

## DESCRIPTIVE EPIDEMIOLOGICAL STUDY OF THE INCIDENCE OF TUBERCULOSIS IN MEDAN CITY AT THE NORTH SUMATRA PROVINCIAL HEALTH OFFICE

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### Abstract

Tuberculosis (TB) is an infectious disease that most often attacks the lungs and is caused by a type of bacteria, namely *Mycobacterium tuberculosis*. WHO explains that in 2022, an estimated 10.6 million people will suffer from tuberculosis worldwide, including 5.8 million men, 3.5 million women and 1.3 million children. In 2022, as many as 1.3 million people in the world will die from TB, including 167,000 people with HIV. Based on data from the North Sumatra Provincial Health Service, the number of tuberculosis cases in North Sumatra was found to be 34,714 cases. In men, there were 22,455 cases or 64.69% and in women, there were 12,259 cases or 35.31%. Tuberculosis cases in Medan City were found to be 10,050 cases. According to gender, the number of Tuberculosis cases in the city of Medan in men was 6,400 cases amounting to 63.68%, higher than Tuberculosis cases in women, namely 3,650 cases amounting to 36.32%. This research aims to determine the incidence of Tuberculosis in the city of Medan descriptively. This research is a quantitative study with a cross-sectional research design using secondary data on National TB Control which has been data collected by the North Sumatra Provincial Health Service in 2023.

**Keywords:** Tuberculosis, Disease Occurrence, Infectious Diseases, Epidemiology

### Introduction

Tuberculosis is an infectious disease caused by the germ *Mycobacterium tuberculosis*. Tuberculosis is still a public health problem that is a global challenge. The Ministry of Health of the Republic of Indonesia explains that TB is an infectious disease caused by the germ *Mycobacterium tuberculosis*. These germs spread from TB patients through the air and usually attack the lung organs.

Tuberculosis (TB) is an infectious disease that most often attacks the lungs and is caused by a type of bacteria. The disease spreads through the air when an infected person coughs, sneezes, or spits. About a quarter of the world's population is estimated to have been infected with the bacterium *Mycobacterium tuberculosis*. About 5–10% of people infected with TB will eventually show symptoms and develop TB disease. Humans who are infected but have not (yet) had the disease cannot transmit it. TB disease is usually treated with antibiotics and can be fatal if left untreated. In certain countries, the Bacille Calmette-Guérin (BCG) vaccine is given to infants or young children to prevent TB.

A total of 1.3 million people died from TB in 2022 (including 167,000 people with HIV). Worldwide, TB is the second infectious killer after Covid-19 (above HIV and AIDS). In 2022, an estimated 10.6 million people will develop tuberculosis worldwide, including 5.8 million men, 3.5 million women, and 1.3 million children. TB occurs in all countries and age groups. Tuberculosis is curative and preventable. (WHO, 2023)

Until now, tuberculosis is still a global problem, even in 2017 WHO reported 1.3 million deaths caused by TB and there were 300,000 deaths from pulmonary TB with HIV. Please note that HIV and TB have a fairly close relationship. This is because in general people with HIV are very easily exposed to mycobacterium tuberculosis which causes TB, because people with HIV have a very low immune system. WHO's 2022 global tuberculosis report provides a comprehensive and up-to-date assessment of TB and progress in prevention, diagnosis, and treatment of the disease at various levels such as global, regional, and country. WHO also said that data from the Ministry of National Health recorded as many as 22 countries and territories with more than 99% of the world's population and reported TB cases. (WHO, 2022)

Indonesia is ranked 3rd with the highest TB cases in the world after India and China. This is because the number of TB cases in Indonesia found and reported to the TB Information System (SITB) in 2022 is 717,941 cases with TB discovery coverage of 74% of the target of 85%. The success rate of treatment is 86%. Although still below the global target of 90% set by WHO, the success rate of TB treatment in Indonesia always increases every year. This is one of the hopes that Indonesia will be able to end this TB disease. This figure increased compared to the previous year, which amounted to 397,377 cases in 2021. TB in Indonesia is divided into three parts, namely on the island of Sumatra as much as 33%, then Java and Bali as much as 23%, and finally in the eastern part as much as 44% (Sari et al., 2022). Therefore, eastern Indonesia is the largest contributor to TB patients, but we can see that the percentage of TB patients on each island is not much different.

