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Bivariate Analysis of Factors Related to Medication Adherence in Tuberculosis Patients

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Abstract.
Background. Tuberculosis (TB) is still a major public health problem in Indonesia, with a significant trend of increasing cases in recent years. The success of TB treatment is highly dependent on the patient's compliance in taking Anti-Tuberculosis Drugs (OAT) regularly and completely.
Purpose. This study aims to analyze factors related to medication adherence to tuberculosis patients in the working area of the Darma Health Center, Kuningan Regency.
Method. This study uses an observational analytical design with a bivariate approach. The sampling technique used a total sampling of 90 TB patients. Data was collected using standardized questionnaires that had been tested for validity and reliability, then analyzed using Chi-Square and Odds Ratio (OR) tests.
Results. The results showed that family support, access to health facilities, attitudes, and knowledge levels had a significant relationship with medication adherence ($p < 0.05$). Lack of family support increased the risk of non-compliance by 6.7 times, difficult access to health facilities increased the risk by 7.1 times, less positive attitudes by 5.9 times, and lack of knowledge by 11 times. Meanwhile, the role of health workers and motivation did not show a significant relationship with medication adherence.
Conclusion. The conclusions of this study confirm that social, behavioral, and cognitive factors have an important role in determining TB treatment adherence.
Implementation. TB control interventions need to focus on improving patient education, strengthening family support, and improving access to health services to increase the success of tuberculosis treatment.

Keywords: Tuberculosis; adherence to medication; Family Support; Knowledge; Access to Health Facilities

INTRODUCTION

Based on the *trend* in the number of tuberculosis cases discovered in Indonesia, it has increased significantly in the last four years. In 2020, there were 400,000 cases found, increasing to 443,000 cases in 2021, or an increase of around 10.75%. In 2022, the number of cases rose more drastically to 724,000 cases, showing an increase of around 63.4% compared

to the previous year. In 2023, the number of cases reached 821,000, an increase of about 13.4% from 2022. By 2024, 885,000 cases have been found, showing a continuing upward trend and confirming the importance of more intensive handling (Ministry of Health of the Republic of Indonesia, 2024).

DOTS (*Directly Observed Treatment Shortcource Chemotherapy*) is a short-term TB cure strategy with direct supervision of TB patients so that they swallow TB drugs regularly according to the provisions until they are declared cured. The DOTS strategy provides a high recovery rate and reaches 95%, which is recommended by WHO globally to overcome TB (Fikes UNUSA, 2023).

The government's efforts in dealing with TB every year show progress, this can be seen from the increasing number of sufferers who are found and cured every year. According to the standard, the percentage of positive BTA is estimated to be 10% of the estimated suspects in the community with a tolerated value of between 5-15%. If this number is too large (>15%), it may be due to too strict screening or there is a problem in laboratory testing (false positives) (Ginting, 2020). Patient non-compliance in treatment will have the effect of not achieving conversion rates and recovery rates, so efforts to improve treatment compliance are a priority in the P2TB program. Non-compliance of TB patients in taking medication causes low recovery rates, high mortality and recurrence rates and more fatal is the occurrence of germ resistance to some Anti-Tuberculosis Drugs or *Multidrug Resistance*, so TB disease is very difficult to cure (Carles et al., 2022).

The drug adherence rate in TB treatment in Indonesia will reach 86.5%, while in West Java province it will reach 73% in 2024 (Ministry of Health of the Republic of Indonesia, 2024). Achievement of medication compliance figures at Darma Health Center reaching 83.7% still does not reach the minimum target of drug adherence to 90%. Compliant patients are patients who complete their treatment regularly and completely without interruption for at least 6 months, while patients who do not comply with taking medication if the frequency of taking medication is not in accordance with what has been set (Widyastuti, 2020).

In Jannah's (2022) research, there are many factors that affect compliance with Tuberculosis treatment, including the length of treatment, transportation to health services, socio-economic, characteristics of sufferers, and social support received by sufferers. A big role that can be given to increase the compliance of Tuberculosis patients is motivation and support from families such as supervision and encouragement for Tuberculosis patients in undergoing treatment.

Regularity or adherence to treatment is very important for every patient to achieve recovery. The combination of short-term anti-tuberculosis drugs and the application of drug swallowing supervision is a strategy to ensure the recovery of the patient, even though the drugs used are good, but if the patient does not receive treatment regularly, generally the treatment results will be disappointing. The cause is the lack of attention to tuberculosis patients from various related parties, as a result of which TB control programs in various places have become very weak (Fitri, 2020).

Based on the results of a preliminary study conducted on December 3, 2024 at the Darma Health Center as supporting data, researchers conducted interviews with TB officers, then obtained 99 people who suffered from TB, with a record of 15 patients who did not comply with taking Anti-Tuberculosis Drugs (OAT).

Based on the results of the preliminary study and data from the Kuningan Regency Health Office. The reason for the researcher to make the Darma Health Center as a research site, the Darma Health Center is ranked 4th with the highest TB cases in Kuningan Regency and based on medical record data obtained during interviews with TB officers, that out of a total of 99 TB patients, there are 15 patients who do not comply with treatment, either in repeated taking medication or absenteeism during treatment, Therefore, this is the reason why researchers chose the Darma Health Center as a research site related to medication adherence to Tuberculosis patients.

Research on the adherence to taking Anti-Tuberculosis Drugs (OAT) has been widely conducted, both at the national and international levels, because compliance is a key factor in the success of tuberculosis control programs. Various studies show that non-adherence to TB treatment contributes to low cure rates, increased recurrence rates, and the emergence of drug resistance (MDR-TB).

Previous research has identified that family support is an important factor that affects medication adherence. The study of Herawati et al. (2020) and Lutfian et al. (2025) shows that TB patients who receive good family support have a greater chance of being compliant in undergoing treatment. This support includes supervision of taking medication, assistance to health facilities, and emotional support.

In addition to family support, access to health facilities has also been shown to affect TB patient compliance. Research by Marin et al. (2024) shows that long distances, transportation limitations, and poor infrastructure conditions are significant obstacles to the sustainability of TB treatment, especially in areas with difficult geographical conditions.

In terms of individual factors, several studies confirm that patients' knowledge and attitudes towards TB disease and its treatment have a strong relationship with medication adherence. Patients with good knowledge tend to have a positive attitude and high awareness to complete treatment completely (Widianingrum, 2022; Ulfah et al., 2018). However, the results of research related to the motivation and role of health workers still show diverse and inconsistent findings.

Most previous studies have examined these factors partially, with different regional designs and characteristics, so the local context of primary health care has not been fully accommodated.

LITERATURE REVIEW

The Role of Health Workers in the Treatment of Tuberculosis

Role is an individual's behavior that is expected according to the position they have. A role is a pattern of behavior, beliefs, values, and attitudes that are expected to describe the behavior that should be shown by the individual role holder in situations that generally occur (Sarwono, 2014).

