

# Factors Associated with Quality of Life among Pulmonary Tuberculosis Patients

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**Abstract** Pulmonary tuberculosis (TB) can significantly affect a person's quality of life, but the extent varies depending on several factors. The study aimed to analyze the quality of life and related factors among pulmonary TB patients aged 18 years or older, newly diagnosed, and undergoing treatment at Prof. Dr. Chairuddin P. Lubis Universitas Sumatera Utara Hospital, Medan, Indonesia. This is a cross-sectional study of 100 pulmonary TB patients selected using consecutive sampling. Primary data were collected through in person interviews using the WHOQOL-BREF questionnaire. The chi-square and logistic regression tests were used for data analyses. The multivariate regression test showed a significant association between intensive treatment phase and physical domain deterioration, a significant association between reduced family income and psychological domain deterioration, a significant association between males and having comorbidity with social relationship domain deterioration, in which comorbidity was the most affecting factor and a significant association between low education level and reduced family income with environmental domain deterioration, in which low education level was the most affecting factor. In conclusion, patients in the intensive phase of treatment, with reduced family income, sex of male, having comorbidity, and being less educated should

be a priority for families, health workers, and the government in addressing the quality-of-life deterioration among pulmonary TB patients.

**Keywords** Pulmonary Tuberculosis, Quality of Life, WHOQOL-BREF

## 1. Introduction

The disease known as tuberculosis (TB) is ancient. It has impacted humans for thousands of years, according to studies on human skeletons [1]. Its cause was unknown until Dr. Robert Koch announced on March 24, 1882, that he had identified the causative bacillus, later identified as *Mycobacterium tuberculosis* [2]. When a TB patient coughs or releases the bacteria into the air, the bacteria will be inhaled by individuals so that can be infected and may cause the disease. Generally, infection is localized to the lungs, known as pulmonary tuberculosis, however, infection can also occur elsewhere, known as extrapulmonary tuberculosis. About 90% of cases of the disease occur in adults, with men accounting for a greater proportion of cases than women [3]. Poverty and poor living conditions such as overcrowding, poor sanitation, physical housing conditions and malnutrition increase the

risk of developing TB [4].

Globally, there were 7.5 million newly diagnosed cases of TB in 2022—the highest number since the WHO began to track the disease in 1995. In 2022, 87% of global TB cases were reported in 30 countries and eight countries accounted for two-thirds of this total: India (27%), Indonesia (10%), China (7.1%), Philippines (7.0%), Pakistan (5.7%), Nigeria (4.5%), Bangladesh (3.6%), and Democratic Republic of Congo (3.0%) [3]. Some of the main factors associated with TB control and treatment are inappropriate program implementation, lack of health workers, and individual personal circumstances. The empowerment of community health centre as primary health care providers requires reinforcement and evaluation. The central government as a policy maker needs to ensure that the pulmonary TB treatment program can be implemented in a harmonized and balanced approach [4].

WHO defines quality of life as a patient's perception of position in their culture and value system, performing consideration of their objectives, aspirations, social standards, and interests [5]. According to WHOQOL-BREF guidelines, quality of life is assessed based on domain and overall, namely the physical, psychological, social relationship, and environmental domain [6].

In most domains, TB patients have a lower quality of life compared to healthy individuals, with the physical function domains being most affected. However, since some patients have other medical conditions or socioeconomic issues, the relative contribution of TB to a decline in quality of life can occasionally be affected. Numerous studies indicate that lower socioeconomic status, lower education levels, and older men are associated with a lower quality of life among TB patients [7]. In addition, pulmonary TB disease can affect patients' quality of life due to the complicated and prolonged treatment process. The success of treatment is determined by compliance in taking anti-tuberculosis drugs with the right combination and dose. Such adherence can accelerate the death of bacteria, increase the probability of cure, and recovery from disease [8].

There are not many researches that have regression test and systematically looked at the probabilities of the factors associated with the quality of life. This study is valuable because by knowing the quality-of-life pulmonary TB patients, interventions according to the problems discovered can be carried out so that successful treatment of pulmonary TB patients can be achieved better. Hence, the purpose of this study was to analyze the quality of life among pulmonary TB patients and related factors.

## 2. Materials and Methods

### 2.1. Study Design and Setting

This cross-sectional study was conducted from August

to October 2023 at Prof. Dr. Chairuddin P. Lubis Universitas Sumatera Utara Hospital, Medan, Indonesia.

This study used two types of variables. The dependent variables were quality of life, i.e., physical, psychological, social relationship, and environmental domain. Age, sex, education level, family income, comorbidity, treatment phase, and adverse drug reactions were the independent variables. Age was classified as > 40 years and 18–40 years because we did limit this study to adults only. Sex was categorized into male and female. Education level was classified as lower education (primary high school and junior high school) and higher education (senior high school and college). Comorbidity is when a pulmonary TB patient has another disease at the same time, which is classified as having comorbidity or not having comorbidity. For further explanation of the types of comorbidities suffered by participants, we have explained it in table 1. The treatment phase was classified as intensive phase if it lasts from the beginning of treatment until the end of the second month of treatment with the treatment regimen of rifampicin, isoniazid, pyrazinamide, and ethambutol, while the continuation phase is treatment that lasts from the beginning of the third month of treatment until the end of treatment at the end of the sixth month with rifampicin and isoniazid as a treatment regimen. Adverse drug reactions were classified as having adverse drug reactions if there were more than 4 symptoms and no adverse drug reactions if there were less than 3 symptoms.

