



FACTORS INFLUENCING THE OCCURRENCE OF PULMONARY TUBERCULOSIS IN THE PRODUCTIVE AGE GROUP

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ABSTRACT

Tuberculosis (TB) remains a major public health issue, particularly in developing countries like Indonesia, which ranks third globally for TB cases. In Papua, the number of TB cases has been steadily increasing, especially among the productive age group (15-50 years). This study aims to analyze the factors influencing the occurrence of pulmonary tuberculosis in Nabire District, Central Papua, using an observational analytic design with a case-control study. The case population in this study consists of all patients diagnosed with pulmonary tuberculosis (TB) BTA (+) residing in the working area of Sriwini Health Center, totaling 50 individuals. The control population includes patients diagnosed with negative pulmonary TB, totaling 100 individuals, with a total sample size of 150, selected using the total sampling technique. The instrument used in this study is a questionnaire, which contains a list of questions related to the respondent's identity and the variables of the study, including age, gender, occupation, smoking status, alcohol consumption, housing density, house lighting, and household contact history. The questionnaire used is standardized with a Cronbach's alpha value of 0.937, so no validity or reliability testing was conducted. The data from this study were analyzed using the chi-square test. The results provide valuable insights into the local epidemiology of TB and underscore the need for targeted public health interventions to address these risk factors. Improving TB detection, treatment adherence, and public awareness are essential for controlling the TB burden in Nabire and similar areas in Central Papua.

Keywords: age; risk factor; sex; smoking; TBC

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INTRODUCTION

Tuberculosis (TB) is a contagious disease caused by the bacterium *Mycobacterium tuberculosis*. This bacterium is a bacillus that is acid-fast, commonly referred to as AFB (Acid-Fast Bacilli), and primarily affects the lungs, causing pulmonary tuberculosis (TB). In addition to the lungs, this bacterium can also infect other organs, such as the lymph nodes, pleura, bones, and more. Pulmonary TB is a disease that spreads through airborne droplets of mucus or sputum from a TB patient when they cough or sneeze, potentially transmitting TB to others. The TB bacteria can remain in the air for extended periods, especially in dark and humid environments. Therefore, individuals in the same room as a TB patient are at higher risk of contracting the disease (Rosdiana, 2018).

Pulmonary TB is a significant issue for developing countries, including Indonesia, where it is estimated that 95% of TB cases occur in developing countries, with approximately 89% of TB cases found in adults and 11% in children. To date, TB remains one of the leading causes of death worldwide, second only to HIV/AIDS, and is among the top 20 causes of death globally. Indonesia ranks third in the world for the highest number of TB cases, following India and China (WHO, 2021)

The World Health Organization (WHO) reported that the estimated number of people diagnosed with TB globally in 2021 was 10.6 million cases, an increase of approximately 600,000 cases from 2020, when 10 million cases were estimated. Of these 10.6 million cases, 6.4 million (60.3%) people have been reported and are receiving treatment, while 4.2 million (39.7%) have not been diagnosed or reported. Of the total 10.6 million cases in 2021, approximately 6 million were adult men, 3.4 million were adult women, and the remaining cases were children, totaling 1.2 million cases. TB-related deaths are also very high, with at least 1.6 million deaths due to TB, a rise from the previous year when approximately 1.3 million deaths occurred. Additionally, 187,000 people died from both TB and HIV (WHO, 2021)

According to the Global Tuberculosis Report of 2021, the incidence rate of TB in Indonesia in 2020 was 301 per 100,000 people, a decrease from the 2019 rate of 312 per 100,000 people. However, the TB mortality rate in 2019 and 2020 remained the same at 34 per 100,000 people. In 2021, the number of TB cases identified reached 397,377, an increase from the 351,936 cases in 2020. The highest number of cases were reported from provinces with large populations, such as West Java, East Java, and Central Java, which together accounted for 44% of all TB cases in Indonesia. When comparing by gender, the number of cases in men was higher than in women, both nationally and regionally. Nationally, the male-to-female ratio of TB cases was 57.5% to 42.5% (WHO, 2021;Putri et al., 2023).

The Case Notification Rate (CNR) in Indonesia's health profile for 2021 also increased from 130/100,000 people in 2020 to 146/100,000 people in 2021. This indicates that the number of TB cases that have been treated and reported among 100,000 people in Indonesia continues to rise. The provinces with the highest CNR include Papua (268/100,000), DKI Jakarta (263/100,000), and Gorontalo (223/100,000). The Success Rate, an indicator used to evaluate TB treatment success, refers to the number of cured cases and those who completed their treatment out of all reported and treated TB cases. According to the Ministry of Health's target for this indicator in 2021, which was set at 85%, the national success rate reached 86.0%, although several provinces, including Papua, fell short of the target, with a Success Rate of 72%(Kemenkes RI, 2021;Dinkes Papua, 2022).