Health workers based on the Law of the Republic of Indonesia on Health No. 36 of 2014 are any person who devote themselves to the health sector and have knowledge and skills through education in the health sector for certain types that require authority in carrying out health efforts. Health workers also have an important role to improve the quality of maximum health services to the community so that the community is able to increase awareness, willingness, and the ability to live a healthy life so that they are able to realize the highest degree of health as an investment in the development of socially and economically productive human resources. Health workers have several officers whose work is interrelated, namely doctors, dentists, nurses, midwives, and other medical personnel (Constitution of the Republic of Indonesia, 2014).

According to Niven (2020), the support of health workers is another factor that affects compliance behavior. Their support is especially useful when patients face that these new healthy behaviors are important. Likewise, they can influence the patient's behavior by expressing their enthusiasm for certain actions of the patient, and continuously, giving positive rewards to patients who have been able to adapt to their treatment program (Niven, 2020).

Based on the results of research from Cucu Herawati (2020), it shows that there is a relationship between the role of health workers and medication adherence in TB patients. This

study is similar to other previous studies that stated that there is a relationship between health workers and medication adherence (p=0.001). There was a strong relationship (r=0.656) between the role of drug supervisors by families and health workers on the knowledge, prevention and compliance behavior of TB patients, the relationship pattern that occurred had a positive pattern, which means that the higher the behavior of family drug overseers and health workers, the higher the prevention and adherence behavior of taking drugs (Herawati et al., 2020).

Attitude

Attitude is a closed response experienced by an individual to the stimulus he receives, the stimulus comes from the internal individual or external individual, so that the attitude is abstract or cannot be seen with the naked eye but can only be interpreted based on the behavior that arises due to the existing attitude (Alpha, 2023). According to notoatmodjo (2012) in (Khoriandari, 2022) Attitudes function as behavioral tendencies (actions) or closed reactions rather than tasks (open reactions) or activities. It can be interpreted that attitude has the meaning of a human tendency to react to something he sees. The form of human reaction can be indifferent or indifferent, like or dislike, accept or dislike. Attitude is a collection of symptoms in responding to stimuli or objects so that attitude involves thoughts, feelings, attention, and other psychiatric symptoms.

Based on research conducted by Herlina Sirait (2020), it was stated that based on the results of statistical tests, a value of p = 0.043 was obtained, which means that there is a significant relationship between attitude and adherence to taking anti-Tuberculosis drugs in pulmonary TB patients at the Teladan Health Center in Medan in 2019. Research conducted by Selvi (2023) stated that there was no relationship between the patient's attitude and medication adherence because the pvalue was 0.827 > 0.05 (Sri Mulyani, 2024).

Factors Influencing Attitudes

There are factors that can influence attitudes. These factors include:

1. Personal Experience. To be able to form the basis for the formation of attitudes, personal experience must leave a strong impression. Therefore, attitudes will be easier to form if the personal experience occurs in something that involves emotional factors.
2. The influence of others that is considered important. In general, individuals tend to have attitudes that are in the same direction as the attitude of people who are considered

important. This tendency arises out of impulse and is motivated by the desire to avoid conflict with the person considered important.

3. Cultural Influence. Over time, culture turns out to be able to guide a person's attitude in dealing with various problems Culture is able to color the attitude of someone who lives in an area, culture is able to give a pattern of experience of individuals in a certain community.
4. Mass Media. Displaying news in newspapers, advertisements, or other communication media, factual news that is presented objectively can be influenced by the attitude of consumers or recipients.
5. Educational Institutions and Religious Institutions. In the moral concept and teachings of educational institutions and religious institutions, the belief system is very decisive. So it is not surprising that moral concepts and teachings influence a person's attitude.

6. Emotional Factors. Emotional factors are sometimes a form of attitude whose statements are based on emotions that function as a kind of channeling frustration or diverting the form of a person's ego defense mechanism Azwar (2005) in (Khoriandari, 2022).

Factors influencing knowledge

According to Notoatmodjo (2018), there are causative factors that affect knowledge, namely:

1. Education level. Education is one of the efforts to improve a person's character so that the person can have good abilities. This education influences a person's attitude and behavior to mature through teaching.
2. Information. Information is knowledge gained from learning, experience, or instruction. This information can also actually be found in daily life because we can find this information around our environment, be it family or relatives.
3. Environment. The environment is everything that exists around an individual, be it the physical, biological, or social environment.
4. Age. Age can affect a person's ability to grasp and mindset. The older he gets, the more his catching and mindset will develop so that his knowledge will improve.

Motivation

Motivation comes from the word motive which means "drive" or "driving force" that exists in a person that causes someone to do an action or activity (Notoatmodjo, 2018d). According to Siagian (2008), Motivation is a driving force that results in a person being willing and willing to exert their abilities in the form of expertise or skills, manpower and time to carry

out various activities that are their responsibility and reap their obligations in order to achieve the goals of various predetermined goals.

Based on the description above, what is meant by motivation in this study is a psychological condition or situation in a person that will arouse or move and has a very important role in every human action or deed that can be interpreted as the background of human behavior itself.

Motivation to recover or get a better quality of life

The motivation to recover or get a better quality of life for TB sufferers is a force that comes from within that encourages behavior towards the cure that is to be achieved. The main goal of TB patients visiting a hospital/clinic is to achieve recovery or get a decent life. Motivation is able to affect the recovery of TB patients, because with motivation TB patients will carry out various treatment activities that have been recommended. The motivation to get a better quality of life drives behavior to achieve its goals. Many problems arise when a person suffering from a certain disease does not have the motivation for his own recovery, this obstacle may occur due in large part to the lack of support from the environment for him. Motivation with sufficient intensity will give the individual direction to do something diligently and continuously (Arviani, 2020).

TB patients really need a lot of support and help from others around them, this support can be in the form of verbal and/or nonverbal information or advice, real help or actions provided by social familiarity or obtained because of their presence and have emotional benefits or behavioral effects for the recipient.

Based on research conducted by (Widianingrum, 2022) with a value *p value* = 0.000) where the results show that there is a motivational relationship with medication adherence to tuberculosis patients (Widianingrum, 2022).

Epidemiology of Tuberculosis

The epidemiology of Tuberculosis disease, is as follows:

1. The cause or agent of tuberculosis is bacteria *Mycobacterium tuberculosis* which is in the form of a straight or slightly bent stem with a size of 0.2-0.4 x 1.4 cm. These bacteria can survive on phlegm for 20-30 hours, the bacilli that is in the splash material can live for 8-10 days. And these bacteria can die if exposed to direct sunlight for 2 hours (Ika Handayani, 2021).
2. Host factors that increase susceptibility to tuberculosis. Some of the factors that can increase

some diseases and the duration of tuberculosis are age, nutritional status, gender, smoking status (Ika Handayani, 2021).

Transmission of Tuberculosis

The factors that allow a person to be exposed to tuberculosis germs A person is exposed to tuberculosis germs is determined by the concentration of splashes in the air and the length of time that air is breathed, and a patient's transmissibility is determined by the amount of germs expelled from his lungs. The higher the degree of positivity of the sputum test results, the more contagious the patient is. This bacterium when it enters the body often will multiply and can spread through blood vessels or lymph nodes, therefore tuberculosis infection can infect almost all organs (Anggraeni, 2019).

