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Socio-demographic and Behavioral Factors Relationship with Pulmonary Tuberculosis: A Case-control Study

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Abstract

BACKGROUND: Pulmonary tuberculosis (TB) is still a world health problem, especially in Indonesia. The prevalence of pulmonary TB has increased from 2013 to 2018. One of the factors that play a role in the spread of pulmonary TB is socio-demographic and behavioral factors.

AIM: This study aims to determine the influence of behavioral and social demographics on the incidence of pulmonary TB.

METHODS: The design of this study used a case-control study design to determine the relationship between socio-demographic factors and behavioral factors with the dependent variable, namely the incidence of pulmonary TB. The sample size of cases with controls is 1:1, cases consist of 60 respondents and controls 60 respondents. Data analysis using univariate, bivariate (chi-square), and multivariate (multiple logistic regression) analysis with alpha= 0.05.

RESULTS: The socio-demographic factors associated with pulmonary TB are family income, employment status, and nutritional status. Behavioral factors that are related are knowledge, attitude, smoking, and history of contact with TB patients. The dominant factor that is most related to pulmonary TB is the behavioral factor, namely the knowledge variable $p \leq 0.001$ odds ratio = 2.899 (95% CI 2.475–2.981).

CONCLUSION: It is suggested that it is important to increase public knowledge about pulmonary TB with the participation of health workers and health cadres by providing information and education about the prevention of pulmonary TB in the community.

Introduction

Tuberculosis (TB) disease is still a global health problem. TB is an infectious disease or lung infectious disease that is a major cause of health, one of the top 10 causes of death worldwide, and the leading cause of death from an infectious agent (ranked above HIV/AIDS) caused by the bacillus *Mycobacterium* TB (MTB), that is, it spreads when a person with TB expels the bacteria into the air; e.g., coughing. It usually affects the lungs (pulmonary TB) but can also affect other sites (extrapulmonary TB). About a quarter of the world's population is infected with MTB and is therefore at risk of developing TB disease [1], [2].

The TB inventory study found TB Incidence of 321/100,000. Globally, the incidence of TB per 100,000 population is decreasing by about 2% per year. The regions that experienced the fastest decline in 2013-2017 were the WHO Europe region at 5% per year and the WHO Africa region at 4% per year. In 2017, the best estimate of the proportion of TB patients who died from the disease case fatality rate (CFR) was 16%, down from 23% in 2000. The CFR must fall to 10% by 2020 to reach the first phase of the end TB strategy. There is considerable variation in CFR outcomes, ranging from <5% in some countries to more than 20% in most countries in the WHO Africa region. This shows inequalities among countries in accessing TB diagnosis and treatment [3].

Data from Indonesian Basic Health Research (Riskesdas) in 2013 show that the prevalence of pulmonary TB diagnosed by health workers in Indonesia is 0.4%, not much different from 2007. Based on Riskesdas in 2018, in Indonesia, 0.42% of the population was diagnosed with TB disease. The highest incidence of TB in Indonesia is in Papua Province with a prevalence of 0.77%, then Banten Province with a prevalence of 0.76%, and then West Java Province with a prevalence of 0.63% [4].

The Target of the TB Control Strategy Plan in 2019 The prevalence of pulmonary TB has decreased to 245 / 100,000 population. The five provinces with the highest pulmonary TB in 2018 were West Java (0.7%), Papua and DKI Jakarta (0.6%), Gorontalo (0.5%), and Banten and West Papua (0.4%). With an incidence of 842,000 cases per year and notification of TB cases of 442,172 cases, there are still around 47% who have not been notified, either unreached, undetected, or unreported [5].

The prevalence of pulmonary TB by the province has increased from 2013 to 2018. Banten

province has increased wherein 2013 the prevalence of pulmonary TB was 0.4–0.8% in 2018 a 2-fold increase, South Sumatra also experienced an increase wherein 2013 the prevalence of pulmonary TB was 0.2–0.5% in 2018. West Java has decreased but is still in the top three positions wherein 2013 the prevalence of pulmonary TB was 0.7–0.6% in 2018, Aceh experienced an increase wherein 2013 it was 0.3–0.5% in 2018. Based on the health profile of Banten Province, the health status of the home environment which has a role in TB transmission is still not good [4], [6].