Based on data from the Papua Health Department's profile for 2021, the number of positive TB cases in Papua in 2021 was 25,689, an increase from 11,532 cases in 2020. The majority of cases (92%) occurred in the productive age group (15-50 years), and 8% occurred in children aged 0-14 years. The cure rate for TB in Papua was still very low in 2021, with 874 men (37.3%) and 706 women (38.5%) achieving a cure. Moreover, low adherence to TB treatment significantly impacted the cure rates. This research aims to identify the factors that influence the occurrence of pulmonary TB at the Sriwini Health Center in Nabire, Central Papua, in 2024 (Dinkes Papua, 2022).

In Nabire District, Central Papua, pulmonary TB cases have also shown an increasing trend, particularly in the productive age group. This increase indicates that specific factors influence the transmission and prevalence of the disease among the productive population. These factors include age, gender, occupation, smoking habits, alcohol consumption, and household contact with a TB-positive individual (Fawzy, 2017; Kemenkes RI, 2022)The productive age is a period during which individuals are active in economic and social activities, so exposure to risk factors like smoking, alcohol consumption, and high stress from work demands can increase their vulnerability to TB infection (Patil et al., 2018). Furthermore, household contact with TB patients is a significant risk factor, as TB is an airborne disease (Haerana et al.,

2021a). In addition to individual factors, the environmental conditions and healthcare system in Nabire District also affect TB incidence. Limited access to healthcare facilities, inadequate public knowledge about TB prevention, and challenges in detecting TB at early stages exacerbate the control of the disease in the area (Lesatri, 2019)l. The objective of this study is to analyze the factors influencing the occurrence of pulmonary tuberculosis in the productive age group in Nabire District, Central Papua.

METHOD

The research method used in this study is an observational analytic design with a case-control study. A case-control study is an analytic research (survey) that examines how risk factors are studied using a "retrospective" approach. This research was conducted in the working area of Sriwini Community Health Center, Nabire District, Central Papua Province, from July to September 2024. The case population in this study consisted of all patients who underwent a microscopic test at Sriwini Community Health Center in 2023 and 2024 until July, with sputum examination results indicating TB-positive (BTA+), and who resided within the working area of Sriwini Community Health Center, totaling 50 people. The control population consisted of all patients who underwent a microscopic test at Sriwini Community Health Center in 2023 and 2024 until July, with sputum examination results indicating negative TB, totaling 100 people. The case sample in this study was selected using total sampling, meaning the entire case population was used as the research sample. The case group in this study consisted of 50 respondents who were TB patients. For the control sample, the case-control ratio used was 1:2. The control sample size was twice the case sample size, totaling 100 respondents who were TB-negative patients. The control sample was selected using purposive sampling with matching techniques. The instrument used in this study was a questionnaire, which contained a list of questions regarding the respondent’s identity and the variables studied, such as age, gender, occupation, smoking status, alcohol consumption, housing density, lighting conditions, and household contact history. The questionnaire was accompanied by an informed consent form. The questionnaire used is standardized with a Cronbach's alpha value of 0.937, so validity and reliability tests were not performed. The data analysis used in this study was the chi-square test (kai square) and odds ratio (OR) calculation, to determine whether there is a statistically significant relationship between the independent and dependent variables with a significance level of 0.05.

RESULT

Respondent Characteristics

The characteristics of the respondents in this study, both from the case and control groups, are shown in the following table:

Table 1.
Respondent Characteristics

Variable	Case		Control	
	f	%	f	%
Age				
15-64 Year	44	88	100	100
<15 dan >64 Year	6	12	0	0
Sex				
Male	29	58	31	31
Female	21	42	69	69
Smoking				
Yes	23	46	25	25
No	27	54	75	75

Based on the data in Table 1 above, it is known that the most common age group among the case group is the productive age, with 44 people (88%), and in the control group, all 100

people (100%) are within the productive age range. The distribution of gender shows that the majority in the case group are male, with 29 people (57%), while in the control group, the majority are female, with 69 people (69%). In terms of smoking behavior, the case group has 23 smokers (46%) and the control group has 25 smokers (25%). Regarding contact with TB patients, the case group has 9 people (18%) who had contact, and the control group has 11 people (11%).

Analysis of the Relationship Between Age and the Occurrence of Pulmonary Tuberculosis

The results of the analysis of the relationship between age and the occurrence of pulmonary tuberculosis at the Sriwini Health Center in Nabire Regency in 2024 can be seen in the following table:

Table 2.
Relationship Between Age and the Occurrence of Pulmonary Tuberculosis

Age	Group				P-Value
	Case		Control		
	f	%	f	%	
15-64 Year	44	88	100	100	0.002
<15 dan >64 Year	6	12	0	0	

Table 2 shows that the highest percentage is in the productive age category, both in the case group (88%) and the control group (100%). The lowest percentage is in the non-productive age category, both in the case group (12%) and the control group (0%). In the age variable, the statistical test results yielded a P-value of 0.002. The P-value is less than 0.005, which means that the age variable has an effect on the occurrence of pulmonary tuberculosis.