In general, the degree of transmission of tuberculosis depends on the number of tuberculosis bacilli in the sputum, upper virulence, bacillus and the chance of air pollution from coughing and sneezing. And it occurs in a room where sputum sparks are for a long time. Ventilation can reduce the amount of sparks, while direct sunlight can kill germs, sparks can last for several hours in dark and humid conditions (Anggraeni, 2019).

Diagnosis Tuberculosis

All tuberculosis suspects were examined for 3 specimens of sputum within 2 days, namely At Time – Morning – At Time (SPS).

1. The diagnosis of tuberculosis in adults is established by the discovery of tuberculosis germs. In the national tuberculosis program, BTA through microscopic sputum examination is the main diagnosis. Other examinations such as thoracic photos, cultures and sensitivity tests can be used to support the diagnosis as long as it is in accordance with the indications (Ministry of Health of the Republic of Indonesia, 2019).
2. It is not permissible to diagnose Tuberculosis based on thoracic photographs alone. Thoracic photographs alone do not always give a typical picture of pulmonary tuberculosis, so it often occurs *Overdiagnosis* (Ministry of Health of the Republic of Indonesia, 2019).

Risk factors for Tuberculosis

The incidence of tuberculosis can be caused by the presence of risk factors that can cause a person to be infected with tuberculosis including knowledge, age, smoking, and housing density. Some things that can encourage behavior change are knowledge (*Knowledge*), attitude (*Attitude*), and actions (*Practice*). Likewise, the sanitary condition of the house has

several factors that affect the occupancy density, floor type, ventilation, and humidity (Fransiska & Hartati, 2019).

Behavioral factors of TB patients can also affect the occurrence of TB. The behavior of TB patients who often litter sputum can cause people around them to be infected because TB bacteria are found in the sufferer's sputum. TB patients who do not apply cough and PHBS etiquette in their place of residence can provide an opportunity for TB bacteria to easily infect others. Another factor that can cause a person to be exposed to TB disease is smoking behavior. If a person has a smoking habit then the person is more susceptible to contracting TB bacteria, the condition of the home environment can be another factor in the incidence of TB. is a factor that can make TB bacteria survive in the home environment so that the incidence of TB is increasing (Pralambang & Setiawan, 2021).

Measurement of Tuberculosis Incidence

According to (Ministry of Health of the Republic of Indonesia, 2019) The measurement of the incidence of tuberculosis is determined based on previous treatment history, there are several types of sufferers, namely:

1. New cases are patients who have never been treated with OAT (anti-tuberculosis drugs) or have swallowed OAT from one month (4 weeks) The BTA (acid-resistant bacilli) examination can be positive or negative.
2. A *relapse* is a patient who has previously received tuberculosis treatment and has been declared cured or completely cured, rediagnosed with a positive BTA.
3. Transplant is a person with tuberculosis (TB) who is receiving treatment from another place, then moves for treatment to a certain place. The patient must bring a referral/transfer letter.
4. Cases of treatment after negligence (*default/drop out treatment*) are patients who return to treatment with the results of BTA (+) sputum examination after stopping treatment for 2 months or more.
5. Cases after Failure are patients whose sputum examination results remain positive or return to positive in the fifth month or more.

Tuberculosis Prevention

Based on health meter regulation number 67, TB control is all health efforts that prioritize promotive and preventive aspects, without neglecting curative and rehabilitative aspects aimed at protecting public health, reducing the rate of illness, disability or death, cutting

transmission, preventing drug resistance and reducing the negative impact caused by Tuberculosis (Presidential Decree of the Republic of Indonesia, 2021).

Tuberculosis prevention includes:

1. Health promotion or promkes aims to increase the involvement of policy makers, increase the integration of program implementation, and empower the community.
2. Tuberculosis surveillance based on indicators and incidence. In the implementation of tuberculosis surveillance, data collection is carried out actively and passively, both manual and electronic.
3. Control of risk factors aimed at reducing transmission and preventing the spread of tuberculosis.
4. Immunization and BCG immunization in infants is an act of immunization carried out to reduce the risk of TB severity (Ministry of Health of the Republic of Indonesia, 2020).

Tuberculosis Treatment

TB treatment aims to cure patients, prevent death, prevent recurrence, break the chain of transmission and prevent the occurrence of bacterial resistance to OAT (Anti-Tuberculosis Drugs).

There are 2 stages in TB Treatment, namely:

1. The first stage of treatment (intensive) is 2-3 months. At this stage, the patient will receive medication every day direct supervision to prevent drug resistance.
2. The second stage is the advanced stage, which is 4-6 months. At this stage the patient gets fewer types of drugs with the consumption rule being 3 × a week.
3. This advanced stage is necessary to kill persistent germs so that recurrence can be prevented.

Based on the 2009 TB Recovery Guidelines in the Ministry of Health No. 364/Menkes/SK/V/2009, the principles are as follows:

1. OAT should be given in the form of a combination of several types of medication, in sufficient quantities and in the appropriate dosage according to the category of treatment. Do not use a single OAT (monotherapy). The use of OAT-Fixed Dose Combination (OAT-KDT) is more beneficial and highly recommended.
2. To ensure patient compliance with swallowing medicine, direct supervision (DOT = *Directly Observed Treatment*) is carried out by a drug swallowing supervisor (OAT).
3. TB treatment is given in 2 stages, namely the initial (intensive) stage and the advanced stage.

a. Early stages. Treatment is given daily. The guidelines at this stage are to effectively reduce the number of germs in the patient's body and minimize the influence of a small number of germs that are already resistant to the patient before treatment. The initial stage of treatment was carried out for 2 months.
b. Advanced stage. It is a stage to kill the rest of the germs in the body so that it can prevent recurrence. Based on the Presidential Regulation of the Republic of Indonesia N0. 67 In 2021 that the target percentage of Tuberculosis Treatment Success Rate Achievement is 90% by 2024 (Presidential Decree of the Republic of Indonesia, 2021).

Strategies to Improve Medication Adherence

Niven (2020) stated that various strategies have been tried to improve compliance are:

1. Support of healthcare professionals. The support of health professionals is indispensable to improve compliance. The simplest example of such support is the existence of communication techniques. Communication plays an important role because good communication provided by health professionals, both doctors and nurses, can instill obedience in patients.
2. Social support. The social support in question is family. Health professionals who can convince the patient's family to support the improvement of the patient's health can reduce non-compliance.
3. Healthy behavior. Health behavior is a response of a person (organism) to a stimulus or object related to illness and disease of the health care system, food and beverage. Health maintenance behavior consists of 3 aspects, namely:
   a. Disease prevention and healing behavior. Behavior improves health when a person is in good health. Behavior improves health when a person is in good health.
   b. Nutritional (food) and drinking behaviors. Food and drink can maintain and improve a person's health.
   c. Providing information. Providing clear information to clients and families about the disease they suffer from and how to treat it (Niven, 2020).