### 2.2. Population and Sample

The population of this study is all pulmonary TB patients who are undergoing treatment at Prof. Dr. Chairuddin P. Lubis Universitas Sumatera Utara Hospital, with a total of 133 pulmonary TB patients.

The sample size was estimated using Slovin's formula since the population was already identified. With a margin of error of 5% and a population of pulmonary TB patients, the estimated sample size was 100 patients, selected using consecutive sampling [9]. The sample of this study had the inclusion criteria of being 18 years of age or older, newly diagnosed, and undergoing treatment, while the exclusion criteria were non-cooperative and non-communicative patients which makes it difficult to be interviewed and/or fill out questionnaires.

### 2.3. Data Collection Procedure

Primary data were collected through in person interviews using the WHOQOL-BREF instruments. WHOQOL-BREF is a quality-of-life measurement tool developed by the WHO. It is valid ( $r = 0.89-0.95$ ) and reliable ( $R = 0.66-0.87$ ) [6]. This tool was translated into Indonesian directly from the WHO website and has been validated for TB patients at Duren Sawit Public Health Center, East Jakarta, DKI Jakarta, Indonesia [10].

The WHOQOL-BREF questionnaire consists of 26 questions. One question is about the person’s overall perception of quality of life; one question is about the person’s general perception of health; and 24 questions are about four dimensions of health: physical, psychological, social relationship, and environmental [11]. According to the WHOQOL-BREF guidelines, a higher score indicates a better quality of life. The calculation is carried out by calculating the mean score in each domain and multiplying by 4 to be comparable to WHOQOL-100. The score obtained will be transformed into a scale of 0–100 using the formula  $(\text{score}-4) \times (100/16)$  [6]. Quality of life is assessed by cut-off points according to the mean result of the transformation of each domain [12].

### 2.4. Data Analysis

The data were analyzed by SPSS version 27.0. The mean and standard deviation (SD) were used as the cut-off points for each domain; if the value is greater than the cut-off point, it is categorized as having a good quality of life and vice versa. Descriptive statistics, the chi-square test, and the logistic regression test were used for data analyses.

### 2.5. Ethical Consideration

This study was approved by the Health Research Ethics Committee, Medical Faculty, Universitas Sumatera Utara on July 7<sup>th</sup>, 2023 (No. 570/KEPK/USU/2023). The participants were required to sign an appropriate informed consent. Anonymity and confidentiality were assured during the data collection and analysis.

## 3. Results

### 3.1. Characteristics of Respondents

The characteristics of the pulmonary TB patients are shown in Table 1. Among 100 respondents, the majority of them were aged 18 to 30 (26%) with a mean age of  $45.2 \pm 15.9$ . Most of the respondents were male (54%), had a high education level (70%), had no family income reduction (51%), and had no comorbidities (69%). Regarding comorbidity, most of them had diabetes (25%). The majority of respondents in this study are undergoing the continuation treatment phase (59%), and only a few respondents have experienced more than 4 symptoms of adverse drug reactions (40%). The most common adverse drug reactions are numbness on the hand or feet (52%), gastrointestinal disorders (42%), hypersensitive skin (42%), and sleep disorders (38%).

**Table 1.** Characteristic of respondents

Respondents' Characteristics	Frequency (n=100)	Percentage (%)
<b>Age, years</b>		
Mean $\pm$ SD	45.2	15.9
18–30	26	26
31–40	13	13
41–50	17	17
51–60	25	25
61–70	16	16
> 70	3	3
<b>Sex</b>		
Male	54	54
Female	46	46
<b>Education Level</b>		
Low	30	30
High	70	70
<b>Family income</b>		
Reduce	49	49
Not reduce	51	51
<b>Comorbidity</b>		
Yes	31	31
Diabetes	25	25
Hypertension	9	9
HIV	2	2
Diabetes and hypertension	5	5
No	69	69
<b>Treatment phase</b>		
Intensive	41	41
Continuation	59	59
<b>Adverse drug reactions</b>		
Yes ( $\geq$ 4 symptoms)	40	40
Gastrointestinal disorders	42	42
Headache	31	31
Fever	14	14
Visual impairment	25	25
Sleep disorders	38	38
Hepatitis	1	1
Hypersensitive skin	42	42
Joint pain	33	33
Numbness on hand/foot	52	52
No ( $\leq$ 3 symptoms)	60	60

SD: standard deviation

### 3.2. Quality of Life of Pulmonary Tuberculosis Patients

The quality of life, especially the physical domain, is the lowest mean compared to others ( $49.6 \pm 23.8$ ). Detailed data on each domain of quality of life between those who had a bad and good quality of life were presented in Table 2.

