (OR 1.6, 95% CI: 1.2-9.8) [31]. Consistent with these findings, research conducted at the Oesapa Community Health Center found that the risk of TB was 4.469 times higher among smokers compared to non-smokers.

Exercise Habits and Positive TB MRT Results

This study found that 81 respondents had never engaged in physical exercise, of whom 33 tested positive for TB. Among those who exercised 2–3 times a week, 9 respondents tested positive, and among those who exercised once a week, 8 respondents tested positive. Bivariate testing indicates a negative relationship, where a decrease in the frequency of exercise is associated with an increase in positive MRT results for TB. Another study comparing case and control groups found that 81.48% of the case group did not engage in healthy exercise behaviors compared to the control group and suggested that exercise could reduce the risk of Mycobacterium tuberculosis resistance [32]. Exercise can also strengthen the immune system, helping to protect individuals from TB or aid in recovery for those already infected [33]. Previous research has demonstrated that exercise habits can reduce the risk of TB transmission [34].

Residential Density and Positive TB MRT Results

According to the Minister of Health Decree No. 829/Menkes/SK/VII/1999, the minimum bedroom area should be 8 m², with no more than 2 people per room. If these standards are not met, the residence is classified as overcrowded. High residential density can facilitate the transmission of diseases among family members, especially when their immune systems are compromised. An increased number of occupants leads to decreased oxygen levels in the room, which can exacerbate the spread of tuberculosis [35]. This study found that the majority of respondents lived in houses that were not densely populated. The findings from the Oesapa Community Health Center working area indicated no significant relationship between residential density and positive TB MRT examination results. This is inconsistent with previous research, which found an association between residential density and the incidence of TB (P-value = 0.014) [36].

Availability of Information and Positive TB MRT Results

A total of 92.0% of respondents reported that information boards, brochures, or leaflets about TB were available at the health facilities they visited. Additionally, 98.0% of the officers provided explanations about TB, and 96.0% of respondents were able to ask health workers about TB information. Out of 146 respondents with available information, 49 were positive for TB, and 4 were negative, with 1 positive and 3 negative among those who did not have information. The presence of leaflets and brochures about TB helps increase correct understanding of TB's causes, symptoms, transmission, and control at the individual level. Accessible information supports TB patients in obtaining necessary health services [37]. With adequate information, individuals are more likely to seek immediate treatment at the nearest health

facility.

Cough Symptoms and Positive TB MRT Results

Bivariate testing in this study found a significant relationship between cough symptoms and the incidence of TB, as confirmed by the Molecular Rapid Test (p-value = 0.000 < 0.05; r = 0.585). The association is categorized as moderate and indicates a unidirectional relationship, meaning an increase in cough symptoms is associated with an increase in TB cases. Coughing can release up to 3,000 droplets of phlegm into the air, which can survive at room temperature for several hours and potentially lead to infection if inhaled. Adequate ventilation or airflow and exposure to direct sunlight can reduce the risk of TB transmission from phlegm droplets [38]. One cough can release around 3,000 droplets containing 0-3,500 tuberculosis bacteria, while sneezing can expel between 4,500 and 1,000,000 tuberculosis bacteria [39]. According to Lee et al., (2020) TB sufferers tend to cough more frequently than non-TB sufferers, and the severity of the cough can reflect the severity of the TB condition.

Symptoms of Shortness of Breath with Positive MRT Results for TB

This study found a significant relationship between shortness of breath and positive MRT examination results for TB (p-value = 0.000 < 0.05; r = 0.630), with shortness of breath accounting for 39.69% of the variance in the dependent variable. Shortness of breath, a condition where an individual feels a lack of air, difficulty breathing freely, or breathlessness in various situations (e.g., walking, running, or even sitting), is a common symptom of TB. This symptom occurs due to lung tissue damage caused by the infection.

Symptoms of Weight Loss with Positive TB MRT Results

TB infection can increase the body's metabolism and reduce appetite, leading to significant weight loss due to decreased energy reserves. The study found a relationship between weight loss symptoms and TB with a strong correlation (p-value = 0.000 < 0.05; r = 0.655), explaining 42.90% of the variance in the model. Previous research indicates that low body mass index (BMI) is associated with TB reactivation, as a low BMI can predispose individuals to TB [41]. This is supported by research in Riau, which found a link between BMI and TB incidence [42].

Loss Appetite with Positive TB MRT Results

Appetite can be influenced by various hormonal factors. In TB patients, leptin, a hormone that suppresses appetite, tends to increase, while ghrelin, which stimulates appetite, tends to decrease. Previous studies have shown lower levels of ghrelin in malnourished individuals compared to those who are well-nourished, and leptin concentrations can decrease with TB treatment [43].. This study found a significant relationship between decreased appetite and positive TB MRT examination results (p-value = 0.000 < 0.05; r = 0.655), accounting for 45.42% of the variance in the model.

Fever Symptoms with Positive TB MRT Results

The study results revealed a significant relationship between fever symptoms and the incidence of TB at the Oesapa Community Health Center (p-value = 0.000 < 0.05; r = 0.693), with fever explaining 48.02% of the variance in the model. TB patients often experience fever as part of the body's response to the Mycobacterium tuberculosis infection. When TB bacteria infect the body, the immune system releases chemicals such as cytokines (e.g., interleukins and tumor necrosis factor) to combat the infection. These chemicals can elevate body temperature, leading to fever.

Symptoms of Night Sweats with Positive TB MRT Results

Night sweats are a significant symptom in TB patients, impacting both diagnosis and disease management. The occurrence of night sweats, though not fully understood, is believed to be linked to the body's circadian rhythm [44]. Night sweats indicate that the body is actively fighting an infection and can signal that TB is still active and requires effective treatment. Excessive sweating can lead to fluid and electrolyte loss, which may need medical attention to prevent dehydration and imbalances. The study found a significant relationship between night sweats and positive MRT examination results for TB (p-value = 0.000 < 0.05; r = 0.624), with night sweats explaining 38.93% of the variance in TB results. This study's findings should be interpreted in light of its limitations, including the cross-sectional design, which precludes causal inferences, and the reliance on self-reported data, which may be subject to bias. Additionally, the study's generalizability may be limited by the convenience sampling method and the focus on a single health center. Nevertheless, the study's strengths include its contribution to the understanding of TB diagnosis in the Oesapa Community Health Center working area, its exploration of various factors associated with TB diagnosis, and its use of a comprehensive data collection approach, which included questionnaires,

medical records, and MRT results.

6. CONCLUSION

The study concludes that the variables significantly related to positive TB MRT examination results in the Oesapa Community Health Center area in 2024 include phlegm removal behavior, smoking behavior, exercise habits, coughing, shortness of breath, weight loss, loss appetite, fever, and night sweats without physical activity.

7. RECOMMENDATIONS

Given that some respondents still misunderstand the causes of TB, there is a need for public education on TB, including correct cough etiquette and proper phlegm disposal to prevent infection. Additionally, promoting a Clean and Healthy Lifestyle within the community is essential to improving overall health.

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9. CONFLICT INTEREST

The authors declare that they have no conflict of interest.

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