Relationship Between Concepts

According to *Lawrence Green* The compliance behavior of TB patients is influenced by 3 factors, including predisposing factors, supporting factors, and driving factors. The predisposing factors referred to in the study include knowledge, attitudes, perceptions, beliefs, beliefs, values or norms that a person believes. Supporting factors that influence the adherence

to taking anti-45 tuberculosis drugs (OAT) are the availability of health facilities and infrastructure such as the availability of health facilities and infrastructure, the affordability of health facilities (distance), and a person's motivation. Meanwhile, the driving factors include family, friends, teachers, the role of health workers (Notoatmodjo, 2018).

These factors will be related to the patient's adherence to taking OAT when combined with positive behavior. Of the three factors, knowledge, attitude, motivation, distance, family support and the role of health workers are sub-sections that will be studied whether there is an effect on patients' adherence to tuberculosis treatment.

Based on literature review and previous research, there are several research gaps as follows:

1. Limitations of local contextual studies. Most of the research was conducted at the hospital level or urban areas, while studies that specifically examined the adherence to taking TB drugs at the health center level with the characteristics of semi-rural areas are still limited, especially in the working area of the Darma Health Center.
2. The inconsistency of the research results is related to the motivation and role of health workers. Some studies have shown a significant association, while others have found no meaningful association, so additional research is needed to clarify the role of these variables in the context of primary health care.
3. Lack of comprehensive multi-factor analysis. Previous research has tended to examine only one or two factors, without simultaneously examining family factors, access to services, attitudes, motivation, and knowledge in a single, complete bivariate analysis model.
4. Lack of risk-based empirical evidence (Odds Ratio). Not all studies present the magnitude of the risk of non-compliance quantitatively, making it difficult to determine which factors are most dominant influencing TB patients' compliance.

METHODS

The sampling method in this study uses *the total sampling* method, which is a sampling technique where the number of samples is equal to the population. This *total sampling* method is used for a sample of cases because the population is less than 100, so the entire population is used as a research sample. In addition, sampling is carried out in two ways, namely *door to door* and waiting for patients at the Puskesmas during operational hours. The *door to door* technique is used specifically to reach TB patients who have a history of non-compliance at the time of treatment and have been diagnosed. With this approach, researchers can ensure that all cases are well documented and willing to participate in the study. Meanwhile, in determining the control group, it is carried out by waiting for patients at the Puskesmas during operational hours and using *matching techniques* based on inclusion and exclusion criteria in

the work area of the UPTD Darma Puskesmas so that data collection can be carried out in a more structured and efficient manner and ensure the accessibility of data from a wider population.

Research instruments are standard data collection tools or data collection tools that have validity and reliability standards. Instruments that *Valid* and *Realistic* which determines the quality of the data collected. An instrument in addition to having norms of validity and reliability, must also have an objective value and a standard procedure for its use (Badriah, 2019).

In this study, the instrument used in collecting data is a questionnaire where the researcher distributes questions in the form of a questionnaire for each research variable with a total of 63 questions that have been standardized and adopted from previous research.

Bivariate Analysis

According to Badriah (2019), bivariate analysis is performed on two variables that are thought to be interrelated with each other, either in parallel positions (on the comparative approach) and positions that are causal or experimental. This bivariate analysis was conducted to determine the relationship between family support, the role of health workers, access to health services, attitudes, motivation, and knowledge levels in patients with TB at the Darma Health Center.

The percentage of variables in this study uses an ordinal scale, so the statistical test that can be used is *the chi square* test. The *chi square* statistical test is used to see the relationship or influence between independent variables and dependent variables that are categorical and have an ordinal scale.

The formula *for chi square* is as follows:

$$x^2 = \frac{\Sigma\,(0-E)^2}{E}$$

Description:
x2 : Chi Square Test
Σ : Number of rows
0 : Observation Results
E : Expected Value

Then the relationship between free variables and bound variables is proven according to Notoatmodjo (2018) The interpretation is:

a) If the p value < 0.05, it means that there is a significant relationship between the independent variable and the dependent variable.

b) If the p value ≥ 0.05, it means that there is no significant relationship between the independent variable and the dependent variable.

Test results *Chi Square* can only conclude whether there is or is not a difference in proportion between groups or in other words can only conclude the existence or absence of a relationship between two category variables. Thus the test *Chi Square* can be used to search for relationships and cannot see how big the relationship is (Notoatmodjo, 2018).

If the *requirements of the Chi Square* test are not met, then the alternative test, namely *the Fisher Exact* test, in this study, the error tolerance limit is determined at 5% (a=0.05), then if from the results of *the Chi Square calculation* (a p value ≤ 0.05 is obtained), this means that statistically there is a meaningful relationship between independent variables and dependent variables. However, if the p value ≥ 0.05, it means that there is no meaningful relationship between the independent variable and the dependent variable (Notoatmodjo, 2018).

Table 1. Cross Table

	Compliance (Control)	**Non-Compliance (case)**	**Quantity**
Exposed	a	b	A+B
Not exposed	c	d	C+D
Total	**A+C**	**B+D**	**N**

Source : (Heriana, 2018).

Suppose to find the expected value (E) for cell a is:

$$Ea = \frac{(a + b) \times (a + c)}{N}$$

For Eb, Ec and Ed can be searched in the same way. Especially for table 2×2, you can find the value of X^2 by using the formula:

$$X^2 = \frac{N(ad - bc)^2}{(a + c)(c + d)(a + b)(c + d)}$$

The chi square test is very well used for tables with degrees of freedom (DF) correct. Meanwhile, specifically for table 2×2 (DF is 1), it is better to use the corrected chi square test (*yate corrected or yate's correction*). The *formula chi square yate's correction* is as follows:

$$X^2 = \Sigma \frac{(IO - EI - 0.5)^2}{E}$$

Or

$$X^2 = \frac{N(ad - bc)^2 - (N/2)^2}{(a + c)(c + d)(a + b)(c + d)}$$

According to (Anggraeni, 2019), conditions *odds ratio* (OR), as follows:

1. OR (*Odds Ratio*) < 1, meaning that the factor being studied is a protective factor for the occurrence of the effect.
2. OR (*Odds Ratio*) > 1, meaning that the factors being studied are risk factors.
3. OR (*Odds Ratio*) = 1, meaning that the factor being studied is not a risk factor

DISCUSSION

Bivariate analysis is a statistical test used to see significant relationships between independent variables, namely family support, role of health workers, access to health facilities, attitudes, motivation, and knowledge. With bound variables, namely medication adherence in tuberculosis patients. The statistical test used in the study is the Chi Square test, the results of the bivariate analysis are:

The Relationship of Family Support to Medication Compliance in Tuberculosis Patients in the Working Area of the Darma Health Center, Kuningan Regency

Table 2. The Relationship of Family Support to Medication Compliance in TB Patients in the Darma Health Center Area, Kuningan Regency

Family Support	Compliance				Total		OR	95% CI	*p- value*
	Non-compliant		Obedient		n	%			
	n	%	n	%					
Less	12	80	28	37,3	40	44,4	6,714	1,743-25,871	0,002
Good	3	20	47	62,7	50	55,6			
Quantity	**15**	**100**	**75**	**100**	**90**	**100**			

Source : Primary Data 2025

Based on table 2, it shows that respondents who have poor family support are mostly found in the case group which is 80%, while respondents who have good family support are mostly found in the control group which is 62.7%. The results of the statistical test showed that the value of p = 0.002 < 0.05 , which means that there is a significant relationship between family support and medication adherence in people with tuberculosis. An *odds ratio* (OR) value of

6.714 with a 95% confidence interval (1,743–25,871) showed that respondents with low family support were 6.714 times more at risk of non-compliance in taking medication compared to respondents with good family support.

