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Determinants of Treatment Adherence among Pulmonary Tuberculosis Patients at the UPT Simalingkar Community Health Center in 2024.

Determinan Kepatuhan Pasien Tuberkulosis Paru Dalam Menjalani Pengobatan di UPT. Puskesmas Simalingkar Tahun 2024

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Abstract

Background: Pulmonary tuberculosis (TB) is a chronic infectious disease that remains a major global and national public health problem, with Indonesia ranking second among countries with the highest TB burden worldwide. Non-adherence to treatment is one of the main barriers to successful TB control, as it may lead to treatment failure, drug resistance, and increased morbidity and mortality. At the Simalingkar Community Health Center (UPT Puskesmas Simalingkar), the specific factors determining treatment adherence among pulmonary TB patients have not been extensively studied. **Objective:** This study aimed to analyze the determinants of treatment adherence among pulmonary tuberculosis patients at the Simalingkar Community Health Center in 2024. **Methods:** This study employed an analytical cross-sectional design. The study population consisted of all pulmonary TB patients undergoing treatment at the Simalingkar Community Health Center, with a total sample of 90 respondents selected using a total sampling technique. Data were collected through questionnaires and medical records, and analyzed using univariate, bivariate (Chi-square test), and multivariate (logistic regression) analyses, with a significance level of $p < 0.05$. **Results:** A total of 77.8% of patients were adherent to treatment. Bivariate analysis showed significant associations between education ($p < 0.001$), employment status ($p = 0.004$), knowledge ($p = 0.006$), and health care services ($p = 0.011$) with treatment adherence. Age, sex, and family support were not significantly associated with adherence. Multivariate analysis indicated that the most dominant factor associated with treatment adherence was educational level (OR = 9.004; 95% CI: 2.58–31.49), followed by employment status (OR = 5.59; 95% CI: 1.48–21.12), and health care service support (OR = 3.99; 95% CI: 1.09–14.56). **Conclusion:** The significant determinants of treatment adherence among pulmonary TB patients at the Simalingkar Community Health Center were educational level, employment status, and health care service support, with education being the most dominant factor. It is recommended that TB control programs place greater emphasis on interventions aimed at improving health literacy, socio-economic support, and the quality and accessibility of health care services to enhance treatment adherence.

***Keywords*: Compliance, Treatment of Pulmonary TB Patients, UPTD Puskesmas Simalingkar.**

Abstrak

Latar Belakang: Tuberkulosis (TB) paru merupakan penyakit infeksi kronis yang masih menjadi masalah kesehatan global dan nasional, dengan Indonesia menempati peringkat kedua beban TB tertinggi di dunia. Ketidakpatuhan pasien dalam menjalani pengobatan merupakan salah satu faktor penghambat utama keberhasilan pengendalian TB, yang dapat menyebabkan kegagalan terapi, resistensi obat, dan peningkatan morbiditas serta mortalitas. Di UPT Puskesmas Simalingkar, faktor-faktor yang secara spesifik menentukan kepatuhan pasien TB paru belum banyak diteliti. **Tujuan:** Penelitian ini bertujuan untuk menganalisis

determinan kepatuhan pasien tuberkulosis paru dalam menjalani pengobatan di UPT Puskesmas Simalingkar Tahun 2024. **Metode:** Penelitian ini menggunakan desain *cross-sectional* analitik. Populasi penelitian adalah seluruh pasien TB paru yang sedang menjalani pengobatan di UPT Puskesmas Simalingkar dengan sampel sebanyak 90 orang yang diambil dengan teknik *total sampling*. Data dikumpulkan melalui kuesioner dan rekam medis, kemudian dianalisis secara univariat, bivariat (uji Chi-square), dan multivariat (regresi logistik) dengan tingkat kemaknaan p<0,05. **Hasil:** Sebanyak 77,8% pasien patuh terhadap pengobatan. Hasil analisis bivariat menunjukkan adanya hubungan yang signifikan antara pendidikan (p<0,001), pekerjaan (p=0,004), pengetahuan (p=0,006), dan pelayanan kesehatan (p=0,011) dengan kepatuhan berobat. Variabel usia, jenis kelamin, dan dukungan keluarga tidak menunjukkan hubungan yang signifikan. Hasil analisis multivariat menyimpulkan bahwa faktor yang paling dominan berhubungan dengan kepatuhan adalah tingkat pendidikan **(**OR=9,004; 95% CI: 2,58-31,49), diikuti oleh status pekerjaan (OR=5,59; 95% CI: 1,48-21,12), dan dukungan pelayanan kesehatan (OR=3,99; 95% CI: 1,09-14,56). **Kesimpulan:** Determinan yang signifikan terhadap kepatuhan pengobatan pasien TB paru di UPT Puskesmas Simalingkar adalah tingkat pendidikan, status pekerjaan, dan dukungan pelayanan kesehatan, dengan pendidikan sebagai faktor yang paling dominan. Disarankan agar program penanggulangan TB lebih memfokuskan intervensi pada peningkatan literasi kesehatan, dukungan sosial-ekonomi, serta kualitas dan aksesibilitas pelayanan kesehatan untuk meningkatkan kepatuhan berobat.

Kata Kunci: *Kepatuhan, Pengobatan Pasien TB Paru, UPTD Puskesmas Simalingkar .*

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Introduction

Tuberculosis is a chronic infectious disease caused by bacteria. *Mycobacterium tuberculosis*. This bacterium is very easily transmitted through the air because it is very small, allowing it to reach the alveoli inhaled in tiny droplets (*droplet nuclei*). *Mycobacterium tuberculosis. Mostly,* it attacks the lungs, but it can also affect other organs.[1]In 2020, tuberculosis ranked 13th as the leading cause of death globally and the second leading cause of death from infectious diseases after COVID-19 (above HIV/AIDS). In the same year, an estimated 10 million people worldwide suffered from TB. Of these, 5.6 million were men, 3.3 million were women, and 1.1 million were children.[2].

According to the *World Health Organization* [3], Tuberculosis (TB) remains a global health problem. TB was the second leading cause of death worldwide after COVID-19 in 2022. More than 10 million people contract TB each year. Without treatment, the mortality rate from TB is high (around 50%). Globally, in 2022, TB caused approximately 1.30 million deaths. With WHO-recommended treatment, 85% of TB cases can be cured. The number of people newly diagnosed with TB globally was 7.5 million in 2022. Thirty countries with a high TB burden accounted for 87% of global TB cases in 2022. Two-thirds of the global total occurred in eight countries: India (27%), Indonesia (10%), China (7.1%), the Philippines (7.0%), Pakistan (5.7%), Nigeria (4.5%), Bangladesh (3.6%), and the Democratic Republic of the Congo (3.0%). In 2022, 55% of TB patients were male, 33% female, and 12% were children (aged 0–14 years).