One of the factors that play a role in the spread of TB germs is environmental factors, namely the condition of the house that does not meet health requirements including ventilation, lighting, type of floor, type of wall, humidity, temperature, and density of occupancy. The density of occupancy that does not meet the requirements has a risk for pulmonary TB 16.15 times greater than the density of occupancy that meets the requirements. The results of previous studies found that the type of floor has a significant relationship with the incidence of pulmonary TB disease, the bacteria that cause TB can survive a long time in a dark, humid, cold, and not well-ventilated room [7], [8], [9].

Another risk factor is smoking where the results of the study show that there is a dose-response relationship between the number of cigarettes smoked every day and the risk of active pulmonary TB with an odds ratio (OR) of 5.59. Another factor is a history of other diseases such as diabetes and HIV. The results showed a significant relationship between a history of diabetes and HIV status with the risk of being infected with TB bacteria after controlling for variables of age, sex, demographic factors, and an increase in serum acute phase reactants [8]. Important risk factors for transmission of infection are younger age, poor nutrition, absence of Bacille Calmette-Guérin (BCG) vaccination, contact with sputum-positive adults, and exposure to environmental tobacco smoke [10].

Socio-cultural factors associated with TB are ethnicity, living in small settlements, unemployment, not having access to tap water, no bathroom or toilet flushing, being underweight, smoking, frequent alcohol consumption, and immunosuppressive care and work [11], [12]. Other studies have shown that more people with TB know about TB symptoms than about duration of illness or free treatment. Knowledge about TB is limited to that obtained at school or from relatives with TB. Attitudes and practices of patients and the population, in general, indicate that there is still a stigma attached to TB [13], [14], [15]. The problem of TB transmission is still high with the high behavioral and social demographic risk factors along with the increase in TB disease, and it is necessary to know the influence of behavioral and social demographics on the incidence of pulmonary TB at the Cikulur Health Center Banten.

Methods

This research method is a quantitative approach. The design of this study used a case-control study design or a retrospective study. The research was conducted in 2019-2020. The case-control design in this study was used to determine the relationship between socio-demographic factors (age, gender, family income, employment status, nutritional status, and history of diabetes mellitus) and behavioral factors (knowledge, attitudes, affordability of health services, smoking, and history of patient contact). with the dependent variable is the incidence of pulmonary TB. The eligible population is all residents who seek treatment at health service facilities at the health center level selected as research sites. The sampling technique was purposive sampling with inclusion and exclusion criteria. The sample cases in this study were patients with pulmonary TB based on the results of the examination recorded in the medical records at the selected health center level, and the controls were neighbors who had never been diagnosed with pulmonary TB. From the calculation of the sample, the minimum sample size of cases is 120 people, with a comparison of the sample size of cases with controls, namely 1:1, where the case group sample consists of 60 respondents and the control group sample is 60 respondents. Data collection techniques by interview using a questionnaire that has been validated. Data analysis with univariate, bivariate, and multivariate analysis with a= 0.05. Data analysis using statistical software. Multivariate analysis using multiple logistic regression to analyze the effect of the independent variable and the dependent variable.

Results

Bivariate analysis was conducted to determine the relationship between socio-demographic (age, gender, family income, employment status, nutritional status, history of diabetes mellitus) and behavioral factors (knowledge, attitudes, affordability of health services, smoking, and patient contact history) with the dependent variable, namely the incidence of pulmonary TB.

The results of the study in Table 1 on socio-demographic factors with the incidence of pulmonary TB are known that based on the age variable; there is no significant relationship with the incidence of pulmonary TB (p = 0.262). The majority of respondents aged >30 years did not have pulmonary TB (66.7%), while respondents aged 30 years had pulmonary TB (45.0%). Bivariate analysis based on gender showed that there was no significant relationship between the sex variable and the incidence of pulmonary TB (p = 0.848). History of diabetes mellitus did not have a

Table 1: The relationship of socio-demographic factors with the incidence of pulmonary TB