Based on a bivariate analysis that used the Chi-square test to determine the relationship between family support for medication adherence to TB patients, a value of $p=0.002 < 0.05$ was obtained. Therefore, respondents who received less family support had a risk of 6.714 times greater, when compared to respondents who had good family support with a value of 95% CI = (1.743–25.871).

This explanation is in line with Behavioral Theory *Lawrence Green* that places family support as a reinforcing factor (*Reinforcing Factor*) in health behavior. Family support includes emotional, informational, and practical aspects, such as reminding medication schedules and accompanying controls to health facilities. When patients feel that they receive attention and help from their families, they tend to be more enthusiastic and confident in completing treatment, and avoid psychosocial pressure that can hinder the therapy process (Notoatmodjo, 2018). In theory, family support plays a key role in the treatment of chronic diseases such as TB. This support can be in the form of emotional, instrumental, informational, or award support given by the family to the patient. When patients feel cared for, motivated, and helped by their families in the treatment process, for example by reminding them to take medication or accompanying control to health facilities, it increases the patient's confidence and willingness to continue undergoing therapy until it is complete (Friedman, 2021).

These findings are reinforced by the results of the study (Lutfian *et al*., 2025) in *Japan Journal of Nursing Science*, which shows that family support plays a significant role in improving treatment adherence and quality of life for TB patients. The study concluded that patients who received family support were more likely to complete therapy than those who received less attention from the immediate environment. This is in line with the results of the research (Herawati et al., 2020) which showed that respondents with high levels of family support were 6 times more likely to be compliant with medication compared to respondents with low family support.

In line with research (Setyarini *et al.*, 2024) which suggests that there is a significant relationship between family support and patient compliance levels. In the study, a significance value (Sig. 2-tailed) of 0.000 or $p < 0.05$ was obtained, which showed that family support had an effect on patient compliance in undergoing treatment.

Based on results in the field, it is shown that the lack of family support is one of the main

obstacles in the treatment process of TB patients. Some respondents who had less family support admitted that they were not always escorted to the health center by family members, even when their physical condition was weak. There are also respondents who are not reminded to take medication regularly, so they often forget or delay the time of taking medication. In addition, medication collection schedules and phlegm examinations are not always monitored by families, causing patients to miss control days or take medications not on time.

This condition shows that without the active involvement of the family, patients are more prone to experiencing fatigue, confusion in treatment schedules, and loss of enthusiasm to undergo therapy completely. On the other hand, patients who received strong support from their families in both physical, emotional, and logistical forms were more regular in following treatment and had higher motivation to recover.

Thus, these results confirm that family support is not only complementary, but a key factor in ensuring the success of tuberculosis treatment. Therefore, it is necessary to take an approach that directly involves families in patient education, monitoring training, and counseling on the importance of their role in the recovery process of family members suffering from TB.

Therefore, these results underscore that social support, particularly from the nuclear family, is an essential component in improving the success of tuberculosis treatment. Interventions that actively involve families in education, monitoring, and mentoring need to be strengthened as a supporting strategy in TB control programs in the community.

The Relationship of the Role of Health Workers to Medication Compliance in Tuberculosis Patients in the Working Area of the Darma Health Center, Kuningan Regency

Table 3. The Relationship of the Role of Health Workers to Medication Compliance in TB Patients in the Darma Health Center Area, Kuningan Regency

The role of health workers	**Compliance**				**Total**		**OR**	**95% CI**	***p-value***
	Non-compliant		**Obedient**		**n**	**%**			
	n	**%**	**n**	**%**					
Less	0	0	0	0	0	0	-	-	-
Good	15	100	75	100	90	100			
Quantity	**15**	**100**	**75**	**100**	**90**	**100**			

Source: Primary Data 2025

Based on table 3, it shows that all respondents, both in the case and control groups

(100%), considered that the role of health workers was in the good category. There were no respondents who assessed the role of health workers in the category of lacking. This shows that in general, health workers at the Darma Health Center have carried out their role optimally in supporting the treatment process of TB patients, including in terms of education, monitoring, and motivation.

However, due to the absence of variation in the role categories of health workers, further statistical analysis such as odds *ratio* (OR), *confidence interval* (CI), and significance test (*p-value*) cannot be carried out. Thus, in this study, no statistically significant relationship was found between the role of health workers and medication adherence, although descriptively these roles were considered good by all respondents.

Based on a bivariate analysis using the Chi-square test to see the relationship between the role of health workers and medication adherence in TB patients, it was found that all respondents, both compliant and non-compliant, got a good role of health workers. This result is shown by the number of respondents as many as 15 non-compliant people and 75 compliant people, all of whom are in the category of good health workers.

This explanation is in line with Behavioral Theory *Lawrence Green*, which also includes the role of health workers as a reinforcing factor in shaping and strengthening health behaviors. Positive interactions between patients and healthcare workers, such as clear communication, regular monitoring, and an empathetic attitude, will strengthen patient adherence to therapy. This support helps patients stay on the treatment path despite facing internal and external obstacles (Notoatmodjo, 2018).

Based on the results in the field, some respondents stated that they felt helped because the officers not only administered medication, but also listened to patients' complaints and provided motivation during the treatment process. The presence of communicative and responsive officers to the patient's needs has been proven to encourage patients to be more disciplined and confident in undergoing long and continuous treatment.

The consistency of the officers in carrying out their roles reflects that TB services at the health center have met minimum service standards and have been oriented to the needs of patients. This is very important because the involvement of officers is not only as a drug provider, but also as a facilitator, motivator, and direct supervisor in the success of TB control programs at the primary level.

Because all respondents stated that they got a good role for health workers, there was no variation in the independent variable category. Thus, risk analysis such as *the Odds Ratio*

cannot be calculated or does not show a difference in risk between groups, as no respondents rated the role of health workers as lacking. This shows that the role of health workers is not a distinguishing factor in medication adherence in this study, but still plays an important role as a support for the success of treatment in general.

This research is not in line with (Nehe, 2022) The results showed that the variable role of health workers had a significant relationship with medication adherence in TB patients with a value of *p value* 0.021. The results of this study concluded that there was no relationship between the role of family and health workers and medication adherence in TB patients.