Tuberculosis (TB) is a chronic infectious disease that remains a public health problem. According to the Global TB Report, in 2023, Indonesia will rank second globally in the number of TB cases, after India and before China, with an estimated number of TB cases of 1,060,000 and 134,000 TB deaths per year in Indonesia (17 people die from TB every hour). As part of efforts to control TB, the government issued Presidential

Regulation No. 67 of 2021 on TB Control. There are six TB control strategies in Indonesia, namely: 1) Strengthening the commitment and leadership of the central, provincial, and district/city governments to support the acceleration of TB elimination by 2030; 2) Increasing access to quality and patient-centered TB services; 3) Optimizing promotion and prevention efforts, providing TB preventive treatment, and infection control; 4) Utilizing research results and technology for TB screening, diagnosis, and management; 5) Increasing the participation of communities, partners, and other multi-sectors in TB elimination; and 6) Strengthening program management through strengthening the health system.

The World Health Organization (WHO) has set a target of achieving a TB-free world by 2035, aiming to reduce TB incidence to below 10 per 100,000 people. The number of people dying from tuberculosis (TB) worldwide is expected to be halved by 2035. Globally, TB incidence is declining by about 2% per year, and between 2015 and 2020, the cumulative decline was 11%. This figure exceeds half the target. *End TB Strategy*(Strategy to End TB), namely a 20% reduction between 2015 and 2020[3].

The National TB Control program aims to eliminate TB by 2030 and achieve a TB-free Indonesia by 2050. The 2020-2024 tuberculosis control strategy in Indonesia is being implemented to achieve targets of reducing the tuberculosis incidence from 319 per 100,000 people in 2017 to 190 per 100,000 people, and reducing the tuberculosis death rate from 42 per 100,000 people in 2017 to 37 per 100,000 people in 2024.[4]Tuberculosis is a serious infectious disease caused by germs. *Mycobacterium tuberculosis* generally attacks the lungs. The interaction between the body and Mycobacterium tuberculosis greatly determines the development and outcome of active pulmonary tuberculosis (APTB), and macrophage-derived monocyte antibodies play an important role in granulomatous responses to Mycobacterium *tuberculosis*. Recent studies have shown that monocytes in vitro from peripheral blood can come into contact with mycobacteria or their cellular products, become infected with Mycobacterium tuberculosis, differentiate into macrophages through the expression of marker cells (cell markers), release cytokines, exhibit anti-mycobacterial activity, and support *T-cell proliferation*. Given the central role of monocytes in initiating the immune response, their morphological changes in peripheral blood may reflect the state of immunity to TB infection.[5].

Mycobacterium tuberculosis is the TB germ that can cause tuberculosis (TB) in humans, although it can also infect other organs. Most TB germs attack the lungs. Someone who can spread this disease is a patient whose test results show positive acid-fast bacilli (AFB), which release the germ into the air as droplet nuclei [6,7].

In general, tuberculosis (TB) is a major public health problem. The World Health Organization declared tuberculosis a global emergency in 1993. According to the 2011 WHO Annual Report on Global TB Control, 22 countries have a TB burden. According to the WHO report in 2014, there are 9 million new cases of TB and 1.5 million deaths each year.[7,8].

There was a decline in new TB cases in 2020, but not fast enough to achieve the END TB Strategy target. There was a cumulative decline of only 9% in TB cases in 2015-2019, followed by a 20% reduction in new TB cases between 2015-2020, according to the WHO Global Tuberculosis Report (Ministry of Health, 2020). Of the new TB cases occurring each year, 13% of TB cases in Indonesia have received treatment. However, new cases of drug-resistant TB may increase by 2.4% annually, with an estimated total incidence of drug-resistant tuberculosis cases of 24,000, or 8.8 per 100 population. Approximately 48% of patients will begin the second phase of tuberculosis treatment, with approximately 11,500 cases of rifampicin-resistant tuberculosis reported in 2019.[6,7].

With the increase in new TB cases every year, it is possible that it is caused by various factors, including patient non-compliance in taking medication, lack of treatment knowledge, lack of family support, lack of drug diagnostic services, transportation, history of previous TB treatment, unavoidable drug side effects, high rates of therapy failure, and even death. In Indonesia, the dropout rate is 31%, while the treatment success rate is less than 50%. This is due to the high mortality rate.

In 2022, the Ministry of Health, together with all health workers, detected more than 700,000 cases of Tuberculosis (TB). This figure is the highest achievement since TB was declared a national priority program. Currently, it is known that Indonesia ranks second after India regarding tuberculosis (TB), namely with a total of 969 thousand cases and 93 thousand deaths per year, or equivalent to 11 deaths per hour. Quoted from the 2022 Global TB Report, it is also known that the highest number of TB cases in the world attacks the productive age group, especially those aged 45 to 54 years. The National Strategy for TB Elimination has also been stated in Presidential Decree number 67 of 2021 concerning Tuberculosis Control. There are several strategies to overcome TB in Indonesia, including strengthening commitment, increasing access to TB services, optimizing

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TB promotion and prevention efforts, improving TB treatment and infection control, and utilizing research results and technology.

The estimated number of drug-resistant TB cases in Indonesia per year is 4,972 cases. (Ministry of Health of the Republic of Indonesia, 2021; P2PL, 2020)as published in February 2022. This estimate is based on the number of new TB cases and RO-TB cases, which are consistently increasing each year. The Indonesian government needs to act immediately to address this issue to prevent an increase in morbidity and mortality related to RO-TB. Tuberculosis (TB) is common in poor countries and some developing countries.

Tuberculosis is an ancient disease that still occurs today. Based on data from the Central Statistics Agency of North Sumatra Province, the number of pulmonary TB sufferers is 17,303 people, with the highest number of cases in Medan City, ranking first with 2,430 cases, followed by Deli Serdang Regency in second place with 1,698 cases, Simalungun Regency in third place with 1,298 cases, and Nias Regency in the lowest number with 57 cases.[10].