Socio-demographic factors	Pulmonary TB		p-value	OR (95% CI)
	Case (%)	Control (%)		
Age				
>30 years old	33 (55.0)	40 (66.7)	0.262	0.611
≤30 years old	27 (45.0)	20 (33.3)		(0.292–1.280)
Gender				
Male	20 (66.7)	22 (63.3)	0.848	0.864
Female	40 (33.3)	38 (36.7)		(0.408–1.830)
Family income				
<Regional minimum wage	29 (48.3)	9 (15.0)	0.000	5.301 (2.210–12.665)
≥Regional minimum wage	31 (51.7)	51 (85.0)		
Employment status				
Working	18 (30.0)	30 (50.0)	0.040	0.429
Not working	42 (70.0)	30 (50.0)		(0.203–0.906)
Nutritional status				
Abnormal	13 (21.7)	34 (56.7)	0.000	0.212
Normal	47 (78.3)	26 (43.3)		(0.095–0.470)
History of diabetes mellitus				
Yes	25 (41.7)	26 (43.3)	0.999	0.934
No	35 (58.3)	34 (56.7)		(0.453–1.927)

TB: Tuberculosis.

significant relationship with the incidence of pulmonary TB (p = 0.999).

Socio-demographic factors that are significantly related to the incidence of pulmonary TB are family income, employment status, and nutritional status. Based on the family income variable, it was found that there was a significant relationship with the incidence of pulmonary TB (p = 0.000) and (OR = 5.301 [2.210–12.665]). Respondents whose income is <regional minimum wage tend of 5.301 times greater chance to experience pulmonary TB compared to respondents who have income above the regional minimum wage.

Table 2: The relationship of behavioral factors with the incidence of pulmonary TB

Behavioral factors	Pulmonary TB		p-value	OR (95% CI)
	Case (%)	Control (%)		
Knowledge				
Low	27 (45.0)	15 (25.0)	0.011	2.455
High	33 (55.0)	45 (75.0)		(1.246–5.222)
Attitude				
Negative	38 (63.3)	25 (58.3)	0.028	2.418
Positive	22 (36.7)	35 (58.3)		(1.356–6.322)
Access to health facilities				
Difficult	32 (53.3)	24 (40.0)	0.200	1.714
Easy	28 (46.7)	36 (60.0)		(0.831–3.536)
Smoking				
Yes	33 (55.0)	18 (30.0)		
No	27 (45.0)	42 (70.0)	0.010	3.153 (2.166–5.743)
History of contact with TB patients				
Yes	28 (46.7)	21 (35.0)		
No	32 (53.3)	39 (65.0)	0.001	6.234 (3.780–10.385)

TB: Tuberculosis.

Based on employment status, there was a significant relationship with the incidence of pulmonary TB (p = 0.040) and (OR = 0.429 [0.203–0.906]). Unemployment status is known to have a protective effect for suffering from pulmonary TB by 0.429 times. Nutritional status was significantly related to the incidence of pulmonary TB (p = 0.000) and (OR = 0.212 [0.095–0.470]). Abnormal nutritional status is known to have a protective effect for suffering from pulmonary TB by 0.212 times.

The results of the bivariate analysis based on behavioral factors found that the variable that was not significantly related to the incidence of pulmonary TB was the variable of affordability of health services with a p = 0.200. The majority case group is easy to reach health services by 53.3%, and the majority control group is difficult to reach health services by 60.0%.

Based on Table 2, Behavioral factors that were significantly related to the incidence of pulmonary TB were knowledge, attitudes, smoking, and history of contact with patients with pulmonary TB. There is a significant relationship between the knowledge variable and the incidence of pulmonary TB (p=0.011) and (OR=2.455 (1,246-5,222)). Respondents who have less knowledge tend to be 2,455 times more likely to experience pulmonary TB compared to respondents who have good knowledge.