Analysis of the Relationship Between Gender and the Occurrence of Pulmonary Tuberculosis

The results of the analysis of the relationship between gender and the occurrence of pulmonary tuberculosis at the Sriwini Health Center, Nabire Regency in 2024 can be seen in the following table:

Table 3.
Relationship Between Gender and the Occurrence of Pulmonary Tuberculosis at the Sriwini Health Center, Nabire Regency in 2024

Sex	Group				P-Value
	Case		Control		
	f	%	f	%	
Male	29	58	31	31	0.003
Female	21	42	69	69	

Table 3 shows that the highest percentage is in the male category (58%) in the case group, while the highest percentage in the control group is in the female category (69%). In the gender variable, the statistical test results yielded a P-value of 0.003. The P-value is less than 0.005, indicating that the gender variable has an effect on the occurrence of pulmonary tuberculosis.

Analysis of the Relationship Between Smoking Behavior and Pulmonary Tuberculosis Patients with the Occurrence of Pulmonary Tuberculosis

The results of the analysis of the relationship between smoking behavior and pulmonary tuberculosis with the occurrence of pulmonary tuberculosis at the Sriwini Health Center, Nabire Regency in 2024 can be seen in the following table:

Table 4.
Relationship Between Smoking Behavior and Pulmonary Tuberculosis Patients with the Occurrence of Pulmonary Tuberculosis at the Sriwini Health Center, Nabire Regency in 2024

Smoking	Group				P Value
	Case		Control		
	f	%	f	%	
Yes	23	46	25	25	0.016
No	27	54	75	75	

Table 4 shows that the highest percentage is in the non-smoking behavior category, both in the case group (54%) and the control group (75%). The lowest percentage is in the smoking behavior category, both in the case group (46%) and the control group (25%). In the smoking behavior variable, the statistical test results yielded a P-value of 0.016. Since the P-value is greater than 0.005, this indicates that the smoking behavior variable does not have a significant effect on the occurrence of pulmonary tuberculosis.

DISCUSSION

The Relationship Between Age and the Occurrence of Pulmonary Tuberculosis at the Sriwini Health Center, Nabire Regency in 2024

In this study, the relationship between age and the occurrence of pulmonary tuberculosis (TB) at the Sriwini Health Center, Nabire Regency in 2024 was analyzed. The results showed that the highest percentage of respondents in both the case and control groups was in the productive age group, with 88% in the case group and 100% in the control group. On the other hand, the lowest percentage was in the non-productive age group, with only 12% in the case group and 0% in the control group. Statistical analysis of the age variable yielded a P-value of 0.002, which is less than 0.005. This suggests a statistically significant relationship between age and the occurrence of pulmonary tuberculosis. Specifically, the productive age group (15-50 years) is at a higher risk of contracting pulmonary TB. This is consistent with previous studies that show that individuals in the productive age group are more likely to be exposed to factors such as crowded living conditions, smoking, and exposure to TB bacteria, which increase their risk of infection (Haerana et al., 2021b; Patil et al., 2018)

Adults in the productive age group are also more likely to engage in activities that expose them to TB risk, including traveling for work or education, and may face higher stress levels due to economic and social pressures, which can weaken their immune system. These factors make this age group particularly vulnerable to contracting TB. Furthermore, individuals in this age group are often more mobile and may interact with individuals in high-risk environments, which increases their exposure to TB (Wang et al., 2023). In contrast, the non-productive age group, especially children and the elderly, is at a lower risk for contracting TB compared to the working-age population. Children tend to have less exposure to TB bacteria due to more limited social and economic activities, and the elderly population may have weakened immune systems, making them more susceptible to other diseases but not necessarily increasing the prevalence of pulmonary TB (Patil et al., 2018; Wang et al., 2024).

The relationship between productive age and the incidence of tuberculosis (TB) is complex, as age significantly affects susceptibility and disease progression. Research shows that both younger populations (10-24 years) and older adults (65 years and above) experience high rates of TB incidence, although for different reasons. The following section outlines the age-related dynamics. Adolescents and young adults (ages 10-24) account for about 17% of global TB cases, with an estimated 1.78 million new cases in 2012 (Snow et al., 2018). This age group faces unique challenges in detection and treatment, often leading to underreporting and delayed diagnoses (Snow et al., 2018). Older adults (65 years and above) show a significant

increase in TB incidence, with projections indicating that by 2035, they will represent 78% of incident cases in Taiwan (Ku & Dodd, 2019). The elderly population also experiences a higher proportion of bacteriologically confirmed cases, with a significant increase in clinically diagnosed pulmonary TB. While younger individuals are at risk due to social and health factors, older adults face increased vulnerability due to age-related health decline. This dual burden requires targeted TB control strategies for both age groups (Li et al., 2021).