Based on initial observations conducted by researchers at the Simalingkar Community Health Center in Medan City, and reports on TB patient detection and treatment, data showed that the total number of suspected TB cases was 123, with 82 men and 41 women. The data above revealed that TB cases were more common in men.

The high number of TB patients is also due to a lack of knowledge, attitudes, and practices regarding the spread, transmission, and treatment of TB. This lack of knowledge and understanding of the disease can complicate the healing process and increase transmission rates, thereby affecting the success of treatment. This disease also occurs due to a lack of understanding of transmission, which is also linked to economic factors, making the healing process very difficult. Poor adherence to therapy is due to low family support, which prevents patients from completing the treatment program according to the established schedule.

Based on the background of the problem above, the author is interested in conducting research. This research, entitled "Determinants of Pulmonary Tuberculosis Patient Compliance with Treatment at Simalingkar Community Health Center in 2024", will later contribute to the prevention and treatment of Pulmonary TB patients in the Simalingkar Health Center work area and can provide input and suggestions to ensure the success of the intended treatment.

Experimental Section

Research Design

This study employed an analytical cross-sectional design, observing both independent and dependent variables simultaneously. The study examined the determinants of TB patient adherence to treatment using questionnaires and medical records.

Population and Sample.

The study population consisted of patients who met the predetermined inclusion criteria (Nursalam, 2014). Accordingly, the population comprised 90 patients with pulmonary tuberculosis who had been diagnosed by a physician at the UPT Simalingkar Community Health Center. The sample was defined as a subset that represents the entire study population. This study employed a total sampling technique; therefore, all 90 pulmonary tuberculosis patients actively undergoing treatment at the UPT Simalingkar Community Health Center were included in the study sample.

Data Collection.

The data collected in this study consisted of three types: primary, secondary, and tertiary. Primary data were collected directly from the research subjects through interviews and questionnaires. Secondary data were collected from official documentation that supported the primary data, including relevant government regulations related to the research topic. Tertiary data were obtained from highly credible sources, including scientific journals, textbooks, and previously published research findings.

Operational Definitions of Variables

In this study, several variables were measured using predetermined measurement instruments. To ensure clarity and consistency in understanding the variables examined, operational definitions were established. Treatment adherence was defined as the patient's compliance with the prescribed treatment

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regimen. It was measured using a questionnaire, with outcomes categorized as adherent or non-adherent on an ordinal scale. Age was the respondent's length of life, calculated from birth, and was measured via a questionnaire, then categorized into two groups: 15–58 years and <15 years or >58 years, using an ordinal scale. Sex was defined as the biological and anatomical classification of respondents into male or female and was measured using a nominal-scale questionnaire. Education level referred to the respondent's formal educational attainment, measured by questionnaire and classified as high (diploma or bachelor's degree), middle (senior high school/vocational school), or low (kindergarten, elementary school, or junior high school), using an ordinal scale. Occupation was defined as any activity performed by the respondent to earn income for family needs at the time of pulmonary tuberculosis diagnosis and was measured using a questionnaire, categorized as employed or unemployed on a nominal scale. Knowledge referred to the respondent's understanding of pulmonary tuberculosis transmission prevention efforts, measured by questionnaire and categorized as good (correct answers >75%) or poor/insufficient (correct answers ≤75%) on an ordinal scale. Family support was defined as material and non-material assistance provided by the patient's family, including reminding the patient to take medication, measured by questionnaire and categorized as supportive (score 11–19) or not supportive (score 0–10) on an ordinal scale. Health service support referred to the presence or absence of guidance and services provided by health workers to the respondents, measured by questionnaire and categorized as available (score 3–5, >50% of total score) or unavailable (score 1–2, ≤50% of total score) on an ordinal scale.

Measurement Aspects

Treatment adherence was assessed using a 10-item questionnaire with "Yes" and "No" response options. A score of 2 was assigned to each "Yes" response and 0 to each "No" response, resulting in a maximum score of 20 and a minimum of 0. Based on class interval calculation (P = R/BK), adherence was classified into two categories: adherent (scores 11–20) and non-adherent (scores 0–10) [1]. Age was categorized into productive age (15–58 years) and non-productive age (<15 years and >58 years). Sex was classified as male or female. Educational level was grouped into high (diploma and bachelor's degree), middle (junior high school and senior high school/vocational school), and low (kindergarten and elementary school). Employment status was categorized as employed (including farmers, laborers, fishermen, traders, private employees, and civil servants) or unemployed (if the respondent stayed at home only). Knowledge was measured using 15 multiple-choice questions with three answer options (a, b, and c); correct answers were scored as 1 and incorrect answers as 0, yielding a score range of 0–15. Knowledge levels were classified as good (≥11 correct answers or >75%) and poor/insufficient (<11 correct answers or ≤75%) [2]. Family support was measured using 10 dichotomous questions with "Yes" and "No" responses, scored 2 and 0, respectively, yielding total scores ranging from 0 to 20. Based on class interval calculation (P = R/BK), family support was categorized as good (scores 11–20) or poor (scores 1–10). Health service support was assessed based on the presence or absence of guidance and services provided by health workers. It was categorized as available if respondents scored 50% or more of the total score (scores 3–5) and unavailable if they scored 50% or less (scores 1–2).

Validity and Reliability Testing

Validity and reliability testing were not conducted in this study because the questionnaire was adopted from a previous study by Putra (2022), which had already been used to measure the research variables. The reliability analysis conducted by the original researcher showed that the Cronbach's alpha for the knowledge variable (18 items) was 0.922. In contrast, the family support variable, consisting of 19 items, yielded a Cronbach's alpha value of 0.857. Both values exceeded the r-table value of 0.361, indicating that the instruments were reliable.

Data Processing.

Based on the data obtained from the administered surveys, data management was carried out using a computerized system, as follows. First, data collection involved gathering information obtained from questionnaires, survey forms, and observations. Second, data checking was conducted by examining the completeness and consistency of the questionnaire responses or observation sheets to ensure accurate data processing, thereby producing valid and reliable results and minimizing potential bias. Third, coding was performed by assigning codes to the variables under study. Fourth, data entry involved inputting the coded responses from each respondent into the computer program used in this study, namely SPSS. Finally, data

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processing involved analyzing all data entered into the computer application in accordance with the research objectives and analytical requirements.

Data Analysis.