Table 3: Multivariate analysis result

Variable	B	SE	Nilai p	Exp (B)	95% CI	
					Lower	Upper
Family Income	0.523	0.001	<0.001	2.283	2.229	2.887
Employment Status	0.006	0.001	<0.001	1.107	1.006	1.110
Nutritional status	0.020	0.001	<0.001	1.021	1.017	1.022
Knowledge	0.321	0.001	<0.001	2.899	2.475	2.981
Attitude	0.013	0.002	<0.001	1.987	1.983	1.991
Smoking	0.141	0.004	<0.001	2.867	2.861	1.874
History of Contact with TB Patients	0.139	0.010	<0.001	2.879	2.862	2.896

There is a significant relationship between the attitude variable and the incidence of pulmonary TB (p = 0.028) and (OR = 2.418 [1.356–6.322]). Respondents who have a negative attitude tend to be 2.418 times more likely to experience pulmonary TB compared to respondents who have a positive attitude. There is a significant relationship between smoking behavior and the incidence of pulmonary TB (p = 0.010) and (OR = 3.153 [2.166–5.743]). Respondents who smoke tend to be 3.153 times more likely to experience pulmonary TB compared to respondents who do not smoke. There was a significant relationship between the history of contact with TB patients and the incidence of pulmonary TB (p = 0.001) and (OR = 6.234 [3.780–10.385]) respondents who had a history of contact with TB patients had a 6.234 times greater chance of experiencing pulmonary TB compared to respondents who had no history of contact with TB patients.

The final results of the multiple logistic regression multivariate analysis in Table 3 showed seven variables that persisted in the model. The variables in the final model are family income, employment status, nutritional status, knowledge, attitudes, smoking, and history of contact with TB patients. The multivariate analysis found that the knowledge variable was the most influential variable on the incidence of pulmonary TB in the 15 year age group with an OR value of 2.899 (95% CI 2.475-2.981). This means that respondents who have less knowledge have the most significant risk, which is 2.899 times greater for experiencing pulmonary TB compared to respondents who have high knowledge.

Discussion

Socio-demographic factors

Family income is one of the socio-demographic variables related to the family's ability to access welfare and health. A person whose income is <regional minimum wage tends to 5.301 times greater chance to experience pulmonary TB than those who have an income above the regional minimum wage. The results of other studies also show that family income affects the incidence and risk of suffering from TB.

Family income is also influenced by the number of dependents in the family and the type of work. Family income above the average will increase a person's awareness to get a balanced nutritional intake that affects a person's nutritional status in increasing body resistance in responding to infectious diseases, one of which is pulmonary TB. Income also increases a person's affordability in obtaining health services. With access to health services, a person can prevent disease with regular control [9], [16].

Occupational variables in this study are known to have a significant relationship with the incidence of pulmonary TB. The analysis stated that someone who worked turned out to be a protective factor for pulmonary TB. Several studies have stated that a person's employment status is related to a person's risk for developing pulmonary TB. A person's employment status is a socio-demographic aspect related to income and describes the level of economic ability which is closely related to several aspects, namely health [12].

People who work and have income can meet their family needs such as nutritional intake, housing, and access to health care, this can reduce the risk of TB infection to family members. Another source states that a person will be more at risk of contracting pulmonary TB in the work environment. However, someone who is infected with TB and does not work has very close interactions and more time to interact with family members so that TB transmission has a greater chance of occurring because of transmission originating from family members [17], [18].

In this study, it was found that nutritional status had a relationship with the incidence of pulmonary TB. The analysis stated that someone with abnormal nutritional status turned out to be a protective factor for pulmonary TB. Several studies have stated that a person's nutritional status is related to a person's risk of developing pulmonary TB.

Some research results state that a person with poor nutritional status has 18.5 times the risk of being infected with TB compared to normal nutritional status. Another study also showed that a person whose nutritional status is below normal BMI <18 has a 2.5 times risk of being infected with TB compared to normal nutritional status [19].

Nutritional status of a person Related to the immune system in response to disease. Nutrient intake that enters the body is not balanced with what the body needs, will result in the disruption of the formation of antibodies and lymphocytes formed from protein and carbohydrates that function as a protection system for the body against various diseases that enter one of them is TB bacteria that enter through the respiratory tract.

A person who has a normal nutritional status does not necessarily have an optimal immune system and avoids TB transmission. In this case, BCG immunization status also plays a role in the prevention of pulmonary TB, but in this study, it was not discussed related to immunization status because of the possibility of recall bias in the case-control design.