In conclusion, the findings of this study highlight that age, particularly being in the productive age group, is a significant risk factor for the occurrence of pulmonary tuberculosis. The productive age group is more likely to be exposed to factors that contribute to the spread and susceptibility of TB. This aligns with findings from other regions and reinforces the importance of targeted interventions and awareness programs aimed at this group to prevent the spread of tuberculosis (Olmo-Fontánez & Turner, 2022). Age is a predisposing factor for changes in behavior related to the physical and psychological maturity of individuals with pulmonary tuberculosis (TB). According to the Central Statistics Agency (BPS), age is divided into three groups: young age (under 15 years), productive age (15 to 64 years), and elderly (above 64 years). In the spread of TB, individuals of productive age are more vulnerable to infection due to their higher mobility (Kemenkes RI, 2018). Based on the results of univariate analysis, the highest percentage is found in the productive age category for both the case and control groups, with 88% in the case group and 100% in the control group. The lowest percentage is found in the non-productive age category for both the case and control groups, with 12% in the case group and 0% in the control group. The statistical test for age yielded a P-value of 0.002. This P-value, which is less than 0.005, indicates that age has an influence on the occurrence of pulmonary tuberculosis in the working area of the Siriwini Health Center, Nabire Regency.

Individuals under 46 years old typically have higher mobility, which increases their likelihood of exposure to TB bacteria. According to Notoatmodjo, age is the length of time lived from birth, and as people grow older, their ability to address issues generally improves. With age, individuals also tend to mature in how they adjust their behaviors to their environment. Older adults usually adopt better healthcare-seeking behaviors, as they often have fewer work activities, allowing them to follow treatment schedules more consistently. Productive age is the age where individuals have more contact with others, in environments such as schools, workplaces, and others. It is not surprising that this increases the likelihood of coming into contact with TB. Active pulmonary TB infection significantly increases with age, with the highest incidence typically affecting young adults. In Indonesia, it is estimated that 75% of pulmonary TB patients are in the productive age group, 15-50 years old (Sutrisna & Elsi Rahmadani, 2022; Seniantara et al., 2018).

The results of this study align with research at the Peninggalan Community Health Center, Tungkai Jaya District, Musi Banyuasin Regency, South Sumatra Province, in May 2022. Out of 30 respondents with pulmonary TB, 25 (83.3%) were of productive age, while 5 (16.7%) were of non-productive age. The statistical analysis showed a significant relationship between age and the occurrence of pulmonary TB, with respondents of productive age having a 0.284 times higher chance of developing pulmonary TB compared to those of non-productive age (Nopita et al., 2023). Penelitian Sunarmi & Kurniawaty (2022) The majority of pulmonary TB cases are found in individuals aged 15-55 years (productive age), as this age group often spends significant time and energy working. The high level of physical exertion, combined with reduced rest, can weaken the immune system. Conversely, most non-TB individuals are over 55 years old. Based on study findings and relevant theories, the researcher suggests that

there is a significant relationship between age and pulmonary TB incidence. The researcher concludes that older adults are more susceptible to pulmonary TB due to the natural decline in organ function associated with aging. According to the researcher's analysis, pulmonary TB is indeed more common in individuals of productive age due to the higher level of interaction at this stage, as evidenced by the study results, where 44 individuals (88%) in the TB case group were of productive age.

The Relationship Between Gender and Pulmonary Tuberculosis Incidence

Pulmonary TB affects both adults and children, as well as both men and women. The number of TB cases among men is 1.3 times higher than among women. Analysis results show that the highest percentage was found among men (58%) in the case group, while women made up 69% of the control group. Statistical testing of the gender variable produced a P-value of 0.003, which is less than 0.005, indicating that gender significantly influences the incidence of pulmonary tuberculosis. Gender significantly influences tuberculosis (TB) transmission, with notable differences in incidence and mortality rates between men and women. Studies indicate that men are generally more affected by TB due to a combination of physiological, behavioral, and social factors. This review explores gender disparities in TB prevalence, the impact of social determinants, and implications for public health interventions. The global male-to-female ratio for TB notifications is approximately 1.7, with men experiencing higher incidence rates (Law et al., 2020; Miele et al., 2020). Although women are diagnosed less frequently, they often face more severe consequences due to social roles and limitations in healthcare infrastructure (Kubjane et al., 2023). The relationship between gender and the incidence of pulmonary tuberculosis (TB) reveals that men are more commonly affected by the disease compared to women. One contributing factor is that men are more likely to engage in risk behaviors such as smoking, which weakens the immune system and makes them more susceptible to TB. Studies have shown that men are six times more likely to develop TB than women. Additionally, the majority of TB cases occur within the adult age group (20-40 years), where the number of female patients tends to be higher due to gender-specific factors such as healthcare-seeking behavior and social determinants. However, it remains clear that, overall, men have a greater likelihood of contracting TB due to a combination of lifestyle choices, higher exposure to risk factors, and biological differences (Alberta et al., 2022).