Univariate analysis was conducted using descriptive statistics to describe each research variable, tabulating data to determine the frequency distribution of respondents. The analysis included measures of central tendency and dispersion, such as the mean, median, minimum, and maximum values. The results were presented in textual, tabular, and graphical forms. Bivariate analysis aimed to examine the relationships between the variables studied. This analysis used the Chi-square test because the independent variables were ordinal. A 95% confidence level was applied, and a relationship was considered statistically significant when the p-value was less than 0.05, leading to the rejection of the null hypothesis (H_0). Multivariate analysis was conducted to assess the magnitude of the relationship between independent variables and the dependent variable. Logistic regression was employed in this study because both the dependent and independent variables were measured on an ordinal scale.

Results and Discussion

Overview of research location

Simalingkar Community Health Center is located at Jalan Bawang Raya No. 37, Simalingkar National Housing Complex, Mangga Village, Medan Tuntungan District, Medan City. The community health center's service area covers three sub-districts: Mangga Village, Simpang Selayang, and Simalingkar B. The population in the community health center's service area is 74,137, comprising 34,790 men and 39,347 women. With such a large population, the community health center plays an important role in medical services, and public health programs (promotive and preventive efforts), including IEC (Communication, Information and Education) to improve the health status of the local community.

Simalingkar Community Health Center is an outpatient health center. Its facilities are designed to support healthcare services for the surrounding community, particularly in the management of various infectious and non-infectious diseases, including TB.

Based on 2024 human resources data at the Simalingkar Community Health Center, the health workforce is 52, including medical personnel (5 general practitioners and 16 nurses), 2 pharmacists, 2 pharmaceutical analysts, and 2 laboratory analysts who can support pharmaceutical and diagnostic services. Three community health educators are available for patient IEC.

For TB treatment at Simalingkar Community Health Center, drugs are available at all times in sufficient quantities to support TB patient treatment services.

Univariate analysis

a. Respondent characteristics

Table 1. Frequency distribution of respondents (TB patients) according to characteristics at the Simalingkar Community Health Center UPT, Medan City, in 2024

Characteristics	n	%
Age (years)		
22	2	2,2
27	2	2,2
32	14	15,6
34	4	4,4
35	4	4,4
43	5	5,6
56	7	7,8
59	32	35,6
60	11	12,2
62	5	5,6
65	4	4,4
Gender		

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Woman	28	31,1
Man	62	68,9
last education		
DII/scholar	12	13,3
SMA/equal	51	56,7
Junior High School/equal	9	10,0
SD/equal	18	20,0
Work		
IRT/Doesn't work	36	40,0
Farmer	4	4,4
Laborer	28	31,1
Trader	16	17,8
Private officer	2	2,2
civil servant	4	4,4

Based on Table 1, the majority of respondents (35.6%) were 59 years old, male (68.9%), had a high school education/equivalent (56.7%), and were unemployed/homemakers (40.0%) and worked as laborers (31.1%).

b. Compliance

Table 2. Frequency distribution of respondents according to compliance at the Simalingkar Community Health Center UPT, Medan City, in 2024

Compliance	n	%
Obey	70	77,8
Not compliant	20	22,2
Total	90	100

Table 2 shows that the majority (77.8%) of TB patients at the Simalingkar Community Health Center UPT, Medan City, in 2024 were compliant with TB treatment.

c. Knowledge

Table 3. Frequency distribution of respondents according to knowledge at the Simalingkar Community Health Center UPT, Medan City, in 2024

Knowledge	n	%
Good	64	71,1
Not enough	26	28,9
Total	90	100

According to Table 3, most TB patients (71.1%) have good knowledge of efforts to prevent TB transmission.

d. Family support

Table 4. Frequency distribution of respondents according to family support at the Simalingkar Community Health Center UPT, Medan City, in 2024

Family support	n	%
Support	39	43,3
Does not support	51	56,7
Total	90	100

Based on Table 4, the majority of TB patients (56.7%) do not receive support from their families. both materially and by reminding patients to take TB medication.

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e. Health services

Table 5. Frequency distribution of respondents according to health services at the Simalingkar Community Health Center UPT, Medan City, in 2024

Health services	n	%
There is	46	51,1
There isn't any	44	48,9
Total	90	100

According to Table 5, the majority of TB patients (51.1%) received guidance from officers.

Bivariate Analysis

a. Relationship between age and compliance

Table 6. Relationship between age and compliance of TB patients undergoing treatment at the Simalingkar Community Health Center, Medan City, in 2024

Age	Compliance				Total		*p*
	Obey		Not compliant				
	n	%	n	%	n	%	
Productive	26	68,4	12	31,6	38	100	0,078
Non-productive	44	84,6	8	15,4	52	100	

Table 6 shows that the proportion of TB patients who adhered to treatment was higher among non-productive-age patients (84.6%) than among productive-age patients (68.4%). Still, the difference was not statistically significant (*p=0.078*).

b. The relationship between gender and compliance

Table 7. Relationship between gender and TB patient compliance in undergoing treatment at the Simalingkar Community Health Center, Medan City, in 2024

Gender	Compliance				Total		*p*
	Obey		Not compliant				
	n	%	n	%	n	%	
Woman	23	82,1	5	17,9	28	100	0,592
Man	47	75,8	15	24,2	62	100	

Based on Table 7, the proportion of TB patients who adhered to treatment was higher among women (82.1%) than among men (75.8%), but the difference was not statistically significant (*p=0.592*).

c. The relationship between education and compliance

Table 8. Relationship between education and TB patient compliance in undergoing treatment at the Simalingkar Community Health Center, Medan City, in 2024

Education	Compliance				Total		*p*
	Obey		Not compliant				
	n	%	n	%	n	%	
High	11	91,6	1	8,3	12	100	< 0,001
Secondary	52	86,6	8	13,3	60	100	
Low	7	38,9	11	61,1	18	100	

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Based on Table 4.8, the proportion of TB patients who adhered to treatment was higher among those with high education (91.6%) than among those with medium (86.6%) or low (38.9%) education, and the difference was statistically significant (p<0,001).

d. The relationship between work and compliance

Table 9. Relationship between work and TB patient compliance in undergoing treatment at the Simalingkar Community Health Center, Medan City, in 2024

Work	Compliance				Total		*p*
	Obey		Not compliant				
	n	%	n	%	n	%	
Work	48	68,6	22	31,4	70	100	0,004
Doesn't work	6	30,0	14	70,0	20	100	