Table 2. Description of quality of life

Quality of Life	Frequency (n=100)	Percentage (%)
<b>Physical domain</b>		
Mean $\pm$ SD	49.6 $\pm$ 23.8	
Bad	55	55
Good	45	45
<b>Psychological domain</b>		
Mean $\pm$ SD	71.9 $\pm$ 18.1	
Bad	50	50
Good	50	50
<b>Social relationship domain</b>		
Mean $\pm$ SD	67.9 $\pm$ 21.2	
Bad	50	50
Good	50	50
<b>Environmental domain</b>		
Mean $\pm$ SD	65.1 $\pm$ 15.7	
Bad	51	51
Good	49	49
<b>Overall</b>		
Mean $\pm$ SD	63.6 $\pm$ 15.6	
Bad	45	45
Good	55	55

SD: standard deviation

### 3.3. Associated Factors of Quality of Life among Pulmonary Tuberculosis Patients

The association between independent variables and the physical domain of the pulmonary TB patients is shown in Table 3. The deterioration in the physical domain was dominated by respondents aged > 40 (33%), male (28%), low-level educated (19%), family income reduction (29%), comorbidities (19%), intensive phase (33%), and adverse drug reactions (28%). Bivariate analysis showed that treatment phase ( $p < 0.001$ ) and adverse drug reactions ( $p = 0.014$ ) had a significant association with the physical domain.

The association between independent variables and the psychological domain of the pulmonary TB patients is shown in Table 4.

Table 3. Bivariate Analysis of Physical Domain

Variables	Physical Domain			p-value
	Bad (n)	Good (n)	Total (n)	
<b>Age, years</b>				
> 40	38	23	61	0.065*
18–40	17	22	39	
<b>Sex</b>				
Male	28	26	54	0.493
Female	27	19	46	
<b>Education Level</b>				
Low	19	11	30	0.273
High	36	34	70	
<b>Family income</b>				
Reduce	29	20	49	0.410
Not reduce	26	25	51	
<b>Comorbidity</b>				
Yes	19	12	31	0.397
No	36	33	69	
<b>Treatment phase</b>				
Intensive	33	8	41	< 0.001**
Continuation	22	37	59	
<b>Adverse drug reactions</b>				
Yes	28	12	40	0.014**
No	27	33	60	

\*denotes p-value < 0.25; \*\*statistically significant at p-value < 0.05

Table 4. Bivariate Analysis of Psychological Domain

Variables	Psychological Domain			p-value
	Bad (n)	Good (n)	Total (n)	
<b>Age, years</b>				
> 40	35	26	61	0.065*
18–40	15	24	39	
<b>Sex</b>				
Male	29	25	54	0.422
Female	21	25	46	
<b>Education Level</b>				
Low	18	12	30	0.190*
High	32	38	70	
<b>Family income</b>				
Reduce	30	19	49	0.028**
Not reduce	20	31	51	
<b>Comorbidity</b>				
Yes	16	15	31	0.829
No	34	35	69	
<b>Treatment phase</b>				
Intensive	26	15	41	0.025**
Continuation	24	35	59	
<b>Adverse drug reactions</b>				
Yes	26	14	40	0.014**
No	24	36	60	

\*denotes p-value < 0.25; \*\*statistically significant at p-value < 0.05

The deterioration in the psychological domain was dominated by respondents aged > 40 (35%), male (29%), low-level educated (18%), family income reduction (30%), comorbidities (16%), intensive phase of treatment (26%), and adverse drug reactions (26%). Bivariate analysis showed that family income (p = 0.028), treatment phase (p = 0.025), and adverse drug reactions (p = 0.014) had a significant association with the psychological domain.

The association between independent variables and the social relationship domain of the pulmonary TB patients is shown in Table 5. The deterioration in the social relationship domain was dominated by respondents aged >40 (35%), male (23%), low-level educated (16%), family income reduction (28%), comorbidities (22%), intensive phase of treatment (24%), and adverse drug reactions (22%). Bivariate analysis showed that sex (p = 0.016) and comorbidities (p = 0.005) had a significant association with the social relationship domain.

**Table 5.** Bivariate Analysis of Social Relationship Domain

Variables	Social Relationship Domain			p-value
	Bad (n)	Good (n)	Total (n)	
<b>Age, years</b>				
> 40	35	26	61	0.065*
18–40	15	24	39	
<b>Sex</b>				
Male	23	21	54	0.016**
Female	17	29	46	
<b>Education Level</b>				
Low	16	14	30	0.663
High	34	36	70	
<b>Family income</b>				
Reduce	28	21	49	0.161*
Not reduce	22	29	51	
<b>Comorbidity</b>				
Yes	22	9	31	0.005**
No	28	41	69	
<b>Treatment phase</b>				
Intensive	24	17	41	0.155*
Continuation	26	33	59	
<b>Adverse drug reactions</b>				
Yes	22	18	40	0.414
No	28	32	60	

\*denotes p-value < 0.25; \*\*statistically significant at p-value < 0.05

The association between independent variables and the environmental domain of the pulmonary TB patients is shown in Table 6. The deterioration in the environmental domain was dominated by respondents aged > 40 (37%),

male (30%), low-level educated (23%), family income reduction (33%), comorbidities (18%), intensive phase of treatment (26%), and adverse drug reactions (23%). Bivariate analysis showed that age (p = 0.016), education level (p < 0.001), and treatment phase (p = 0.001) had a significant association with the environmental domain.