Behavioral factors

Behavioral factors that were significantly related were knowledge, attitude, smoking, and patient contact history. Several previous studies found that behavior in the form of knowledge and attitudes was related to a person's vulnerability to suffering from pulmonary TB. A person's behavior and attitude in acting are influenced by education. The higher level of education of a person, the higher the level of understanding of health. The results of the study stated that someone with low knowledge had 3.6 times more risk of being infected with TB compared to someone who had a high level of knowledge [20].

The results of the analysis show that lack of knowledge about pulmonary TB increases the risk of suffering from pulmonary TB. Knowledge is a very important domain in the formation of an action. Actions related to the incidence of pulmonary TB include prevention and early detection. The higher a person's knowledge about pulmonary TB, including the mode of transmission, the impact and complications that arise, and access to appropriate treatment, the lower the risk of a person suffering from pulmonary TB. Thus, the formation of a person's behavior due to his knowledge will form a new behavior starting in the cognitive domain.

Knowledge in the form of information about pulmonary TB includes transmission and prevention of TB germs to increase knowledge and cause a response in the form of attitudes in someone to information on TB disease prevention efforts that they know. Finally, the stimulus in the form of information on TB disease prevention efforts that he has known and fully realized will lead to a further response, namely in the form of action or in connection with the stimulus or information on TB disease prevention efforts [21].

Smoking behavior also shows a significant relationship with the risk of suffering from pulmonary TB. This is supported by research which states that children who are around their environment there are smokers at risk of 2 times greater infection with TB compared to

children who do not have smokers in their environment. The harmful substances contained in cigarettes can affect the immune system by reducing lung function, namely impairs ciliary function in the airways, thereby increasing the risk of TB [22].

Another factor that causes smoking behavior to increase the risk of TB is the particle size of cigarettes and other chemicals that have a role in the emergence of airway inflammation. Besides that, the content in cigarettes can cause structural changes in TB bacteria exposure. The function of lung fluid production will also increase for both normal people and those with pulmonary TB. Smoking causes changes in natural and acquired cell immunity which can affect macrophages and leukocytes [23].

The results showed that the history of contact with TB patients was a significant factor associated with the risk of TB. The results of a related study stated that a person with a history of contact with TB patients had a 3.1 times greater risk of being infected with TB than those who did not have a history of contact with TB patients. Another study also stated that those who had close contact with TB patients had a 1.3 times greater risk of becoming infected with TB compared to those who did not have close contact with TB patients. History of contact with patients is the most frequent risk factor associated with the incidence of TB in children. Close contact is one of the assessment indicators based on the scoring technique for diagnosing TB in children [24].

Factors most associated with pulmonary TB

Multivariate analysis showed that the knowledge variable was the variable most associated with the risk of developing pulmonary TB. Respondents who have less knowledge have the greatest risk, which is 2.899 times greater for experiencing pulmonary TB compared to respondents who have high knowledge. The knowledge that is the focus of this research includes the causes, symptoms of the disease, modes of transmission of the disease, treatment, and prevention of pulmonary TB.

Most of the respondents have good knowledge. However, the results of the analysis of perceptions show that some think that the disease they are experiencing is not a dangerous disease, but a common cough, it turns out to have an effect on the emergence of people's indifference to the consequences that can be caused by pulmonary TB disease. This will certainly increase the risk of transmitting it to others.

The results also show that some people do not immediately seek treatment or access health services when they feel symptoms of the disease even though they already know the symptoms of pulmonary TB. This has an impact on the length of a person's illness and the possibility of transmitting it to others will be greater. In addition, delaying access to health services will increase the risk of failure in pulmonary TB treatment.

Conclusion

The results showed that socio-demographic factors that had a significant relationship with pulmonary TB were family income, employment status, and nutritional status. Meanwhile, behavioral factors that were significantly related were knowledge, attitudes, smoking, and patient contact history. The dominant factor most related to pulmonary TB is knowledge. Someone who has less knowledge has a 2.899 times greater risk of developing pulmonary TB compared to those who have high knowledge.

Suggestion

It is suggested that it is important to increase public knowledge about the causes, symptoms of the disease, modes of transmission of the disease, treatment, and prevention of pulmonary TB. Knowledge can be increased with the participation of health workers and health cadres by providing information and education about the prevention of pulmonary TB in the community.

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