In 2022, the number of tuberculosis cases in North Sumatra was found to be 34,714 cases, an increase when compared to tuberculosis cases found in 2021, which was 19,147 cases. According to gender, the number of tuberculosis cases in men is known to be 22,455 cases or 64.69 percent, higher than tuberculosis cases in women which is 12,259 cases or 35.31 percent. In each district/city throughout North Sumatra, more cases occur in men than women. (Profile of Dinkes Provsu, 2022)

The number of tuberculosis cases by Regency / City in 2022, where the highest cases were found and reported in Medan City, was 10,050 cases. According to gender, the number of tuberculosis cases in Medan in men was 6,400 cases or 63.68 percent, higher than tuberculosis cases in women which were 3,650 cases or 36.32 percent.

Meanwhile, in interviews that researchers have conducted, in 2023 the number of TB cases in North Sumatra Province was found to be 83,949 cases, where if you pay attention, the number of TB cases continues to increase from 2022, which is 72,738 cases in all genders and ages.

Risk factors for tuberculosis are divided into 3, namely socio-demographic factors, host factors, and environmental factors. Sociological factors are divided into 7 points, which include gender, marital status, income factors, employment, age, and education. At the same time, the factors must be divided into two points, namely smoking habits and comorbid. The last is that environmental factors are divided into 4 including lighting, ventilation area, contact history, and population density.

The screening for tuberculosis is usually carried out through Mantoux tests, thoracic x-rays, TBA or sputum examinations, igra tests, TCM, and scoring in children (Rahmah et al., 2018). After doing early detection through the tools mentioned, it is hoped that in the future firecrackers can be wiser and check more about themselves.

Tuberculosis can be divided into active TB and latent TB. Usually, people affected by tebelaten are people who contract the TB virus but do not show any symptoms so that the person does not look like a person who has TB disease. Patients with latent TB can not transmit mycobacterium tuberculosis bacteria to others. Usually, patients with tibelaten only need one type of antibiotic at a time, unlike patients with active TB who have to take drugs regularly for 6 months. However, treatment in typhoid patients must be carried out in a disciplined and uninterrupted manner. Patients in bilaten can recover through treatment in a shorter time when compared to patients with active TB (Angelia et al., 2020).

## Research Methods

This study is a quantitative study with a cross-sectional research design where researchers want to know the incidence of tuberculosis in the city of Medan descriptively where data is collected only at certain times to find out the situation at that time. This study uses secondary data on National TB Management which has been recorded and collected by the North Sumatra Provincial Health Office in 2023. In this study, the samples used in this study were some patients who sought treatment in all types of health service facilities in Medan City. Collecting data in this study through several stages, the first stage is the preparation stage, where researchers apply for research permission from the Head of Tuberculosis at the North Sumatra Provincial Health Office. The second stage is for researchers to request data from the TB Program Field for research purposes. The third stage of data processing, in data processing, moves data results to SPSS, coding, and data entry. In this study, the instrument used was secondary data on tuberculosis control at the North Sumatra Provincial Health Office. The data were analyzed by univariate analysis using frequency distribution tables.

## Discussion

Based on secondary data obtained from the North Sumatra Provincial Health Office, the following characteristics of respondents were obtained:

**Table 1. Characteristics of Respondents**

Variable	N	%	CI 95% (Lower – Upper)
<b>Age Classification</b>			
Toddler	8	2.6	1.0 – 4.5
Children	12	3.8	1.9 – 6.1
Late Adolescence	50	16.0	12.2 – 19.9
Early Adulthood	51	16.3	12.2 – 20.5
Late Adulthood	57	18.3	14.1 – 22.4
Early Elderly	56	17.9	13.8 – 22.8
Late Elderly	53	17.0	13.1 – 21.1
Seniors	25	8.0	5.1 – 11.2
<b>Variable</b>	<b>N</b>	<b>%</b>	<b>CI 95% (Lower – Upper)</b>
<b>Gender</b>			
Man	190	60.9	55.8 – 66.3
Woman	122	39.1	33.7 – 44.2
<b>Variable</b>	<b>N</b>	<b>%</b>	<b>CI 95% (Lower – Upper)</b>
<b>Work</b>			
Work	188	60.3	54.8 – 65.4
Not Working	83	26.6	21.8 – 31.4
Student	41	13.1	9.3 – 16.7
<b>Variable</b>	<b>N</b>	<b>%</b>	<b>CI 95% (Lower – Upper)</b>
<b>Anatomical classification</b>			
TB Published	291	93.3	90.4 – 95.8
TB Ekstra Paru	21	6.7	4.2 – 9.6
<b>Variable</b>	<b>N</b>	<b>%</b>	<b>CI 95% (Lower – Upper)</b>
<b>DM History</b>			
Unknown	156	50.0	44.6 – 55.4
Iya	57	18.3	14.1 – 22.4
No	99		26.9 – 37.2
<b>Variable</b>	<b>N</b>	<b>%</b>	<b>CI 95% (Lower – Upper)</b>
<b>HIV History</b>			
Unknown	271	86.9	83.0 – 90.4
HIV negative	41	13.1	9.6 – 17.0
<b>Variable</b>	<b>N</b>	<b>%</b>	<b>CI 95% (Lower – Upper)</b>