**Table 6.** Bivariate Analysis of Environmental Domain

Variables	Environmental Domain			p-value
	Bad (n)	Good (n)	Total (n)	
<b>Age, years</b>				
> 40	37	24	61	0.016**
18–40	14	25	39	
<b>Sex</b>				
Male	30	24	54	0.323
Female	21	25	46	
<b>Education Level</b>				
Low	23	7	30	<
High	28	42	70	0.001**
<b>Family income</b>				
Reduce	33	16	49	0.001**
Not reduce	18	33	51	
<b>Comorbidity</b>				
Yes	18	13	31	0.344
No	33	36	69	
<b>Treatment phase</b>				
Intensive	25	16	41	0.096*
Continuation	26	33	59	
<b>Adverse drug reactions</b>				
Yes	23	17	40	0.288
No	28	32	60	

\*denotes p-value < 0.25; \*\*statistically significant at p-value < 0.05

Multivariate analysis can be performed if the variable in bivariate analysis has a p-value < 0.25. The association between independent variables and the physical domain deterioration of pulmonary TB patients is shown in Table 7. Based on the bivariate analysis, age, treatment phase, and adverse drug reactions could be included in the multivariate analysis. There was a significant association between the treatment phase with physical domain deterioration (p < 0.001). The intensive treatment phase was the most affecting factor in physical domain deterioration (OR = 6.107, 95% CI = 2.319–16.077).

The association between independent variables and the psychological domain deterioration of pulmonary TB patients is shown in Table 8. Based on the bivariate analysis, age, education level, family income, treatment phase, and adverse drug reactions could be included in the multivariate analysis. There was a significant association between family income with psychological domain deterioration (p = 0.036). Family income reduction was the most affecting factor in psychological domain deterioration (OR = 2.466, 95% CI = 1.061–5.730).

**Table 7.** Multivariate Logistic Regression Analysis of Physical Domain

Variables	Coefficient	p-value	OR (95% CI)
<b>Age, years</b>			
18–40			1
> 40	0.818	0.083	2.265 (0.897–5.718)
<b>Treatment phase</b>			
Continuation			1
Intensive	1.809	< 0.001*	6.107 (2.319–16.077)
<b>Adverse drug reactions</b>			
No			1
Yes	0.856	0.077	2.353 (0.913–6.066)
<b>Constant</b>	<b>-1.286</b>	<b>0.004</b>	<b>0.276</b>

OR: odds ratio; CI: confidence interval; \*statistically significant at p-value < 0.05

**Table 8.** Multivariate Logistic Regression Analysis of Psychological Domain

Variables	Coefficient	p-value	OR (95% CI)
<b>Family income</b>			
Not reduce			1
Reduce	0.903	0.036*	2.466 (1.061–5.730)
<b>Treatment phase</b>			
Continuation			1
Intensive	0.774	0.081	2.169 (0.908–5.180)
<b>Adverse drug reactions</b>			
No			1
Yes	0.873	0.051	2.394 (0.998–5.741)
<b>Constant</b>	<b>-1.101</b>	<b>0.004</b>	<b>0.332</b>

OR: odds ratio; CI: confidence interval; \*statistically significant at p-value < 0.05

**Table 9.** Multivariate Logistic Regression Analysis of Social Relationship Domain

Variables	Coefficient	p-value	OR (95% CI)
<b>Sex</b>			
Female			1
Male	1.133	0.010*	3.105 (1.304–7.394)
<b>Comorbidity</b>			
No			1
Yes	1.415	0.004*	4.117 (1.574–10.773)
<b>Constant</b>	<b>-1.039</b>	<b>0.005</b>	<b>0.354</b>

OR: odds ratio; CI: confidence interval; \*statistically significant at p-value < 0.05

The association between independent variables and the social relationship domain deterioration of pulmonary TB patients is shown in Table 9. Based on the bivariate analysis, age, sex, family income, comorbidity, and treatment phase could be included in the multivariate analysis. There was a significant association between sex ( $p = 0.010$ ) and comorbidity ( $p = 0.004$ ) with social relationship domain deterioration. Comorbidity was the most affecting factor in social relationship domain deterioration (OR = 4.117, 95% CI = 1.574–10.773).

The association between independent variables and the environmental domain deterioration of pulmonary TB patients is shown in Table 10. Based on the bivariate analysis, age, education level, family income, and treatment phase could be included in the multivariate analysis. There was a significant association between education level ( $p = 0.007$ ) and family income ( $p = 0.021$ ) with environmental domain deterioration. Lower education level was the most affecting factor in environmental domain deterioration (OR = 4.286, 95% CI = 1.496–12.282).