Based on Table 4.9, the proportion of TB patients who adhered to treatment was higher among those who worked (68.6%) than among those who did not work (30.0%), and this difference was statistically significant (*p=0.004*).

e. The relationship between knowledge and compliance

Table 10. Relationship between knowledge and compliance of TB patients undergoing treatment at the Simalingkar Community Health Center, Medan City, in 2024

Knowledge	Compliance				Total		*p*
	Obey		Not compliant				
	n	%	n	%	n	%	
Good	55	85,9	9	14,1	64	100	0,006
Not enough	15	57,7	11	42,3	26	100	

Based on Table 10, the proportion of TB patients who adhered to treatment was higher among those with good knowledge (85.9%) than among those with poor knowledge (57.7%), and this difference was statistically significant (*p=0.006*).

f. The relationship between family support and compliance

Table 11. Relationship between family support and TB patient compliance in undergoing treatment at the Simalingkar Community Health Center, Medan City, in 2024

Family support	Compliance				Total		*p*
	Obey		Not compliant				
	n	%	n	%	n	%	
Support	28	71,8	11	28,2	39	100	0,367
Does not support	42	82,4	9	17,6	51	100	

Based on Table 11, the proportion of TB patients who adhered to treatment was higher among those without family support (82.4%) than among those with family support (71.8%). Still, the difference was not statistically significant (*p=0.367*).

g. The relationship between health services and compliance

Based on Table 12, the proportion of TB patients who comply with treatment is higher among those who receive health services (89.1%) than among those who do not (65.9%), and this difference is statistically significant (*p=0.011*).

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Table 12. Relationship between health services and TB patient compliance in undergoing treatment at the Simalingkar Community Health Center, Medan City, in 2024

Family support	Compliance				Total		*p*
	Obey		Not compliant				
	n	%	n	%	n	%	
There is	41	89,1	5	10,9	46	100	0,011
There isn't any	29	65,9	15	34,1	44	100	

Multivariate analysis

a. Selection of candidate variables

Table 13. Mark *independent* variables based on the results of bivariate analysis

No.	Independent variables	*p*	Entered into logistic regression analysis
1	Age	0,078	No
2	Gender	0,592	No
3	Education	< 0,001	Of
4	Work	0,004	Of
5	Knowledge	0,006	Of
6	Family support	0,367	No
7	Health services	0,011	Of

Based on the bivariate analysis of all variables, the highest-value variables were selected.p<0.25 into the multivariate model (logistic regression) as shown in Table 13 above. The variables selected for further analysis were education, employment, knowledge, and health services.

b. Early stage logistic regression analysis

Table 14. Results of logistic regression analysis (initial stage) of TB patient compliance in undergoing treatment at the Simalingkar Community Health Center, Medan City, in 2024

Level	Variables	B	*p*	OR	95%CI
Early	Education	1,843	0,003	6,32	1,85-21,56
	Work	1,664	0,017	5,28	1,34-20,76
	Knowledge	1,085	0,126	2,96	0,74-11,87
	Health services	1,598	0,025	4,94	1,23-19,91
	Constant	-11,848	0,000	0,00	--

Based on the initial stage analysis, the variable that did not show a significant relationship was knowledge (p=0.126), so it was removed from the multivariate analysis.

c. Final stage logistic regression analysis

Table 15. Results of the Logistic Regression Test (final stage) of TB patient compliance in undergoing treatment at the Simalingkar Community Health Center UPT, Medan City, in 2024

Stages	Variables	B	*p*	OR	95%CI
End	Education	2,198	0,001	9,00	2,58-31,49
	Work	1,721	0,011	5,59	1,48-21,12
	Health services	1,384	0,036	3,99	1,09-14,56
	Constant	-10,902	0,000	0,00	-

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Based on the OR value from the final-stage multivariate analysis (Table 15), the dominant factor related to TB patients' compliance with treatment at the Simalingkar Community Health Center UPT, Medan City, in 2024 was education, followed by employment and health services.

1) The probability of adherence in TB patients in undergoing treatment is 9 times higher in TB patients with higher education compared to those with lower secondary education, with a confidence interval between 2.6 and 31.5.
2) The probability of adherence in TB patients in undergoing treatment was 5.6 times higher in TB patients who worked compared to those who did not work, with a confidence interval between 1.5 and 21.1.
3) The probability of adherence in TB patients in undergoing TB treatment is 4 times higher in TB patients who have (receive) health services compared to those who do not have (do not receive) health services, with a confidence interval between 1.1 and 14.6.

Discussion

The Relationship Between Age and Compliance of Pulmonary Tuberculosis Patients in Undergoing Treatment at the Simalingkar Community Health Center in 2024

Based on Table 6, 77.8% of the respondents were compliant, of whom 48.9% were non-productive, while the other 28.9% were productive. Of the 22.2% of non-compliant respondents, 13.3% were of productive age, while the other 8.9% were of non-productive age. The results of this study indicate that the compliant age group is in a productive age, while the non-compliant age group is in a non-productive age. One reason non-productive age patients tend to be more compliant with treatment is that they have more time to focus on their health. Patients in this age group, especially the elderly, generally have fewer work demands or social activities that interfere with their treatment schedule. In addition, they tend to be at home more often and more easily receive support from family members to remind or help them with long-term drug therapy. According to research conducted by Tambuwun et al. (2021), in old age, they generally comply with doctors' advice without considering various reasons, driven by the desire to get well. Besides that, older people have fewer activities, so they tend to be more compliant with medication.

In contrast, productive-age patients are more vulnerable to non-adherence due to busy work and social schedules. Many of them work tight schedules, making it difficult to follow their medication regimen consistently. Productive-age individuals often face challenges in maintaining long-term therapy due to work pressure, lack of flexibility, and a lack of awareness of the consequences of non-adherence to treatment.[14,15].

Based on the statistical test results, a p-value of 0.078 was obtained, which is greater than the significance level of 0.05. Therefore, it can be concluded that there is no significant association between age and treatment adherence among pulmonary tuberculosis patients at the UPT Simalingkar Community Health Center in 2024. These findings indicate that the evidence is insufficient to demonstrate a statistically meaningful relationship. Several previous studies have suggested that treatment adherence is not determined solely by age but is also influenced by factors such as knowledge level, family support, and access to health care facilities [16]. The results of this study are consistent with those of Sholichah, Santoso, and Prasetyo (2020) [17], who reported no association between age and treatment adherence among tuberculosis patients in a literature review. Similarly, this study aligns with the findings of Lestari, Dedy, Artawan, and Buntoro (2022) [18], which showed no significant difference between age and treatment completion, with a bivariate analysis yielding a p-value of 0.251 ($p > 0.05$).