<b>Final Treatment Results</b>			
Complete Treatment	100	32.1	27.2 – 37.5
Recover	22	7.1	4.5 – 9.9
Drop Out of Treatment	19	6.1	3.5 – 9.0
Die	4	1.3	0.3 – 2.6
Unknown	167	53.5	47.8 – 58.7

## 1. Age

Based on the frequency table above, it is known that of the 312 patients (respondents) who seek treatment at healthcare facilities in the city of Medan, dominated by the Late Adult age group (36-45 years) with a frequency of 57 people and a percentage of 18.3%. Followed by the Early Elderly age group (46-55 years) with a frequency of 56 people and a percentage of 17.9%.

According to the results of research conducted (Konde, C. P., Asrifuddin, A., & Langi, F. F. G. 2020), age has the potential to cause disease and become a risk factor for tuberculosis. Many cases of tuberculosis occur in the age group of 15-55 years because most people at that age spend their time and energy working. So it consumes a lot of energy and there is no time to rest. Because the amount of rest time is less, the body's resistance will decrease. A crowded work environment and contact with many people can also increase the body's risk of developing pulmonary tuberculosis. These working conditions make the elderly or productive age group more susceptible to pulmonary tuberculosis.

This research is in line with research (Jendra, F. J. D., Margareth, R. S., & Grace, D. K. 2015) the age group of 15-55 years is an age group that has very high mobility so that it is possible to be exposed to higher *Mycobacterium Tuberculosis* bacteria. In addition, endogenous reactivation (reactive bacteria that have been present in the body) can occur in old age.

Based on the findings of the results of research and relevant theories that exist, researchers believe that there is a significant relationship between age and the incidence of pulmonary tuberculosis. Researchers concluded that elderly people are more susceptible to pulmonary tuberculosis because the performance of organs decreases with age.

## 2. Gender

From the table above, it can be seen that the total number of TB sufferers in the city of Medan is 302 people, with the most sufferers dominated by men as much as 60.9%. Men suffer more from TB than women, this has been explained in the report of the Department of Gender and Women's Health World Organization (WHO) which states that the prevalence of men affected by TB is higher when compared to women in all age categories except children. This is in line with research conducted in Jember which said that the incidence of tuberculosis was dominated by men as much as 66% (Rokhmah, 2013). This is also in line with research conducted by Sunarmi (2022) which states that male respondents are more affected by TB when compared to the female sex, which is 63.6% (Sunarmi & Kurniawaty, 2022).

TB Tuberculosis can attack more men than women and can be motivated by the workload borne by men, in addition to the workload of men's lifestyles is also very highlighted such as smoking habits and consuming alcohol. Based on research conducted by Sati Arni shows that people who have a habit of smoking will increase the risk of tuberculosis by 2.4 times greater than people who do not have a habit of smoking. Then if you refer to another study, namely Marissa in 2011 at the puskesmas, it was found that smoking habits have a risk level of 2 coma 407 times the occurrence of tuberculosis.

### 3. Work

Based on the table above, shows that the number of patients with pulmonary tuberculosis who work is 188 people with a percentage of 60.3%, then those who do not work as many as 83 people with a percentage of 26.6%, and students/students who suffer from pulmonary tuberculosis as many as 41 people with a percentage of 13.1%. A significant global health problem is occupational lung disease. This disease can arise, worsen, or be aggravated by various exposures that occur in the work environment. This type of occupational lung disease involves a variety of respiratory conditions similar to those found outside the work environment. In addition, the range of occupational lung diseases also involves acute and chronic conditions, such as hypersensitivity pneumonitis, chronic obstructive pulmonary disease (COPD), to pulmonary tuberculosis (Desdiani, 2023).