Factors such as smoking, alcohol abuse, and malnutrition disproportionately affect men, contributing to higher TB incidence. Women generally exhibit better health-seeking behaviors, which lead to more effective treatment outcomes. Targeted interventions focusing on men, including active case-finding and reducing risky behaviors, could significantly lower TB incidence across the population. Addressing gender-specific barriers to healthcare access is essential to improving TB outcomes for both sexes (Horton et al., 2022; Kubjane et al., 2023). The findings of this study align with research conducted by Sikumbang et al., (2022) at the Tegal Sari Health Center in Medan Denai, where a chi-square test yielded a P-value of 0.006, indicating a significant relationship between gender and pulmonary TB incidence. It was observed that of the 17 male TB cases, there were 8 female TB cases. This study also aligns with research by Nopita et al., (2023) where, among 30 pulmonary TB cases, 22 (73.3%) were male and 8 (26.7%) were female. Statistical analysis results demonstrated a gender-related association with pulmonary TB incidence at the Peninggalan Community Health Center, Tungkal Jaya District, Musi Banyuasin Regency, in 2022. The analysis also yielded an OR=0.305, meaning male respondents were 0.305 times more likely to experience pulmonary TB compared to females (Nopita Evi et al., 2023). Laki-laki lebih berpotensi untuk mengalami kejadian TB paru bila dibanding dengan perempuan, hal ini disebabkan karena laki-laki lebih cenderung melakukan banyak aktivitas di luar rumah, oleh karena itu, peluang

mengalami kejadian TB paru lebih besar (Mendes et al., 2019; Pongkorung et al., 2021; Purwati et al., 2023).

According to Dotulong et al. (2015) The higher incidence of pulmonary TB among men is attributed to their greater mobility compared to women, which increases their likelihood of exposure. Additionally, habits such as smoking and alcohol consumption make men more susceptible to pulmonary TB infection. Men experience poorer clinical outcomes, including higher mortality rates and persistent sputum culture positivity during treatment. This suggests that gender-based disparities persist even after diagnosis (Chidambaram et al., 2021). The findings from this study highlight the need for targeted interventions for both men and women in the fight against TB. Public health strategies should address the specific risks and barriers that men face in seeking timely diagnosis and treatment. For instance, interventions could focus on increasing awareness of TB symptoms, improving access to diagnostic services, and addressing socio-cultural factors that discourage men from seeking medical care. Additionally, gender-sensitive approaches that consider the unique challenges faced by women in accessing healthcare, especially in rural or underserved areas, are also necessary. In conclusion, this study underscores the significant role gender plays in the incidence of pulmonary tuberculosis. Understanding and addressing gender-specific factors, such as behavioral differences, healthcare access, and social influences, is essential for effective TB control and prevention efforts.

The Relationship Between Smoking Behavior and Pulmonary Tuberculosis Incidence

Smoking is the act of burning tobacco and inhaling its contents. According to Hilda Kakuhe (2020), smoking behavior is categorized into two groups: smokers and non-smokers. The substances found in a cigarette, such as nicotine, carbon monoxide, tar, benzene, and methanol, are harmful to the body (Kemenkes RI, 2018). The analysis shows that the highest percentage was in the "Non-Smoking Behavior" group, both in the case group (54%) and the control group (75%). In the variable "Smoking Behavior," the statistical test showed a P-value of 0.016. Since the P-value is less than 0.005, this indicates that smoking behavior has an impact on the incidence of pulmonary tuberculosis. The dangers of smoking for health are profound and diverse, affecting both smokers and those exposed to secondhand smoke. Smoking is a leading cause of preventable diseases and contributes to various serious health issues, including cancer, cardiovascular disease, and respiratory disorders. The following section outlines the primary health risks associated with smoking. Tobacco smoke contains over 4,000 chemicals, with more than 200 known carcinogens, leading to an increased risk of lung cancer and other malignancies (Nur et al., 2022; Ravichandran et al., 2020). Smoking is a major risk factor for heart disease and stroke, with both active and passive smokers facing high risks due to the harmful effects of smoke on blood vessels. Smokers are also vulnerable to chronic obstructive pulmonary disease (COPD), asthma, and pneumonia, while children exposed to secondhand smoke are at risk of developing serious respiratory conditions (Chong, 2023; Ravichandran et al., 2020; Rahman & Huriah, 2021; Rodríguez-hernández et al., 2022; Youn et al., 2022).

Secondhand smoke poses significant health risks, including an increased incidence of respiratory diseases and potential developmental issues in children. Smoking in public places not only endangers health but also creates safety hazards, such as the risk of fire (Chong, 2023). This study aligns with the research conducted by (Nopita et al., 2023). The statistical test showed a p-value of 0.001, indicating a relationship between smoking status and the incidence of pulmonary tuberculosis at the Peninggalan Community Health Center, Tungal Jaya Subdistrict, Musi Banyuasin District, in 2022. The analysis also revealed an odds ratio

(OR) of 0.093, meaning that respondents who smoked had a 0.093 times greater chance of contracting pulmonary tuberculosis compared to non-smokers. Smoking habits are a contributing factor that increases the risk of developing pulmonary tuberculosis. Smoking introduces toxins into the body that can damage health and make individuals more susceptible to various diseases, including tuberculosis bacteria. The risk of contracting pulmonary tuberculosis is 17,500 times higher for smokers compared to non-smokers(Mathofani & Febriyanti, 2020a).