The Relationship Between Gender and Pulmonary Tuberculosis Patient Compliance in Undergoing Treatment at the Simalingkar Community Health Center in 2024

Table 7 shows that of the 77.8% of compliant respondents, 52.2% were male, while 25.6% were female. The higher compliance rate among men compared to women is partly due to the male-dominated sample in this study. Table 1 shows that 68.9% of respondents were male, while 31.1% were female. This is due to unhealthy lifestyles among men, such as smoking and drinking alcohol, which can weaken the immune system and make them more susceptible to exposure to TB-causing agents. Several studies have shown that men are more active than women [18].

Of the 22.2% of non-compliant respondents, 16.7% were male, while 5.6% were female. This indicates that the majority of non-compliant respondents were male. Based on the statistical test results, a p-value of 0.592 was obtained, which is> 0.05. It can be concluded that there is no relationship between gender and treatment compliance among Pulmonary Tuberculosis patients at the Simalingkar Community Health Center

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in 2024. The results of this study are in line with Linkievicz et al. (tahun 2022, who found that there was no relationship between gender and medication adherence.

Researchers assume that gender is a factor related to adherence. However, men and women differ in many ways, including social relationships, environmental relationships, lifestyle habits, biological differences, and physiology. Nevertheless, women and men have equal access to information, including information about pulmonary TB treatment, where men and women receive the same pulmonary TB treatment program. Furthermore, the completion of pulmonary TB treatment is based on each individual's decision to undergo treatment, guided by their desire for recovery. Therefore, if both men and women receive treatment regularly, they are more likely to complete treatment.

The Relationship Between Education and Pulmonary Tuberculosis Patient Compliance in Undergoing Treatment at the Simalingkar Community Health Center in 2024

Education is linked to the learning process; the higher a person's education, the easier it is for them to receive information. With higher education, a person is more likely to receive information from others and the mass media. Information obtained from both formal and non-formal education can also lead to short-term relationships (immediate impact), resulting in changes or increases in medication compliance [20].

Table 8 shows that of the 77.8% of compliant respondents, the majority had secondary education (57.8%), while 12.2% had higher education, and 7.8% had lower education. Conversely, of the 22.2% of non-compliant respondents, the majority came from the lower education group (12.2%), followed by those with secondary education (8.9%), and only 1.1% from higher education. This distribution indicates that education plays a significant role in patients' understanding and awareness of the importance of medication adherence. This finding aligns with previous research showing that higher levels of education correlate with greater health awareness, better access to medical information, and greater ability to understand and follow medication instructions.[21]. Individuals with higher education tend to have better health literacy, thus better understanding the consequences of non-adherence to Pulmonary Tuberculosis therapy.

On the other hand, patients with low levels of education often have difficulty understanding medical instructions, have limited access to health information sources, and are less motivated to complete treatment due to a lack of understanding of the long-term benefits of adherence to the therapy regimen [22]. Other factors that can contribute to non-compliance are low levels of awareness of drug side effects and the long duration of tuberculosis treatment, which can reach six months or more.[23].

Based on the results of the statistical test, the p-value (0.004) was < 0.05, indicating a relationship between work and the compliance of Pulmonary Tuberculosis patients in undergoing treatment at the Simalingkar Community Health Center in 2024. This aligns with the research by Elizah et al. (2024). WHO obtained a chi-square test value of 0.009 and a p-value of 0.009. It can be concluded that there is a relationship between education and compliance in taking anti-pulmonary tuberculosis medication in the Surulangun Community Health Center work area in 2024.

Researchers assume that those with lower levels of education are at risk of difficulty understanding written and verbal instructions given by medical personnel. This can lead to inaccuracies in medication administration, including timing and dosage, potentially reducing the effectiveness of therapy. This difficulty is exacerbated if patients do not receive adequate guidance in understanding medical instructions. Furthermore, the effectiveness of health education provided to patients may also depend on educational level. Patients with higher levels of education are more likely to ask questions or seek clarification regarding their treatment. In comparison, patients with lower levels of education may only passively receive information without an in-depth understanding.

The Relationship Between Work and Pulmonary Tuberculosis Patient Compliance in Undergoing Treatment at the Simalingkar Community Health Center in 2024

A person's routine can limit the time available for medication, especially for those who are busy with work. Individuals with demanding jobs may struggle to find time to take their medication regularly. This differs from individuals with more flexible schedules, who can be more consistent in following their medication regimen.[25].

Table 9 shows that of the 77.8% of compliant respondents, 53.3% were employed, while 24.4% were unemployed. This indicates that employed respondents were more compliant with their treatment compared to unemployed respondents. Employment status is related to adherence and encourages individuals to be more confident and responsible in resolving health issues, thus increasing their self-confidence. TB patients

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who work tend to have the ability to make lifestyle changes and have experience in addressing the signs and symptoms of the disease. Employment makes TB patients more accustomed to utilizing and managing their time, allowing them to take their anti-TB drugs on schedule during work hours.[20].

Of the 22.2% of respondents who were non-compliant, 15.6% were unemployed, while the remaining 6.7% were employed. This suggests that employment status can influence patient adherence to treatment. Unemployed patients may face financial constraints and lack access to information about the importance of regular medication. Furthermore, employment status also plays a socioeconomic role in influencing access to healthcare. Unemployed individuals may have difficulty obtaining health insurance through their workplace, which can limit their ability to obtain necessary medical care. Financial difficulties can also hinder payment for healthcare services, medications, and insurance premiums, ultimately contributing to low treatment adherence.[26].

Based on the results of the statistical test, the p-value (0.004) was < 0.05, indicating a relationship between work and the compliance of Pulmonary Tuberculosis patients in undergoing treatment at the Simalingkar Community Health Center in 2024. The results of this study are consistent with those of Papeo et al. (2021), who found that work was significantly associated with adherence to tuberculosis medication (p-value = 0.03 < 0.05).

Researchers believe that working can increase patients' sense of responsibility and motivation to maintain their health and productivity. Employed respondents are more aware of the importance of completing treatment to ensure they can continue working without being hampered by worsening health conditions. This factor can act as an intrinsic motivation to be more compliant with TB therapy. On the other hand, unemployed patients have less structured activity patterns, making them more prone to missing medication appointments and feeling less urgency about maintaining medication adherence.