The concept of work, which is a routine activity carried out by individuals, has the potential to affect the risk of developing disease. This is as expressed by Azizah (2016). Individuals who do not work and are more often in the home environment tend to avoid various exposures at work, such as dust and germs that can cause lung disease, including pulmonary tuberculosis. This opinion is also corroborated by Tri Fitriani, Arie Wahyudi, and Nani Sari Murni (2022).

Some variables associated with the prevalence and incidence of positive tests include length of work, work location, type of work, and exposure to contact with TB (Desdiani, 2023). According to Dimitrova, all types of work that cause research subjects to be exposed to substances can interfere with lung function and sensory activity allowing research subjects who come into contact with TB patients to be considered risky jobs, while other types of work are considered not risky (Dimitrova, 2005). The types of work of drivers, parking attendants, textile factory workers, mechanics, welding workshop workers, tailors, and construction workers in this study were classified as risky types of work. WHO has recommended that health care workers working in laboratories, clinics, and health care facilities with a high prevalence of MDR TB undergo a Drug Sensitivity Test (DST) examination, considering that these workers have a high risk of becoming MDR TB patients (WHO, 2006).

### 4. Anatomical classification

In the table of analysis results, it can be seen that tuberculosis patients are divided into two based on the anatomical location or presence of bacteria in the organs, namely pulmonary tuberculosis and extrapulmonary tuberculosis or outside the lungs. Based on the results of the analysis showed that more patients with pulmonary tuberculosis were found as many as 291 (93.3%), compared to patients with extrapulmonary tuberculosis which were only 21 (6.7%). Pulmonary tuberculosis is located in the parenchyma (lung tissue). A person is considered pulmonary TB due to the presence of lesions in the lung tissue. Extrapulmonary tuberculosis is TB that occurs outside the lung organs, such as the pleura, lymph glands, urinary tract, and skin, and supplies to the lining of the brain and bones (The Ri, 2017).

Based on data from the Indonesian Tuberculosis Dashboard, TB cases based on anatomical location were found to be higher in pulmonary TB at 730,388 cases, while extrapulmonary TB cases were found in as many as 62,016 cases (Ministry of Health, 2023). The estimated incidence of TB in North Sumatra Province in the last three years has increased. In 2021, 22,726 TB cases were found, then increased to 42,961 cases in 2022 and continued to increase until 2023 to 49,525 cases. There is a district/city with the highest case notification and the one that occupies the top position is Medan City.

Based on previous research, shows that the city of Medan is a densely populated area, thus affecting the increase in pulmonary TB cases. In addition, some areas in Medan City have low PHBS so that a risk of increasing the incidence of pulmonary TB (Technology et al., 2023).

Discussing extrapulmonary tuberculosis, there are still many people who do not understand this type of tuberculosis. So socialization and education are needed for the prevention and control of extrapulmonary TB cases. In previous studies, research has been conducted to analyze the increase in public knowledge through education and socialization in the community. This has a significant influence on increasing public knowledge of extrapulmonary tuberculosis. So this is expected to be an effort to prevent and reduce the incidence of extrapulmonary diseases. (Hanina et al., 2023)

## **5. History of Diabetes Mellitus**

Based on the frequency table above, it is known that of the 312 patients (respondents) who sought treatment at healthcare facilities in the city of Medan, the respondents who had a history of DM were 57 people and the percentage was 18.3%. While in respondents who did not have a history of DM as many as 99 people with a percentage of 31.7%. The remaining 156 people with unknown DM history with a percentage of 50%.

Based on the findings of research conducted by (Widyasari, R. N. 2013) explained that diabetes mellitus can increase the frequency and severity of infection of a disease. It is caused by abnormalities or disorders in the immune system. Possible causes of the increased incidence of Pulmonary TB in people suffering from DM can be defects in the function of immune cells and host defense mechanisms.