Smoking is a common habit in everyday life and is considered a risk factor for various diseases. Smoking increases the risk of pulmonary tuberculosis by impairing mucosal secretion clearance, reducing the phagocytic ability of alveolar macrophages, and lowering immune response or CD4+ lymphopenia due to nicotine in cigarettes. Routine exposure to cigarette smoke, coupled with environmental pollution, can damage the mucosal secretion process in the tracheobronchial system and impair macrophage function in the alveoli, allowing foreign organisms such as *Mycobacterium tuberculosis* to easily penetrate the body's defense system in the lungs (Darmin et al., 2020; Mathofani & Febriyanti, 2020b)In conclusion, smoking presents significant and wide-ranging health risks, not only for smokers but also for those exposed to secondhand smoke. It is a major contributor to preventable diseases, including cancer, heart disease, respiratory disorders, and stroke. Smoking, with its harmful chemicals and carcinogens, leads to serious conditions such as lung cancer, COPD, and pneumonia. Secondhand smoke further exacerbates these risks, especially for children, by increasing the incidence of respiratory issues and developmental problems. Therefore, the dangers of smoking extend beyond individual health, creating public health and safety concerns as well(Dewi et al., 2020).

CONCLUSION

Based on the research conducted at the Sriwini Health Center, Nabire District, Central Papua Province in 2024, it can be concluded that age and gender have an impact on the incidence of pulmonary tuberculosis (TB), indicating that these factors influence the rate of occurrence of the disease. Smoking also has a significant effect on the incidence of pulmonary TB, suggesting that smoking habits increase the risk of developing this disease. The findings highlight the importance of age, gender, and smoking habits in the prevention and control of pulmonary TB, while other factors need further study to gain a deeper understanding of their relationship with the occurrence of this disease.

REFERENCES

- Alberta, L. T., Tyas, D. T. P., Muafiroh, A., & Yuniarti, S. (2022). Faktor Yang Berhubungan Dengan Kejadian Tuberkulosis Parudi Wilayah Puskesmas Pacarkeling Surabaya. *Jurnal Penelitian Kesehatan (JPK)*, 20(4), 6–12.
- Chidambaram, V., Tun, N. L., Majella, M. G., Ruelas Castillo, J., Ayeh, S. K., Kumar, A., Neupane, P., Sivakumar, R. K., Win, E. P., Abbey, E. J., Wang, S., Zimmerman, A., Blanck, J., Gupte, A., Wang, J. Y., & Karakousis, P. C. (2021). Male sex is associated with worse microbiological and clinical outcomes following tuberculosis treatment: A retrospective cohort study, a systematic review of the literature, and meta-analysis. *Clinical Infectious Diseases*, 73(9), 1580–1588. <https://doi.org/10.1093/cid/ciab527>
- Chong, J. (2023). An Intelligent Detection Approach for Smoking Behavior. *International Journal of Cognitive Informatics and Natural Intelligence*, 17(1), 1–18. <https://doi.org/10.4018/IJCINI.324115>

- Darmin, D., Akbar, H., & Rusdianto, R. (2020). Faktor yang Berhubungan dengan Kejadian Tuberkulosis Paru di Wilayah Kerja Puskesmas Inobonto. *Media Publikasi Promosi Kesehatan Indonesia (MPPKI)*, 3(3), 223–228. <https://doi.org/10.56338/mppki.v3i3.1147>
- Dewi, A. A. I. S., Andrika, P., & Artana, I. B. (2020). Gambaran Karakteristik Pasien Tuberculosis Di Poliklinik Paru RSUP Sanglah Denpasar. *Jurnal Medika Udayana*, 9(6).
- Dinkes Papua. (2022). *Profil Kesehatan Dinas Kesehatan Papua 2022*.
- Dotulong Jendra F.J, Margareth R. Sapulete, G. D. K. (2015). Hubungan faktor risiko umur, jenis kelamin, dan kepadatan hunian dengan kejadian TB paru di desa wori. *Jurnal Kedokteran Tropik*, 1(3), 1–10.
- Fawzy, A. (2017). Factors Influencing Tuberculosis Prevalence in Indonesia. *Journal of Public Health*, 10(3).
- Haerana, B. T., Prihartono, N. A., Riono, P., Djuwita, R., Syarif, S., Hadi, E. N., & Kaswandani, N. (2021a). Prevalence of tuberculosis infection and its relationship to stunting in children (under five years) household contact with new tuberculosis cases. *Indian Journal of Tuberculosis*, 68(3), 350–355. <https://doi.org/https://doi.org/10.1016/j.ijtb.2020.10.011>
- Haerana, B. T., Prihartono, N. A., Riono, P., Djuwita, R., Syarif, S., Hadi, E. N., & Kaswandani, N. (2021b). Prevalence of tuberculosis infection and its relationship to stunting in children (under five years) household contact with new tuberculosis cases. *Indian Journal of Tuberculosis*, 68(3), 350–355. <https://doi.org/10.1016/j.ijtb.2020.10.011>
- Horton, K. C., White, R. G., Hoa, N. B., Nguyen, H. V., Bakker, R., Sumner, T., Corbett, E. L., & Houben, R. M. G. J. (2022). Population benefits of addressing programmatic and social determinants of gender disparities in tuberculosis in Viet Nam: A modelling study. *PLOS Global Public Health*, 2(7), e0000784. <https://doi.org/10.1371/journal.pgph.0000784>
- Kemendes RI. (2018). *Infodatin Tuberculosis*.
- Kemendes RI. (2022). *Profil Kesehatan Indonesia 2022*.
- Kemendes RI. (2021). *Profil Kesehatan Indonesia*. In *Kesehatan Indonesia*. Jakarta.
- Ku, C. C., & Dodd, P. J. (2019). Forecasting the impact of population ageing on tuberculosis incidence. *PLoS ONE*, 14(9). <https://doi.org/10.1371/journal.pone.0222937>
- Kubjane, M., Cornell, M., Osman, M., Boule, A., & Johnson, L. F. (2023). Drivers of sex differences in the South African adult tuberculosis incidence and mortality trends, 1990–2019. *Scientific Reports*, 13(1), 1–11. <https://doi.org/10.1038/s41598-023-36432-6>
- Law, I., Floyd, K., & Group, the A. T. B. P. S. (2020). National tuberculosis prevalence surveys in Africa, 2008–2016: an overview of results and lessons learned. *Tropical Medicine & International Health*, 25(11), 1308–1327. <https://doi.org/https://doi.org/10.1111/tmi.13485>
- Lesatri. (2019). Tuberculosis Control in Papua Province: Challenges and Strategies. *Indonesian Journal of Health*, 5(3).