**Table 10.** Multivariate Logistic Regression Analysis of Environmental Domain

Variables	Coefficient	p-value	OR (95% CI)
<b>Education Level</b>			
High			1
Low	1.455	0.007*	4.286 (1.496–12.282)
<b>Family income</b>			
Not reduce			1
Reduce	1.047	0.021*	2.848 (1.170–6.932)
<b>Treatment phase</b>			
Continuation			1
Intensive	0.888	0.056	2.431 (0.977–6.047)
<b>Constant</b>	<b>-1.227</b>	<b>0.002</b>	<b>0.293</b>

OR: odds ratio; CI: confidence interval; \*statistically significant at p-value < 0.05

## 4. Discussion

### 4.1. Quality of Life of Pulmonary Tuberculosis Patients

Patients with pulmonary TB more often experienced a deterioration of quality of life in physical domains (49.6 ± 23.8) by 55% and environmental domains (65.1 ± 15.7) by 51%. Whereas in the psychological domain (71.9 ± 18.1) and the social relationship domain (67.9 ± 21.2), it was found that the quality of life of pulmonary TB patients was balanced between good and bad. However, in the overall quality of life (63.6 ± 15.6), more pulmonary TB had a good quality of life by 55%. According to a previous study conducted in Ghana, West Africa, the quality of life in the physical domain (46.19 ± 21.27), psychological domain (50.67 ± 23.95), social relationship domain (40.9 ± 21.74), and environmental domain (51.91 ± 20.13) were classified as lower than the mean of this study [13]. In a study at Ciamis, Indonesia, almost all domains of quality of life have deteriorated with a mean less than 50, namely, physical domain (20.8 ± 8.8), social relationship domain (36.9 ± 9.2), overall quality of life (45.25 ± 23.3), environmental domain (46.9 ± 10.4), and psychological domain (76.4 ± 11.9) [14]. The findings show that many pulmonary TB patients continue to have a bad quality of life, particularly in the physical domain. The severity of the disease, the duration of symptoms, and comorbidity strongly affect the physical domain deterioration of pulmonary TB patients [15]. A previous study revealed that the quality of life and treatment adherence of patients with pulmonary TB are associated with health conditions, socio-economic factors, demographic factors, and the quality of health services [16].

### 4.2. Factors associated with Quality of Life among Pulmonary Tuberculosis Patients

#### 4.2.1. Physical Domain Quality of Life

Pulmonary TB patients who underwent intensive

treatment phase experienced deterioration in the physical domain (33%). According to bivariate analysis, the treatment phase had a significant association with the physical domain (p < 0.001). In contrast with the study in India, where the treatment phase did not have a significant association with the physical domain. However, in pulmonary TB patients who underwent intensive treatment phase, the mean score of the physical domain (57.7 ± 14.8) was lower than the mean of pulmonary TB patients who underwent intensive treatment phase [17]. A study in Ghana revealed that in the intensive phase, pulmonary TB symptoms such as pain and persistent coughs will be severely disruptive [13]. Whereas a study conducted in Taiwan stated that the worsening of the physical domain of pulmonary TB patients occurs in the first 2 months of treatment and increases positively after 6 months [18]. Some patients who are the head household are unable to play their role and many children of parents with pulmonary TB are forced to drop out of school and choose to work to support the family financially. The presence of a patient with pulmonary TB in the family can increase the workload of the primary caregiver, reducing their capacity to work and care for other family members [19].

Furthermore, pulmonary TB patients who had adverse drug reactions experienced deterioration in the physical domain (28%). According to bivariate analysis, the adverse drug reactions had a significant association with the physical domain (p = 0.014). This is consistent with the study conducted in Taiwan that patients who experienced adverse drug reactions had a significant association with physical domain deterioration. Adverse drug reactions are commonly reported in patients with pulmonary TB who underwent intensive treatment phase, because the types of drugs consumed in that phase are more numerous and have many more adverse drug reactions [18].

The final multivariate analysis revealed that treatment phase was the factor that most affected the physical domain deterioration (OR = 6.107, 95% CI = 2.319–16.077). Pulmonary TB patients who underwent

intensive treatment phase were 6 times more likely to experience physical domain deterioration compared to pulmonary TB patients who underwent continuation treatment phase. According to a study conducted in the United States, pulmonary TB can lead to scarring of the lungs and some patients may not completely recover. In addition, visual impairment and peripheral neuropathy due to adverse drug reactions may cause numbness and difficulty in walking [20]. According to the multivariate equation, the probability of pulmonary TB patients aged more than 40 years, undergoing intensive treatment phase, and having adverse drug reactions to experience physical domain deterioration was 89.8%.

#### 4.2.2. Psychological Domain Quality of Life

Pulmonary TB patients who underwent intensive treatment phase experienced deterioration in the psychological domain (26%). According to bivariate analysis, the treatment phase had a significant association with the psychological domain ( $p = 0.025$ ). In contrast with the study in India, where the treatment phase did not have a significant association with the psychological domain. However, in pulmonary TB patients who underwent intensive treatment phase, the mean score of the psychological domain ( $53.6 \pm 17.6$ ) was lower than the mean score of pulmonary TB patients who underwent continuation treatment phase [17]. According to a study in Taiwan, the treatment phase is associated with psychological domain deterioration, where individuals' concerns about transmitting the disease to their families and the inability to maintain employment may lead to depression [18].