This study is in line with research (Rahmatulloh, Y. Y., & Saefulloh, A. 2022) stating that pulmonary tuberculosis is the most common form of active tuberculosis, with an incidence of 79-89% of all types of tuberculosis. Susceptibility to pulmonary tuberculosis is influenced by the body's immune system because pulmonary tuberculosis often occurs when the body's resistance is weakened. One of the risk factors for pulmonary tuberculosis is diabetes. This can happen because diabetics experience a decrease in body resistance due to a decrease in the body's immune response.

## **6. HIV History**

The incidence of tuberculosis increases in HIV patients due to the decrease in the body's immune system to fight *Mycobacterium tuberculosis* infection. TB patients with HIV have a higher risk of death compared to TB patients without HIV. Based on the table of 312 respondents, most respondents with tuberculosis did not know that they had a history of HIV positive or negative with a percentage of 86.9% as many as 271 people. Meanwhile, respondents with tuberculosis who knew that they had a history of HIV negative had a smaller percentage of 13.1% with a total of 41 people.

The same study was conducted by Leni (2023) which showed that respondents with tuberculosis had more HIV-positive histories than HIV-negative histories with a percentage of 71.7%. In contrast, research conducted by Hardiko (2016) showed that respondents with tuberculosis who had a history of HIV negative were fewer than a history of HIV positive with a percentage of 77.1%. Another study by Begna et al (2014) in South East Ethiopia found that patients who have HIV-positive status have an 11.70 times risk of tuberculosis. Differences in this study with other studies can be due to the number of samples and population, research location, and research methods used.

People with a history of HIV have weakened immunity, so they are more susceptible to infection. TB is caused by bacteria, and low immunity in people with HIV makes them more susceptible to TB. (CDC, 2021). Based on research conducted by Damanik Rz (2023), the development of Tuberculosis since the early 1980s where one-third of HIV-infected patients in the world have co-infection with Pulmonary TB. Tb in people with HIV/AIDS (ODHA) can have an atypical clinical picture that causes difficulty in diagnosis, and become the most opportunistic infection and cause death of people with HIV.

The same study conducted by Palebangan, et al (2022) explained in their research infection of HIV patients with other opportunistic infections can accelerate the emergence of various diseases, as well as in the case of HIV-TB. HIV infection lowers immunity in patients, especially CD4 T lymphocytes, making it easier for TB infection to occur. In HIV patients with TB, it will be easier to fall into severe conditions. In Indonesia, as many as 5-10% of TB cases appear in the HIV patient population, and TB sufferers have a 30% chance of HIV infection in life. Therefore, TB patients are one of the key populations for HIV screening.

## **7. Final Treatment Results**

The results showed that respondents who underwent complete treatment were 100 people while the most respondents were 167 people who did not know the treatment. The number of people whose treatment is unknown is generally because patients stop giving or do not report to health workers. However, in the data above, it can be seen that patients who drop out of treatment with recovered patients are almost the same number, meaning that there are still many patients who drop out of treatment so they become drug-resistant patients.

According to research conducted by Kurnia Sari in 2020, several factors can affect TB treatment, including treatment side effects, drug swallowing supervisors (PMO), and family support factors (Kurnia Sari et al., 2020). In addition, the same study was also conducted by Maria Tuntun (2023) which stated the relationship between side effect factors after treatment with the cessation of patients in treatment.(Tuntun et al., n.d.).

Furthermore, in a study conducted by Maya Masita 2023, it was said that from 11 articles that had met the inclusion criteria for analysis, it was found that there were family support factors and also economic status that influenced patient compliance in undergoing TB treatment(Masita & Helen Andriani, 2023).

So many factors affect the compliance of TB patients in taking TB drugs completely so that drug resistance does not occur which causes the TB virus to mutate to be more virulent than before.

## **Conclusions and Suggestions**

1. In TB patients based on age, it is dominated by adults with an age range of 36-45 years.
2. From the results obtained, it was found that TB sufferers were dominated by men as much as 60.9%, this was motivated by the workload and lifestyle of men
3. In the occupational variable, it was found that the majority of TB were working people, which was as much as 60.3%, this was due to exposure from the work environment.
4. From the results of the final treatment analysis, it was found that as many as 167 respondents had no known treatment, and 19 patients stopped treatment.
5. respondents who have a history of DM as many as 57 people and the percentage is 18.3%. While in respondents who did not have a history of DM as many as 99 people with a percentage of 31.7%. The remaining 156 people with unknown DM history with a percentage of 50%.
6. Most respondents with tuberculosis did not know that they had a history of HIV positive or negative with a percentage of 86.9% as many as 271 people. Meanwhile, respondents with tuberculosis who knew that they had a history of HIV negative had a smaller percentage of 13.1% with a total of 41 people.