- Li, S. jin, Li, Y. fan, Song, W. mei, Zhang, Q. yun, Liu, S. qi, Xu, T. ting, An, Q. qi, Liu, J. yue, & Li, H. chen. (2021). Population aging and trends of pulmonary tuberculosis incidence in the elderly. *BMC Infectious Diseases*, 21(1), 1–10. <https://doi.org/10.1186/s12879-021-05994-z>
- M. Nur, Y., Husna, N., & Rosmanidar, R. (2022). Hubungan Pengetahuan tentang Bahaya Merokok dengan Perilaku Merokok Siswa SMP Negeri 2 Lubuk Alung. *Jurnal Akademika Baiturrahim Jambi*, 11(1), 116. <https://doi.org/10.36565/jab.v11i1.507>
- Mathofani, P. E., & Febriyanti, R. (2020a). Factors Associated With The Incidence Of Pulmonary Tuberculosis (TB) In The Working Area Of Serang City Health Center in 2019 The Factors Associated With The Incidence Of Pulmonary Tuberculosis In The Working Area Of Serang City Health Center 2019. *J. Ilm. Health. Masy*, 12(1).
- Mathofani, P. E., & Febriyanti, R. (2020b). Faktor-Faktor Yang Berhubungan Dengan Kejadian Penyakit Tuberkulosis (TB) Paru di Wilayah Kerja Puskesmas Serang Kota Tahun 2019. *JURNAL ILMIAH KESEHATAN MASYARAKAT : Media Komunikasi Komunitas Kesehatan Masyarakat*, 12(1), 1–10. <https://doi.org/10.52022/jikm.v12i1.53>
- Mendes, L. P. S., Moraes, K. S., Hoffman, M., Vieira, D. S. R., Ribeiro-Samora, G. A., Lage, S. M., Britto, R. R., & Parreira, V. F. (2019). Effects of diaphragmatic breathing with and without pursed-lips breathing in subjects with COPD. *Respiratory Care*, 64(2), 136–144. <https://doi.org/10.4187/respcare.06319>
- Miele, K., Bamrah Morris, S., & Tepper, N. K. (2020). Tuberculosis in Pregnancy. *Obstetrics & Gynecology*, 135(6). https://journals.lww.com/greenjournal/fulltext/2020/06000/tuberculosis_in_pregnancy.26.aspx
- Nopita, E., Suryani, L., & Siringoringo, H. E. (2023). Analisis Kejadian Tuberkulosis (TB) Paru. *Jurnal Kesehatan Saelmakers PERDANA*, 6(1), 201–212. <https://doi.org/10.32524/jksp.v6i1.827>
- Olmo-Fontánez, A. M., & Turner, J. (2022). Tuberculosis in an Aging World. *Pathogens*, 11(10), 1–13. <https://doi.org/10.3390/pathogens11101101>
- Patil, K., Bagade, S., Bonde, S., Sharma, S., & Saraogi, G. (2018). Recent therapeutic approaches for the management of tuberculosis: Challenges and opportunities. *Biomedicine & Pharmacotherapy*, 99, 735–745. <https://doi.org/https://doi.org/10.1016/j.biopha.2018.01.115>
- Pongkorung, V. D., Asrifuddin, A., Kandou, G. D., Kesehatan Masyarakat Universitas Sam Ratulangi Manado ABSTRAK, F., Kunci, K., paru, T., & Hunian, K. (2021). Faktor Risiko Kejadian Tb Paru Di Wilayah Kerja Puskesmas Amurang Tahun 2020. *Jurnal KESMAS*, 10(4), 151–157.
- Purwati, I., Afrianty Gobel, F., & Ulmy Mahmud, N. (2023). Faktor Risiko Kejadian TB Paru di Wilayah Kerja Puskesmas Kaluku Bodoa Kota Makassar. *Journal of Muslim Community Health (JMCH)*, 4(4), 65–76. <https://doi.org/10.52103/jmch.v4i4.1336> [JournalHomepage:https://pasca-umi.ac.id/index.php/jmch](https://pasca-umi.ac.id/index.php/jmch)
- Putri, T. R., Hilmi, I. L., & Salman, S. (2023). Review Artikel: Hubungan Pemberian Imunisasi Bcg Terhadap Penyakit Tuberkulosis Pada Anak. *Journal of Pharmaceutical and Sciences*, 6(1), 237–242. <https://doi.org/10.36490/journal-jps.com.v6i1.16>