The Relationship Between Knowledge and Compliance of Pulmonary Tuberculosis Patients in Undergoing Treatment at the Simalingkar Community Health Center in 2024

Knowledge is a key factor in patient compliance with pulmonary tuberculosis treatment. Patients with a high level of knowledge tend to be more compliant with therapy because they understand the importance of completing treatment as recommended by their medical providers. A study by Kusumawati, Hasibuan, & Lubis (2020) [28] found that patients with greater knowledge of TB had a better understanding of how drugs work, the risk of resistance, and the consequences of non-adherence, and were therefore more disciplined in adhering to long-term therapy.

Based on Table 10, 77.8% of respondents were compliant; 61.1% had good knowledge, while 16.7% had poor knowledge. Of the 22.2% of respondents who were non-compliant, 12.2% had poor knowledge, while 10.0% had good knowledge. This shows that the better a person's knowledge, the more compliant they are. Conversely, patients with low knowledge often have a wrong or insufficient understanding of the disease and its treatment. Research by M'Imunya, Kredo, & Volmink, 2019, [29]. Studies show that patients with less knowledge tend to stop treatment after symptoms begin to improve, unaware that TB bacteria may still be active in the body. This is due to the lack of education patients receive about the importance of completing treatment to prevent drug resistance and disease recurrence.

Lack of knowledge can also lead to patients not understanding the side effects of medications that may occur during therapy. Research conducted by Emi, Purwanta, & Subekti (2009; Septyasari, Putri, Nurhaini, & Hastikanuari (2024, [30,31]Studies have revealed that some patients with limited understanding feel worried or afraid when experiencing side effects such as nausea, vomiting, or joint pain, so they choose to stop treatment without consulting a medical professional. This lack of awareness increases the risk of therapy failure and worsens the patient's condition. Furthermore, this lack of patient knowledge is often linked to myths and misinformation related to TB. Some patients may believe that herbal or alternative treatments can cure TB without the need for lengthy drug therapy. Research conducted by Amisim, Kusen, & Mamosey, 2020; Randu, Sofia, Manoe, Balkis, & Tanof, 2022 [32,33]. Studies show that in some areas, many patients still place more trust in traditional medicine than in proven medical therapies. This belief can lead patients to delay or even refuse necessary medical treatment.

Another factor that can explain the relationship between knowledge and compliance is the patient's level of health literacy. Research conducted by Sari & Idris (2024, 34 revealed that patients with higher levels of education tend to have a better understanding of health information provided by medical professionals. Meanwhile, patients with lower levels of education often have difficulty understanding medication instructions, especially when the information is presented in complex medical terms. Therefore, a simpler,

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more accessible educational approach is needed so that all patients, regardless of educational background, can understand the importance of medication adherence.

Based on the results of the statistical test, the p-value (0.006) was < 0.05, indicating a relationship between knowledge and compliance among Pulmonary Tuberculosis patients who underwent treatment at the Simalingkar Community Health Center in 2024. Christine Handayani Siburian, Santo Damerius Silitonga, & Eka Nugraha V Naibaho, 2023, [35]. In his research at the Somambawa Community Health Center in South Nias, he also found a moderate correlation between knowledge and medication adherence in pulmonary TB patients, with a p-value of 0.008 and r-value of 0.466. This suggests that increasing patient knowledge can improve medication adherence. Furthermore, research by[36]A study at the Tanah Kali Kedinding Community Health Center in Surabaya showed a relationship between knowledge levels and adherence to anti-tuberculosis medication in pulmonary TB patients, with a p-value of 0.030. This finding confirms that adequate knowledge is crucial for encouraging treatment adherence.

Researchers believe that patients receive only brief information when they are first diagnosed with TB, with no further education during the treatment process. If patients are not given repeated explanations, they may forget the information or fail to appreciate the importance of adherence fully. Therefore, a more systematic and ongoing educational approach is needed to ensure patients continue to receive the information they need throughout the treatment process.

The Relationship Between Knowledge and Compliance of Pulmonary Tuberculosis Patients in Undergoing Treatment at the Simalingkar Community Health Center in 2024

Table 11 shows that among the 77.8% of compliant respondents, 46.7% did not receive family support, while 31.1% did. The results of this study indicate that the majority of compliant respondents were those without family support. Not all patients consider family support a crucial factor in undergoing treatment. Some patients may have strong intrinsic motivation, so even without direct family support, they remain compliant with treatment. This is in line with research by Padmawati, Pradnyawati, & Juwita (2024) [37], who found that although family support plays an important role, patient self-motivational factors also make a significant contribution to TB treatment adherence.

Another factor contributing to the high level of compliance among respondents despite not receiving family support is the health education provided by health workers. Research by Sinurat, Saragih, & Derang (2025) [38] emphasizes the importance of self-efficacy in medication adherence among pulmonary TB patients. Health education provided by medical personnel can improve patients' self-efficacy, which, in turn, enhances treatment adherence, even when family support is limited.

Of the 22.2% of non-compliant respondents, 12.2% received family support, while the other 10.0% did not. The results of this study indicate that the majority of non-compliant respondents received family support. This may be due to the ineffectiveness of family support in increasing compliance, particularly when the support is passive or less intensive. For example, family members may remind patients to take their medication without ensuring that they actually do. Research conducted by Adhanty & Syarif (2023) [16] shows that the most effective type of family support in improving TB patient compliance is instrumental support, such as accompanying patients to health facilities or helping them cope with medication side effects. Alhaq & Indawati, 2024 [39]. Their study showed that 80% of pulmonary TB patients received good family support, yet 56% of them were non-compliant with their medication. This indicates that while family support is important, other factors such as drug side effects and long treatment duration may influence patient adherence.

Based on the results of the statistical test, the p-value (0.367) was greater than 0.05, indicating that there is no relationship between family support and compliance with treatment among Pulmonary Tuberculosis patients at the Simalingkar Community Health Center in 2024. The results of this study are in line with those of Suharno, Retnaningsih, & Kustriyani (2022) [40]. The study found no significant relationship between family support and medication adherence in tuberculosis patients. The statistical analysis showed a p-value of 0.670, indicating no significant relationship between the two variables. However, this study aligns with Siallagan, Tumanggor, & Sihotang (2023) [41], which found a significant relationship between family support and medication adherence among pulmonary TB patients. Good family support plays a crucial role in improving patient adherence to treatment.