From the results that have been found by researchers, it turns out that there are still many TB patients who have never checked for comorbidities such as HIV and DM. Therefore, researchers hope that everyone will check their health as early as possible as a form of preventive measure. Involvement

and support from all sectors are also very important to continue to be carried out for the achievement of the program.

## References

- [1] Angelia, A., Doda, D. V. D., & Manampiring, A. E. (2020). Prevalensi Tuberkulosis Laten Dan Evaluasi Kebijakan Rumah Sakit Berdasarkan Persepsi Tenaga Kesehatan Terhadap Pencegahan Tuberkulosis. *Jurnal Biomedik:JBM*, 12(3), 192. <https://doi.org/10.35790/jbm.12.3.2020.31632>
- [2] Azizah, B. (2016) Teori dan Prinsip-prinsip Pendidikan. Semarang: Pustaka Mandiri
- [3] B Dimitrova, A Hutchings, R. Atun, F Drobniewski. Increased risk of tuberculosis among health care workers in Samara Oblast, Russia: analysis of notification data. *International Journal of Tuberculosis*, 2005;9(1):43-48.
- [4] Desdiani. (2023) Penyakit Paru Akibat Kerja, CV. *Media Sains Indonesia*, 1-2
- [5] Fitriani, T., Wahyudi, A., Sari, N. (2022). Analisis Determinan Kejadian Tuberkulosis Paru. *Jurnal Aisyiyah Medika* 166-179.
- [6] Hanina, H., Fairuz, F., Dewi, H., Lipinwati, L., & Iskandar, M. M. (2023). Edukasi Dan Sosialisasi Tuberkulosis Luar Paru Di Desa Maro Sebo Kecamatan Jambi Luar Kota Kabupaten Muaro Jambi. *Medical Dedication (Medic) : Jurnal Pengabdian Kepada Masyarakat FKIK UNJA*, 6(2), 140–144.
- [7] Haryani, Leni, dkk. 2023. Gambaran Faktor Risiko Pasien HIV dengan Tuberkulosis di RSUD Kota Bogor. *Jurnal Epidemiologi Kesehatan Indonesia*, 7(2), 105-110.
- [8] Hardiko, dkk. 2016. Studi Epidemiologi Kejadian Tuberkulosis Paru pada Pasien Hiv di Kabupaten Wonosobo Tahun 2014. *Jurnal Kesehatan Lingkungan Indonesia*, 14(1), 27-34.
- [9] Jendra, F. J. D., Margareth, R. S., & Grace, D. K. (2015). Hubungan Faktor Risiko Umur, Jenis Kelamin, dan Kepadatan Hunian dengan Kejadian Penyakit TB Paru di Desa Wori Kecamatan Wori. *Jurnal Kedokteran Komunitas dan Topik*, 3(2), 57-65.
- [10] Kemenkes RI. (2017). Permenkes RI No 67 Tahun 2016 Tentang Penanggulangan Tuberkulosis. Dinas Kesehatan, 163.
- [11] Kementerian Kesehatan RI. (2023). Dashboard Data TB di Indonesia.
- [12] Konde, C. P., Asrifuddin, A., & Langi, F. L. F. G. (2020). Hubungan antara umur, status gizi dan kepadatan hunian dengan tuberkulosis paru di Puskesmas Tuminting Kota Manado. *KESMAS: Jurnal Kesehatan Masyarakat Universitas Sam Ratulangi*, 9(1).
- [13] Kurnia Sari, S., Tri Kianto Departemen Pendidikan Kesehatan dan Ilmu Perilaku, dan, & Kesehatan Masyarakat, M. (2020). FAKTOR PASIEN DROP OUT PENGobatan TUBERKULOSIS DI INDONESIA: TINJAUAN SISTEMATIK Drop Out Factors of Tuberculosis Treatment in Indonesia: A Systematic Review. *Jurnal Kesehatan Masyarakat Aceh*, 6(2), 115–123.
- [14] Majdi, M. M. (2021). Analisis Faktor Umur, Tingkat Pendidikan, Pekerjaan, Dan Tuberkulosis Paru Di Wilayah Kerja Puskesmas Korleko, Kabupaten Lombok Timur. *Jurnal Sanitasi Dan Lingkungan*, 2(2), 173-184.
- [15] Making, M. A., Banhae, Y. K., Aty, M. Y. V. B., Mau, Y., Abanit, Selasa, P., & Israfil. (2023). Analisa Faktor Pengetahuan Dan Sikap Dengan Perilaku Pencegahan Tb Paru Pada Kontak Serumah Selama Era New Normal Covid 19. *Jurnal Penelitian Perawat Profesional*, 5(1), 43–50.
- [16] Masita, M., & Helen Andriani. (2023). Analisis Determinan Kejadian Loss to Follow-up (Putus Berobat) pada Pasien Tuberkulosis Paru : Literature Review. *Media Publikasi Promosi Kesehatan Indonesia (MPPKI)*, 6(5), 798–806. <https://doi.org/10.56338/mppki.v6i5.3310>