Furthermore, pulmonary TB patients who had adverse drug reactions experienced deterioration in the psychological domain (26%). According to bivariate analysis, the adverse drug reactions had a significant association with the psychological domain ( $p = 0.014$ ). This is consistent with the study conducted in Taiwan that patients who experienced adverse drug reactions had a significant association with psychological domain deterioration. Adverse drug reactions such as hepatitis and visual impairment significantly reduced quality of life scores. Therefore, health workers should be concerned about the possibility of these adverse drug reactions [18]. Adverse drug reactions may occur in mild, moderate, and severe conditions. Therefore, encouragement from health workers is needed to increase optimism and confidence in undergoing treatment. For pulmonary TB patients who experience social isolation, the role of individuals willing to listen and encourage them is invaluable. Talking to TB survivors is also seen by patients as comforting and encourages them to continue their treatment [21].

Furthermore, pulmonary TB patients with reduced family income experienced deterioration in the psychological domain (30%). According to bivariate analysis, family income had a significant association with the psychological domain ( $p = 0.028$ ). This is consistent

with a study conducted in India, which showed a significant association between work changes with psychological domains. According to the study, pulmonary TB patients who had quit their work or experienced work changes had worse mean scores in the psychological domain ( $51.9 \pm 20.8$ ) compared to those who did not experience work changes ( $59.7 \pm 15.8$ ). Health conditions may lead to changes in family income and make individuals unable to playing roles in their family or community as they should [17].

The final multivariate analysis revealed that family income was the factor that most affected the psychological domain deterioration (OR = 2.466, 95% CI = 1.061–5.730). Pulmonary TB patients with reduced family income were twice as likely to experience psychological domain deterioration compared to patients with no reduced family income. According to a previous study, pulmonary TB disease leads to various psychological reactions such as fear, depression, anger, and relief. Physical deterioration such as fatigue, weight loss, and malaise often cause depression. Specific pulmonary TB treatments such as isolation and thoracentesis procedures may also cause fear. In addition, some patients reported that they were relieved to get the diagnosis, because pulmonary TB is a treatable disease, and they had been in pain for a long time without knowing the cause. Meanwhile, the symptoms of pulmonary TB can mimic concerning conditions such as acquired immunodeficiency syndrome (AIDS) and cancer [20]. According to the multivariate equation, the probability of pulmonary TB patients with reduced family income, undergoing intensive treatment phase, and having adverse drug reactions to experience psychological domain deterioration was 80.8%.

#### 4.2.3. Social Relationship Domain Quality of Life

Male pulmonary TB patients experienced deterioration in the social relationship domain (23%). According to bivariate analysis, sex had a significant association with the social relationship domain ( $p = 0.016$ ). This is consistent with a study conducted in India that showed a significant association between sex and the social relationship domain. In that study, the mean score of the social relationship domain in males was lower ( $61.7 \pm 23.7$ ) compared to females ( $72.7 \pm 18.4$ ) [17]. According to a study conducted in Surabaya on 157 respondents, it was revealed that the deterioration was affected by various factors, including low education level, not working, and low income [22]. According to Indonesian regulations, both males and females have equal rights to education and employment. However, population data show that in Indonesia the number of workers is still dominated by male workers [23].

Furthermore, pulmonary TB patients with comorbidity experienced deterioration in the social relationship domain (22%). According to bivariate analysis, comorbidity had a significant association with the social



relationship domain ( $p = 0.005$ ). This is consistent with a study conducted in Saudi Arabia on 114 respondents, that pulmonary TB patients with comorbidity are associated with social relationship domain deterioration. According to that study, the stigmatization of pulmonary TB disease is different for each person, depending on the location and culture [24]. In addition, emotional support from family and health workers can affect the quality of life among pulmonary TB patients [17]. TB is often perceived as a shameful disease that causes patients to isolate themselves to avoid transmission and fears of rejection or discrimination. In contrast, some patients stated that by becoming infected with pulmonary TB, they have changed their lifestyle for the better by eliminating or reducing alcohol, increasing exercise, and eating a healthy diet [25].

The final multivariate analysis revealed that comorbidity was the factor that most affected the social relationship domain deterioration (OR = 4.117, 95% CI = 1.574–10.773). Pulmonary TB patients with comorbidities were 4 times more likely to experience social relationship domain deterioration compared to pulmonary TB patients without comorbidity. According to previous study, family member support such as regular calls, hospital visits, prayers, and assistance with household chores had a positive impact on the quality of life of pulmonary TB patients [20]. According to the multivariate equation, the probability of pulmonary TB patients who are male and have comorbidity to experience social relationship domain deterioration was 81.7%.

#### 4.2.4. Environmental Domain Quality of Life

Pulmonary TB patients aged more than 40 years experienced deterioration in the environmental domain (37%). According to bivariate analysis, age had a significant association with the environmental domain ( $p = 0.016$ ). In contrast with the study in India on 95 respondents, that age did not have a significant association with the environmental domain. However, the mean age showed that pulmonary TB patients 46–65 years had the lowest mean environmental domain ( $58.3 \pm 12.1$ ) compared to 46–65 years ( $59.2 \pm 16.2$ ) and 18–25 years ( $62.2 \pm 16.7$ ) [17]. A study conducted in Surabaya to 157 respondents revealed that being over 45 years old affected the general health deterioration. As age increases, general health conditions tend to decline. This age-related deterioration can continue, particularly if the elderly are unable to maintain their diet and manage their health. However, the elderly who effectively manage and adapt to these changes often experience fewer difficulties in their daily lives [22]. According to a previous study in Brazil, elderly who are highly active in their leisure time tend to have good quality of life scores in mental health, body pain and functional capacity. However, inadequate sidewalk and road infrastructure create a sense of insecurity, which can demotivate this population [26].