Researchers believe that patient adherence to pulmonary tuberculosis treatment is not always determined by family support, but rather by other factors such as personal awareness and commitment to health. Some patients have a good understanding of the importance of medication adherence, so they continue with therapy even without family support.

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The Relationship Between Health Services and Pulmonary Tuberculosis Patient Compliance in Undergoing Treatment at the Simalingkar Community Health Center in 2024

Based on Table 12, 77.8% of respondents were compliant; of these, 45.6% received health services, while 32.2% did not. The results of this study indicate that the majority of respondents who received health services were compliant with treatment. The relationship between the quality of health services and patient compliance in undergoing Pulmonary Tuberculosis treatment is a crucial aspect in efforts to control this disease. One of the main factors that links patient compliance is empathy shown by health workers. Research conducted by Zainaro & Gunawan (2020) [42] revealed a significant relationship between empathy among healthcare workers and medication adherence among patients with pulmonary tuberculosis (p-value = 0.009; odds ratio [OR] = 6.545). This indicates that patients who experience empathy from healthcare workers are 6.5 times more likely to be compliant with treatment than those who do not.

Besides empathy, the quality of drug information services also plays an important role—research by Sriwijaya (2020) [43]. Studies have shown that providing Drug Information Services (DIS) significantly improves patient adherence to anti-TB medication. The group receiving DIS demonstrated higher adherence rates compared to those not receiving the service, highlighting the importance of education and effective communication between healthcare providers and patients.

Of the 22.2% of non-compliant respondents, 16.7% did not receive health services, while 5.6% did. The results of this study indicate that the majority of non-compliant respondents were those who did not receive health services. The questionnaire results showed that respondents who did not receive health services were those who lived far from the Community Health Center and had to travel farther to reach it. Research by Ratna Rahayu et al. (2021 [44] emphasized that improving infrastructure and facilities at community health centers can increase patient satisfaction and adherence to TB treatment. The availability of adequate and easily accessible facilities provides additional motivation for patients to continue their treatment until completion. Meanwhile, 5.6% of respondents in this study who received health services but were non-compliant lacked family support. The research conducted by Adhanty & Syarif (2023) [16]. Research indicates that family support in monitoring and encouraging TB patients significantly contributes to treatment adherence. Active family involvement in the treatment process can help overcome barriers patients may face, such as medication side effects or social stigma. Instrumental family support is also essential, particularly when respondents pick up medication at the community health center.

Based on the results of the statistical test, the p-value (0.011) was < 0.05, indicating a relationship between health services and the compliance of Pulmonary Tuberculosis patients in undergoing treatment at the Simalingkar Community Health Center in 2024. The results of this study are in line with research by [45], which found that health services are a factor associated with compliance among patients with drug-resistant pulmonary tuberculosis. Research shows that health services are significantly associated with compliance in controlling drug-resistant pulmonary tuberculosis (p=0.001).

Researchers assume that quality healthcare directly affects patients' adherence to treatment for pulmonary tuberculosis. Patients who feel cared for by medical personnel tend to be more compliant, driven by a sense of trust in the care provided. Furthermore, patients who receive adequate drug education and information better understand the importance of completing their treatment, thus minimizing the risk of discontinuation. This demonstrates that the quality of interaction between healthcare personnel and patients goes beyond providing medical care and building patient trust and motivation in therapy.

Multivariate Analysis

Patient compliance in undergoing pulmonary tuberculosis treatment is a key factor in the success of therapy. Based on the logistic regression results, education, employment, and health services were associated with patient compliance with treatment at the Simalingkar Community Health Center in 2024. Of the three variables tested, education was the most strongly correlated factor, as indicated by the Odds Ratio (OR), which is much higher than those for the other variables.

The analysis showed that education had the strongest association with patient adherence, with an OR of 9.004. This means that patients with higher levels of education were 9 times more likely to be adherent than those with lower levels. This figure demonstrates that a person's education level significantly determines their understanding of the disease and the importance of diligently following treatment procedures.

Patients with higher education generally have greater access to medical information, both from healthcare professionals and other sources such as the internet and print media. They are also better able to

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understand treatment instructions given by healthcare professionals, including medication side effects, the importance of correct dosage, and the consequences of non-adherence to TB treatment. Research conducted by Absor et al. (2020) [46] showed that patients with higher levels of education were more compliant with treatment than those with lower levels. Similar findings were also reported in the study by Suharno et al. (2022) [40], which found that higher levels of education increase patients' awareness of the importance of completing TB treatment.

Furthermore, employment was also associated with patient adherence to treatment, with an OR of 1.477. This means that employed patients were 1.4 times more likely to be adherent than unemployed patients. This may be explained by improved economic access for employed patients, enabling them to obtain healthcare services and purchase additional medication-related necessities more easily. However, employment can also be a barrier to adherence if patients have limited time for regular check-ups.

Another factor associated with it is healthcare, with an OR of 1.094. Although the relationship is not as strong as education or employment, healthcare remains a significant factor in improving patient compliance. The availability of professional medical personnel, accessibility of healthcare facilities, and good communication between patients and healthcare providers can provide additional motivation for patients to adhere to their prescribed treatment schedule. Research by Dilas et al. (2023 [47]) shows that high-quality health services, especially in patient education, increase adherence to TB treatment.

Conclusion

Based on the results of the multivariate analysis, the variables that showed a statistically significant association with treatment adherence among tuberculosis (TB) patients at the UPT Simalingkar Community Health Center, Medan City, in 2024, after controlling for age, sex, knowledge, and family support, were education level, employment status, and health service support ($p < 0.05$). Variables that were not identified as determinants because they did not show a significant association with TB treatment adherence were age, sex, knowledge, and family support ($p > 0.05$). The most dominant factor associated with TB treatment adherence was education, followed sequentially by employment status and health service support. TB patients with a higher level of education had a ninefold higher likelihood of being adherent to treatment compared to those with middle or lower education levels (95% CI: 2.6–31.5). Patients who were employed had a 5.6 times higher likelihood of treatment adherence than those who were unemployed (95% CI: 1.5–21.1). In addition, patients who received health services had a fourfold higher likelihood of adhering to TB treatment than those who did not (95% CI: 1.1–14.6).

Conflict of Interest

The author declares no competing interests and asserts that the research was conducted autonomously, safeguarding the impartiality and validity of the results.

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