Thus, it can be concluded that the active role of health workers is a crucial supporting factor in improving compliance with tuberculosis treatment. Increasing officer capacity, continuity of coaching, and performance monitoring still need to be carried out so that the quality of service is maintained and has a direct impact on the success of TB patient treatment.

The Relationship of Access to Health Facilities to Medication Compliance of Tuberculosis Patients in the Working Area of UPTD Darma Health Center, Kuningan Regency, Kuningan Regency, Kuningan Regency in 2025

Based on the results of bivariate analysis using the Chi-square test to test the relationship between access to health facilities and medication adherence in tuberculosis patients, a value of $p = 0.002$ ($p < 0.05$) was obtained, which showed a statistically significant relationship. An *odds ratio* (OR) value of 7.111 with a 95% confidence interval (1,843-27,435) showed that respondents who had difficulty accessing health facilities had a 6.676 times greater risk of non-compliance in taking medication compared to respondents who had easy access to health facilities.

This explanation is in line with Behavioral Theory *Lawrence Green*, which refers to service access as a enabling factor (*enabling factors*). Good access to healthcare facilities such as close distance, affordable costs, and appropriate service times allow patients to engage in healthy behaviors, in this case adherence to treatment. On the other hand, when access is limited, even if the patient already has an intention or motivation, the realization of behavior will still be impaired, this enabling factor plays an important role in facilitating behavior change and maintenance (Notoatmodjo, 2018).

In line with the conditions on the ground that show that easy access to health facilities is supported by the availability of transportation facilities, adequate road infrastructure, and a relatively short distance from the residence to the health center. These factors make it easier

for tuberculosis patients to come regularly to health facilities to take medication and undergo follow-up examinations, thereby increasing adherence to treatment.

From the results of observations in the field, respondents with difficult access generally live in areas where roads have not been paved or potholes, which become slippery and impassable when it rains. Most of them also do not have private vehicles, and there is no regular public transportation available in their area. In fact, there are respondents who have to walk to reach the main road or hitchhike a neighbor's vehicle if possible. This condition causes delays in taking medication, absences during the examination schedule, or even premature discontinuation of treatment.

These barriers are the main cause of low adherence in patients with difficult access. Therefore, poor physical accessibility must receive serious attention in the planning of TB control programs, for example through strengthening ball pick-up services, mobile TB posyandu, or home visits by health workers, so that patients in areas with limited access can still undergo complete and regular treatment.

In line with research (Marin *et al.,* 2024) It shows that difficulties in accessing healthcare facilities include geographical factors (long distance, lack of transportation), long waiting times, and high costs contribute significantly to patient non-compliance in tuberculosis treatment. A study in South Sudan found that long, long waits to health facilities were statistically associated with an increased risk of non-compliance (*Adjusted Prevalence Ratio* ≈ 1.77).

Thus, the results of this study reinforce the evidence that accessibility to health services is an important factor in the success of tuberculosis therapy, and needs to be a major concern in intervention planning, especially in areas with limited topography or infrastructure. Efforts such as strengthening the role of health cadres, delivering medicines to homes, and increasing access to local transportation can be effective strategies to increase patient adherence to treatment.

The Relationship of Access to Health Facilities to Medication Compliance in Tuberculosis Patients in the Working Area of the Darma Health Center, Kuningan Regency

Table 4 The Relationship of Access to Health Facilities to Medication Compliance in Tuberculosis Patients in the Working Area of the Darma Health Center, Kuningan Regency

Access to healthcare facilities	Compliance				Total		OR	95% CI	*p- value*
	Non-compliant		Obedient		n	%			
	n	%	n	%					
Difficult	12	80	27	36	39	43,3	7,111	1,843-27,435	0.002
Not difficult	3	8,5	48	64	51	56,7			
Quantity	**15**	**100**	**75**	**100**	**90**	**100**			

Source: Primary Data 2025

Based on table 4, it shows the results of respondents who have access to health facilities that are difficult with various obstacles such as damaged road conditions, long distances, most of them are found in the case group, which is 80%, while respondents who have not difficult access are supported by the availability of transportation facilities, adequate road infrastructure, and a relatively short distance from their residences to health centers. Most of them were found in the control group, which was 64%. The results of the statistical test showed that the value of $p = 0.002 < 0.05$, which means that there is a significant relationship between access to health facilities and medication adherence in people with tuberculosis. Value *Odds Ratio* (OR) of 7,111 with a 95% confidence interval (1,843-27,435) indicates that respondents who have difficulty accessing health facilities have a 7.111 times higher risk of non-compliance in taking medication compared to respondents who have easy access.

The Relationship of Attitudes to Medication Compliance in Tuberculosis Patients in the Working Area of the Darma Health Center, Kuningan Regency

Table 5. The Relationship of Attitudes to Medication Compliance in Tuberculosis Patients in the Working Area of the Darma Health Center in 2025

Attitude	Compliance				Total		OR	95% CI	*p- value*
	Non-compliant		Obedient		n	%			
	n	%	n	%					
Less	10	66,7	19	25,3	29	32,2	5,895	1,788-19,434	0,002
Good	5	33,3	56	74,7	61	67,8			
Quantity	**15**	**100**	**75**	**100**	**90**	**100**			

Source : Primary Data 2025

Based on table 5, of the 29 respondents who had a poor attitude, the majority were in the case group, which was 66.7%, while of the 61 respondents who had a good attitude, most were in the control group, which was 74.7%. The results of the statistical test showed that the value of $p = 0.002 < 0.05$, which means that there is a significant relationship between attitude and adherence to taking medication in people with tuberculosis. An *odds ratio* (OR) value of

5.895 with a 95% confidence interval (1.788–19.434) showed that respondents with a less attitude had a risk of being 5.895 times more at risk of non-compliance in taking medication compared to respondents with a good attitude.

Based on the results of bivariate analysis using the Chi-square test to determine the relationship between attitude and medication adherence in tuberculosis patients, a value of $p = 0.002$ ($p < 0.05$) was obtained, which showed a statistically significant relationship. An *odds ratio* (OR) value of 5.895 with a 95% confidence interval (1.788–19.434) indicates that respondents with a less positive attitude have a 5.895 times greater risk of non-compliance in taking medication compared to respondents with a good attitude.

This explanation is in line with *Theory of Planned Behavior*, which explains that attitudes towards behavior are one of the main factors in forming intentions or intentions to act. A positive attitude towards the effectiveness of treatment, the belief that therapy will heal, and the expectation of good results, will encourage patients to have strong intentions in undergoing treatment obediently. In other words, the more positive the patient's attitude, the more likely it is that obedience behavior will be formed (Ajzen, 2019).

These results are in line with conditions in the field that show that patients' attitudes towards TB treatment greatly affect their adherence to therapy. Some patients with a less positive attitude seem to have no complete understanding of the importance of long-term treatment, and tend to assume that taking medication can be stopped if symptoms have subsided. In addition, it is still found that the treatment of tuberculosis is heavy, tiring, and uncomfortable, so that patients become reluctant to continue treatment consistently.