- [17] Rahmah, S., Indriani, C., & Wisnuwijoyo, A. P. (2018). Skrining Tuberkulosis (Tb) Paru. *Jurnal Kesehatan Manarang*, 3(2), 69. <https://doi.org/10.33490/jkm.v3i2.39>
- [18] Rahmatulloh, Y. Y., & Saefulloh, A. (2022, January). Hubungan Diabetes Melitus Tipe 2 dengan Kejadian Tuberkulosis Paru di RSUD Al-Ihsan Bandung. In *Bandung Conference Series: Medical Science* (Vol. 2, No. 1, pp. 480-486).
- [19] Rohman, H. (2018). Kasus Tuberkulosis Dengan Riwayat Diabetes Mellitus Di Wilayah Prevalensi Tinggi Diabetes Mellitus. *Jurnal Manajemen Informasi Kesehatan Indonesia*, 6(2), 149-156.
- [20] Rokhmah, D. (2013). Gender dan Penyakit Tuberkulosis: Implikasinya Terhadap Akses Layanan Kesehatan Masyarakat Miskin yang Rendah. *Kesmas: National Public Health Journal*, 7(10), 447. <https://doi.org/10.21109/kesmas.v7i10.3>
- [21] Rosenman, K. D., & Hall, N. (1996). Occupational risk factor for developing tuberculosis. *American Journal of Industrial Medicine*, 30(20), 148-154.
- [22] Sari, G. K., Sarifuddin, & Setyawati, T. (2022). Tuberkulosis Paru Post WODEC Pleural Efusion: Laporan Kasus. *Jurnal Medical Profession*, 4(2), 174–182.
- [23] 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>
- [24] Teknologi, J., Dan, K., Sosial, I., Irennius Girsang, V., Berkat, T., Halawa, I., Saragih, F. L., Purba, I. E., & Mutiara Indonesia, U. S. (2023). Analisis Spasial Sebaran Kasus Tuberkulosis (Tb) Paru Bta+ Di Kota Medan Artikel Informasi A b s t r a c t. *Jurnal Teknologi, Kesehatan & Ilmu Sosial*, 5(1), 168–179. <http://e-journal.sari-mutiara.ac.id/index.php/tekesnos>
- [25] Tuntun, M., Aminah, S., & Ch, Y. (n.d.). *Evaluasi Faktor-Faktor Putus Pengobatan Pasien TB di Kota Bandar Lampung Evaluation of Treatment Outcome Factors in TB Patients in Bandar Lampung City*. 12.
- [26] Tulu, Begna, et al. 2014. Smear positive pulmonary tuberculosis and its risk factors among tuberculosis suspect in South East Ethiopia; a hospital based cross-sectional study. *BMC research notes*, 7(1), 1-6.
- [27] World Health Organization. Guidelines for the programmatic management of drug-resistant tuberculosis. Geneve, Switzerland: WHO;2006.p. 1-8.
- [28] WHO. (2022). Global Tuberculosis Report 2022.
- [29] WHO. (2023). *Fact Sheets Detail Tuberculosis 2023*.
- [30] Widayarsi, R. N. (2012). Hubungan antara jenis kepribadian, riwayat diabetes mellitus dan riwayat paparan merokok dengan kejadian TB paru dewasa di Wilayah Kecamatan Semarang Utara Tahun 2011. *Jurnal Kesehatan Masyarakat Universitas Diponegoro*, 1(2), 18848.