Furthermore, pulmonary TB patients with low education levels experienced deterioration in the

environmental domain (23%). According to bivariate analysis, education level had a significant association with the environmental domain ( $p < 0.001$ ). This is consistent with a study conducted in Ghana, West Africa that low education levels had a significant association with environmental domain deterioration [13]. A study of India to 95 patients with pulmonary TB revealed that patients with a high level of education tend to have a better knowledge of the disease and its treatment due to easy access to obtain information. Additionally, higher education tends to encourage individuals to engage in activities and pursuits that can help them cope with the disease and its impact on their lives [17]. Pulmonary TB is a common disease that can be treated. Good communication during treatment, especially in the intensive phase, as well as psychological counseling, is an important part of pulmonary TB management. The pulmonary TB community is also expected to encourage each other so that recovery can be accelerated and the pulmonary TB patient can return to their role in society as soon as possible. The central and regional governments have an important role in enhancing awareness and encouraging social reforms to address the poor knowledge of the public about pulmonary TB disease [7]. As such, efforts can be made to educate the public through public health center counseling, advertisements, billboards, and social media [27].

Furthermore, pulmonary TB patients experienced a reduced family income (33%). According to bivariate analysis, family income had a significant association with the environmental domain ( $p = 0.001$ ). A study from India revealed that pulmonary TB patients who quit their work or experienced work change, had a worse mean score in the environmental domain ( $59.3 \pm 21.5$ ) compared to those who did not experience work change ( $75.5 \pm 17.8$ ) [17]. Currently, the cost of pulmonary TB treatment in Indonesia is covered by the government, however, most patients suffer from financial hardship due to the cost of transportation to the hospital.

The final multivariate analysis revealed that education level was the factor that most affected the environmental domain deterioration (OR = 4.286, 95% CI = 1.496–12.282). Pulmonary TB patients with low education levels are 4 times more likely to experience environmental domain deterioration compared to pulmonary TB patients with high education levels. According to a previous study, patients with a high level of education more comprehend the explanations given by health workers about the disease and the treatment. In addition, poor building maintenance, late doctors, prolonged hospitalization, and visits routine are issues that burden patients [20]. In contrast, other patients argue that hospitalization has a positive impact on their quality of life as they get free meals in the hospital and can reduce negative habits such as drinking alcohol and missing anti-tuberculosis-drugs [28]. According to the multivariate equation, the probability of pulmonary TB patients with

low education levels, reduced family income, and undergoing intensive treatment phase to experience environmental domain deterioration was 89.0%.

## 5. Limitation

This study has a limitation as a cross-sectional study; it could not establish a causal association. Further study, such as a longitudinal study might be needed for better results.

## 6. Conclusions

In conclusion, the study revealed there was a significant association between intensive phase of treatment with physical domain deterioration; there was a significant association between reduced family income with psychological domain deterioration; there was a significant association between males and having comorbidity with social relationship domain deterioration, in which comorbidity was the most affecting factor; there was a significant association between low education level and reduced family income with environmental domain deterioration, in which low education level was the most affecting factor. Therefore, patients in the intensive phase of treatment, reduced family income, sex of male, having comorbidity, and being less educated should be a priority for families, health workers, and the government in addressing the quality-of-life deterioration among pulmonary TB patients.

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## Conflict of Interest Statement

All authors stated no conflict of interest to disclose.

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## REFERENCES

- [1] I. Hershkovitz *et al.*, "Tuberculosis origin: The Neolithic scenario," *Tuberculosis*, vol. 95, no. S1, pp. S122–S126, Jun. 2015, doi: 10.1016/J.TUBE.2015.02.021.