On the other hand, patients with a good attitude towards treatment tend to have a higher awareness to undergo therapy in a disciplined manner until it is complete. Patients show a willingness to come to a health facility regularly, follow a set control schedule, and understand that treatment must be carried out even though they feel healthy. This positive attitude is often influenced by previous personal experiences, family support, or consistent guidance from healthcare workers.

These findings are reinforced by a study by (Catissi et al., 2024) in *International Journal of Environmental Research and Public Health*, which suggests that patients with a positive attitude to TB treatment have a significantly higher level of adherence compared to those with a negative attitude ($p < 0.01$).

In line with research (Widianingrum, 2022) which suggests that there is a significant relationship between attitudes and the level of compliance of TB patients. In the study, the

significance value (*Sig. 2-tailed*) by 0.000 < 0.05, which indicates that motivation affects patient compliance in undergoing treatment. And also research conducted by (Ulfah et al., 2018) which suggests that there is a significant relationship between attitudes and the level of compliance of TB patients. In the study, the significance value (*Sig. 2-tailed*) of 0.020 or p < 0.05, which indicates that attitude affects the patient's compliance in undergoing treatment.

Thus, the results of this study confirm that the patient's attitude is a very decisive psychological factor in the success of tuberculosis treatment. Therefore, interventions to build a more positive attitude towards treatment need to be a concern at every stage of service, both through ongoing counseling and a personalized approach by health workers in the field.

The Relationship of Motivation to Medication Compliance in Tuberculosis Patients in the Working Area of the Darmas Health Center, Kuningan Regency

Table 6. The Relationship of Motivation to Medication Compliance of Tuberculosis Patients in the Working Area of the Darma Health Center, Kuningan Regency

Motivation	**Compliance**				**Total**		**OR**	**95% CI**	***p-value***
	Non-compliant		**obedient**		**n**	**%**			
	n	**%**	**n**	**%**					
Less	8	53,3	30	40	38	42,2	1,714	0,562-5,226	0,340
Good	7	46,7	45	60	52	57,8			
Quantity	**15**	**100**	**75**	**100**	**90**	**100**			

Source : Primary Data 2025

Based on table 6, it shows that respondents who have low motivation, half of the respondents are in the case group, which is 53.3%, while respondents who have good motivation, almost half are in the control group, which is 60%. The results of the statistical test showed that the value of p = 0.340 > 0.05, which means that there was no significant relationship between motivation and adherence to taking medication in people with tuberculosis. An *odds ratio* (OR) value of 1.714 with a 95% confidence interval (0.562-5.226) suggests that less motivation does not significantly increase the risk of non-adherence in taking medication compared to good motivation.

Based on the results of bivariate analysis using the Chi-square test to test the relationship between motivation and medication adherence in tuberculosis patients, a value of p = 0.340 (p > 0.05) was obtained, which indicates the absence of a statistically significant relationship. An *odds ratio* (OR) value of 0.911 with a 95% confidence interval (0.562–5.226) indicates that low motivation does not significantly increase the risk of non-adherence in taking

medication compared to good motivation.

This explanation is in line with *Theory of Planned Behavior*, where motivation is part of the intention (*Intent*) which is formed by three main determinants: attitudes towards behavior, subjective norms, and perceptions of control. Patients who have high motivation usually have formed a positive attitude, received social support, and felt capable of undergoing therapy. Motivation acts as a psychological energy that bridges the gap between intentions and actual behaviors. Therefore, high motivation strengthens the intention to obey, and encourages real action in medicine (Ajzen, 2019).

Based on the findings in the field, some patients stated that they had a desire to recover and intended to undergo treatment. However, various external factors such as busy work, difficulty accessing transportation, side effects of medications, and lack of support from family are often the main obstacles to the consistent implementation of therapy. This condition indicates that even if the patient has good internal motivation, it is not necessarily enough to guarantee adherence to treatment.

As for patients who are internally less motivated, but still show good compliance in undergoing treatment. This is possible due to strong external support, such as assistance from family members, supervision by health workers, and easy access to medical services. One of the important components of such external support is the presence of a PMO (Medication Monitoring Agency), which is an integral part of the DOTS (Directly Observed Treatment, Short-course) strategy in the national tuberculosis control program.

The PMO has a central role in ensuring patient adherence to the daily medication schedule, through direct supervision when the patient takes the medication. The PMO can come from a family, health cadres, neighbors, or health workers who are officially appointed and have received training. PMO's duties are not only limited to supervising drug consumption, but also providing emotional support, motivating patients, reminding medication schedules, and reporting patient compliance to health center officers. Ideally, the existence of PMO can be a bridge between patients and health services, as well as prevent therapeutic *dropouts* that can have an impact on drug resistance.

However, based on findings in the field, some PMOs are not actively carrying out their functions optimally. The PMO's involvement is due to various factors, including a lack of understanding of duties and responsibilities, lack of adequate training, weak monitoring from health workers, or a lack of close relationships with patients. There are also cases where the PMO is only administratively appointed with no real involvement in the treatment process. As

a result, patients do not receive regular supervision, do not feel supervised or psychosocially supported, and are ultimately prone to non-compliance, especially when their internal motivation is low.

The inactivity of the PMO has the potential to reduce the effectiveness of the DOTS program as a whole. This shows that the appointment of the PMO should not be a formality, but should be accompanied by continuous coaching, monitoring, and evaluation. The quality of the PMO's role is critical to the success of therapy, especially for patients who face external challenges such as heavy work, drug side effects, or economic burdens.

Theoretically, motivation plays an important role in supporting the recovery process of tuberculosis patients, according to (Arviani, 2020) stating that motivation with sufficient intensity can provide direction and encouragement for individuals to behave consistently and continuously, including in undergoing treatment. Patients with high motivation are generally encouraged to follow treatment recommendations in order to achieve better recovery and quality of life.

This research is not in line with the research (Widianingrum, 2022) Statistical test results using *Chi square* A degree of significance of p = 0.000 was obtained by setting a significance degree of a<0.05 which means that there is a relationship between motivation and adherence to taking anti-tuberculosis drugs in TB patients.

These results confirm that although motivation does not statistically show a significant association with medication adherence, it still plays an important role as an early driver in the treatment process. However, internal motivation alone is not enough. Strong external support such as the role of family, health workers, and ease of access to services is needed so that patients are able to undergo therapy consistently. The combination of encouragement from within and the surrounding environment is the key in forming sustainable compliance for the achievement of optimal recovery in tuberculosis patients.