- Rahman, A., & Huriah, T. (2021). The smoking behavior of health workers in asia: A literature review. *Jurnal Keperawatan Indonesia*, 24(2), 118–130. <https://doi.org/10.7454/jki.v24i2.864>
- Ravichandran, E., Reddy, E., Prabhakar, C., & Aravind. (2020). A Review on Smoking is Injurious to Health. *Scholars International Journal of Biochemistry*, 3(7), 159–162. <https://doi.org/10.36348/sijb.2020.v03i07.002>
- Rodríguez-hernández, G. T., Tadeo, G., & Hernández, R. (2022). *Revista Salud Bosque*. 12, 1–21.
- Rosdiana, R. (2018). Faktor Yang Berhubungan Dengan Kejadian Tuberkulosis Paru Di Rumah Sakit Umum Daerah Labuang Baji Makassar. *PROMOTIF: Jurnal Kesehatan Masyarakat*, 8(1), 78. <https://doi.org/10.31934/promotif.v8i1.233>
- Seniantara, Gabrilinda, Yohana, Adang, Theresia, Ivana, I. K. (2018). Pengaruh Efek Samping Oat (Obat Anti Tuberculosis) Terhadap Kepatuhan Minum. *Jurnal Keperawatan Suaka Insan (Jksi)*, 3(2), 1–12.
- Sikumbang, R. H., Eyanoer, P. C., & Siregar, N. P. (2022). Faktor-Faktor Yang Berhubungan Dengan Kejadian Tb Paru Pada Usia Produktif Di Wilayah Kerja Puskesmas Tegal Sari Kecamatan Medan Denai. *Ibnu Sina: Jurnal Kedokteran Dan Kesehatan - Fakultas Kedokteran Universitas Islam Sumatera Utara*, 21(1), 32–43. <https://doi.org/10.30743/ibnusina.v21i1.196>
- Snow, K., Charalambos, S., Justin, T. D., Susan, M. S., Susan, M. S., Stephen, M., G., & Stephen, M., G. (2018). The incidence of tuberculosis among adolescents and young adults: a global estimate.. *European Respiratory Journal*.
- Sunarmi, S., & Kurniawaty, K. (2022). Hubungan Karakteristik Pasien Tb Paru Dengan Kejadian Tuberkulosis. *Jurnal 'Aisyiyah Medika*, 7(2), 182–187. <https://doi.org/10.36729/jam.v7i2.865>
- Sutrisna, M., & Elsi Rahmadani. (2022). Hubungan Usia dan Jenis Kelamin dengan TB MDR. *Sehat Rakyat: Jurnal Kesehatan Masyarakat*, 1(4), 370–376. <https://doi.org/10.54259/sehatrakyat.v1i4.1168>
- Wang, S., Wu, D., & Zheng, X. (2023). TBC-YOLOv7: a refined YOLOv7-based algorithm for tea bud grading detection. *Frontiers in Plant Science*, 14(August), 1–18. <https://doi.org/10.3389/fpls.2023.1223410>
- Wang, S., Xie, W., Ding, Y., Liu, H., Zhang, X., Yang, L., Chen, X., Chen, M., Zhang, W., Lu, Y., & Xie, H. (2024). Investigations on the Water-Jet Guided Laser drilling film cooling holes on the 8.5 mm-thick TBC superalloy. *Journal of Manufacturing Processes*, 125, 374–388. <https://doi.org/https://doi.org/10.1016/j.jmapro.2024.07.034>
- WHO. (2021). *Global Tuberculosis Report*.
- Youn, B., Hong, S., & Kim, D. (2022). Health Behaviors in Combustible Cigarette, Heated Tobacco Users and Quitters. *Keimyung Medical Journal*, 41(2), 92–96. <https://doi.org/10.46308/kmj.2022.00157>.