The Relationship of Knowledge to Medication Compliance in Tuberculosis Patients in the Working Area of the Darma Health Center, Kuningan Regency

Table 7. The relationship of knowledge to the adherence to taking drugs for tuberculosis patients in the working area of the Darma Health Center, Kuningan Regency

Knowledge	Compliance	Total			

	Non-compliant		Obedient		n	%	OR	95% CI	*p- value*
	n	%	n	%					
Less	9	60	9	12	18	20	11,000	3,165-38,234	0,000
Good	6	40	66	88	72	80			
Quantity	**15**	**100**	**75**	**100**	**90**	**100**			

Source : Primary Data 2025

Based on table 7, of the 18 respondents who had less knowledge, most were in the case group which was 60%, while of the 72 respondents who had good knowledge, most were in the control group which was 88%. The results of the statistical test showed that the value of p = 0.000 < 0.05, which means that there is a very significant relationship between the level of knowledge and adherence to taking medication in tuberculosis patients. *An odds ratio* (OR) value of 11,000 with a 95% confidence interval (3,165–38,234) showed that respondents with less knowledge had an 11 times greater risk of non-compliance in taking medication compared to respondents with good knowledge.

Based on the results of bivariate analysis using the Chi-square test to examine the relationship between knowledge and medication adherence in tuberculosis patients, a value of p = 0.000 (p < 0.05) was obtained, which showed a statistically significant relationship. An *odds ratio* (OR) value of 11,000 with a 95% confidence interval (3,165–38,234) indicates that respondents with less knowledge have an 11 times greater risk of non-compliance in taking medication compared to respondents with good knowledge.

This explanation is in line with *Theory of Planned Behavior*, where knowledge is the foundation in forming attitudes towards behavior. Good knowledge of tuberculosis, the importance of treatment, and the risk of non-compliance allows patients to evaluate the consequences of their actions more rationally. This knowledge forms a positive attitude towards healthy behaviors, which ultimately influences the intention to obey. In TPB, a positive attitude is a strong predictor for the formation of intentions or intentions to carry out behaviors, such as adherence to taking medication regularly (Ajzen, 2019) in (Scott, et al., 2021).

These results are reinforced by findings in the field that show that many people with tuberculosis do not fully understand the importance of regular and thorough treatment, especially during long-term treatment. Some patients are unaware of the medical consequences if treatment is stopped prematurely, such as drug resistance or disease recurrence. There are also patients who think that treatment can be stopped after symptoms improve, because their understanding is lacking.

In contrast, patients who have a good understanding of tuberculosis and its treatment, tend to show a high level of adherence. They understand that treatment must be undergone until it is finished, even though they feel healthy, because the bacteria that cause TB can still be activated again if the treatment is not completed. Good knowledge also helps patients cope with the side effects of medication more calmly, as they understand that they are part of a manageable healing process.

The findings confirm that knowledge is an important factor in shaping patients' attitudes and behaviors towards compliance in undergoing treatment. Efforts to increase patient knowledge are not only the responsibility of formal health workers, but also need to involve the active role of TB cadres at the community level. TB cadres play a spearhead in reaching patients directly and sustainably, as well as being an important link between health services and the community.

In this context, increasing the capacity of TB cadres is a strategic step that must be pursued systematically. Continuous training, the provision of appropriate educational materials, and the strengthening of interpersonal communication skills are important components so that cadres have the competence to convey information related to tuberculosis in an appropriate, accurate, and persuasive manner.

With cadres who have a comprehensive understanding of TB and adequate educational skills, the counseling process for patients and families can be carried out more effectively and continuously. Competent cadres are not only able to bridge the information gap between healthcare facilities and patients, but also provide much-needed emotional and motivational support in undergoing long-term treatment.

Through this cadre empowerment strategy, it is hoped that the increase in patient knowledge can be achieved more optimally, which in turn will contribute significantly to increasing the level of patient compliance in taking anti-tuberculosis drugs regularly and completely.

This is in line with recent research by (Wang et al., 2024) in *BMC Public Health* showed that the higher the level of people's knowledge about TB, the more likely they were to receive and undergo complete therapy (OR = 1,096). Adequate knowledge helps patients understand the importance of treatment completely, recognize symptoms, and know the risk of drug resistance if therapy is stopped. In a systematic review by (Munro et al., 2019) ,lack of understanding of TB is cited as one of the main obstacles to the success of therapy. Therefore, increasing patient knowledge through structured and continuous education is one of the

important strategies in supporting the success of TB control programs.

This research is in line with research (Widianingrum, 2022) which shows that there is a significant relationship between knowledge and the level of compliance of TB patients. In the study, the significance value (*Sig. 2-tailed)* 0.000 or $p < 0.05$, which indicates that knowledge affects patient compliance in undergoing treatment.

These results confirm that knowledge is an important factor in shaping patients' attitudes and behaviors towards medication adherence. Intensive educational efforts, both by health workers, TB cadres, and health information media, need to be continuously improved so that patients have a correct and complete understanding of their disease. With sufficient knowledge, patients will be more mentally and physically prepared to undergo treatment, and be able to make the right decisions for their recovery.

The novelty of this research lies in the following aspects:

1. A multi-variable comprehensive approach. This study simultaneously analyzed six main factors (family support, role of health workers, access to health facilities, attitudes, motivation, and knowledge) on compliance with TB medication in one bivariate analysis framework.
2. Local context of primary health services**.** This research was carried out specifically in the working area of the Darma Health Center, which has a high number of TB cases and diverse service access characteristics, resulting in contextually relevant findings.
3. Strengthening risk-based evidence (Odds Ratio). The study not only identified the relationship, but also measured the magnitude of the risk of non-compliance on each factor, thus providing a stronger basis for the formulation of policy interventions.
4. Practical implications for TB control programs. The results of this study provide evidence-based recommendations for strengthening the role of the family, improving patient education, and improving access to health services as a strategy to increase compliance with TB medication.

CONCLUSION

Based on the results of the research and discussion that has been described in the previous chapter regarding "Factors related to Medication Compliance in Tuberculosis Patients in the Working Area of the Darma Health Center, Darma District, Kuningan Regency in 2025", it can be concluded as follows:

1. There was a significant association between family support and adherence (p = 0.002; OR = 6,714). Respondents with less family support had a higher risk of non-compliance in undergoing treatment.
2. The role of health workers was assessed well by all respondents, both in the case group and the control group (100%), so that bivariate statistical analysis could not be carried out. Thus, no statistically significant relationship was found, but descriptively the role was still considered important in supporting patient treatment.
3. There is a Relationship between Health Service Access and Compliance: There is a significant relationship between access to health care facilities and medication compliance (p = 0.002; OR = 7,111). Respondents with access to difficult family facilities had a higher risk of non-compliance in undergoing treatment.
4. There was a significant relationship between patients' attitudes and medication adherence (p = 0.002; OR = 5,895). Respondents with a less attitude had a higher risk of non-compliance in undergoing treatment.
5. There was no statistically significant relationship between patient motivation and medication adherence (p = 0.340). This indicates that internal motivation alone is not enough to influence compliance, in the absence of other supporting factors.
6. There was a very significant relationship between knowledge level and compliance (p = 0.000; OR = 11,000). Respondents with less knowledge had a higher risk of non-compliance in undergoing treatment.

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