- [2] A. Sakula, "Robert Koch: centenary of the discovery of the tubercle bacillus, 1882.," *Thorax*, vol. 37, no. 4, pp. 246–251, Apr. 1982, doi: 10.1136/THX.37.4.246.
- [3] WHO, *WHO Global Tuberculosis Report 2023*, no. March. 2023. [Online]. Available: [https://reliefweb.int/report/world/global-tuberculosis-report-2023?gad\\_source=1&gclid=CjwKCAiAqNSsBhAvEiwAn\\_tmxcUStoiAZJ0RQOPrtZvT1y-FsB7JWxgwpIHdPEJAIFFOp5KzCWYPCxoCUkQQAvD\\_BwE](https://reliefweb.int/report/world/global-tuberculosis-report-2023?gad_source=1&gclid=CjwKCAiAqNSsBhAvEiwAn_tmxcUStoiAZJ0RQOPrtZvT1y-FsB7JWxgwpIHdPEJAIFFOp5KzCWYPCxoCUkQQAvD_BwE)
- [4] A. T. Y. Susanti, S. Putra, and A. K. Endah, "Empowering the Critical Role of Public Health Center on Communicable Disease Prevention and Control of Drug-Resistant Tuberculosis," *Univers. J. Public Heal.*, vol. 10, no. 5, pp. 439–447, 2022, doi: 10.13189/ujph.2022.100501.
- [5] WHO, "WHOQOL: Measuring Quality of Life," 2023. <https://www.who.int/tools/whoqol> (accessed Mar. 16, 2023).
- [6] WHO, "WHOQOL User Manual, 2012 Revision," 2012, [Online]. Available: <https://www.who.int/publications/i/item/WHO-HIS-HSI-Rev.2012-3>
- [7] A. N. Aggarwal, "Quality of life with tuberculosis," *J. Clin. Tuberc. Other Mycobact. Dis.*, vol. 17, Dec. 2019, doi: 10.1016/J.JCTUBE.2019.100121.
- [8] A. Dires, T. Hagos, M. Yitayal, G. Amare, and A. Yalew, "Quality of life and associated factors among patients with tuberculosis at the University of Gondar comprehensive specialized hospital," *Qual. Life Res.*, no. 0123456789, 2020, doi: 10.1007/s11136-020-02717-w.
- [9] A. Nurhidayati, "A Survey on Lung Tuberculosis Patients in Pamarican Primary Health Care, Ciamis, Indonesia," 2016. Accessed: Apr. 06, 2023. [Online]. Available: <https://repository.maranatha.edu/21934/>
- [10] S. N. Anisah and R. Djuwita, "Reliability and Validity of WHOQOL-BREF into Indonesian Version as a Measure of Quality of Life of Tuberculosis Patients," *Indian J. Public Heal. Res. Dev.*, vol. 10, no. 12, pp. 1972–1977, Dec. 2019, doi: 10.37506/V10/I12/2019/IJPHRD/192160.
- [11] A. Harper *et al.*, "Development of the World Health Organization WHOQOL-BREF quality of life assessment. The WHOQOL Group," *Psychol. Med.*, vol. 28, no. 3, pp. 551–558, May 1998, doi: 10.1017/S0033291798006667.
- [12] L. Sofiana, S. M. Ayu, Y. Wardani, E. Puspaningrum, and D. D. Hadianti, "Risk factors of quality of life among tuberculosis patients," *Int. J. Public Heal. Sci.*, vol. 11, no. 3, pp. 756–762, 2022, doi: 10.11591/ijphs.v11i3.21005.
- [13] L. Quarcoopome and E. Tornu, "Health-related quality of life of persons living with tuberculosis: A cross-sectional study," *J. Clin. Tuberc. Other Mycobact. Dis.*, vol. 28, no. June, p. 100324, 2022, doi: 10.1016/j.jctube.2022.100324.
- [14] I. Sartika, W. Insani, and R. Abdulah, "Assessment of Health-Related Quality of Life among Tuberculosis Patients in a Public Primary Care Facility in Indonesia," *J. Glob. Infect. Dis.*, vol. 11, no. 3, p. 102, Jul. 2019, doi: 10.4103/JGID.JGID\_136\_18.
- [15] A. N. Aggarwal, D. Gupta, A. K. Janmeja, and S. K. Jindal, "Assessment of health-related quality of life in patients with pulmonary tuberculosis under programme conditions," vol. 17, no. April 2012, pp. 947–953, 2013, doi:

<https://doi.org/10.5588/ijtld.12.0299>.

- [16] T. Kastien-Hilka, A. Abulfathi, B. Rosenkranz, B. Bennett, M. Schwenkglens, and E. Sinanovic, "Health-related quality of life and its association with medication adherence in active pulmonary tuberculosis- a systematic review of global literature with focus on South Africa," *Health Qual. Life Outcomes*, vol. 14, no. 1, 2016, doi: 10.1186/s12955-016-0442-6.
- [17] C. Laxmeshwar *et al.*, "Beyond 'cure' and 'treatment success': quality of life of patients with multidrug-resistant tuberculosis," vol. 23, no. February 2018, pp. 73–81, 2019, doi: <https://doi.org/10.5588/ijtld.18.0149>.
- [18] W.-S. Chung, C.-R. Li, L.-Y. Liao, and W.-T. Yang, "Quality of life among pulmonary tuberculosis patients under treatment in Eastern Taiwan," *Taiwan Journal of Public Health*, vol. 33, no. 1, pp. 23–35, 2014, doi: 10.6288/TJPH201433102089.
- [19] A. E. Asuquo, B. T. Pokam, A. Adindu, E. Ibeneme, and V. Obot, "Health-Related Quality of Life (HRQoL) of Tuberculosis (TB) Patients in Akwa Ibom State, Nigeria," *J. Tuberc. Res.*, vol. 02, no. 04, pp. 199–206, 2014, doi: 10.4236/jtr.2014.24024.
- [20] N. N. Hansel, A. W. Wu, B. Chang, and G. B. Diette, "Quality of life in tuberculosis: Patient and provider perspectives," *Qual. Life Res.*, vol. 13, no. 3, pp. 639–652, 2004, doi: 10.1023/B:QURE.0000021317.12945.f0.
- [21] C. Maynard, S. Tariq, G. Sotgiu, B. Migliori, M. Van Den Boom, and N. Field, "Articles Psychosocial support interventions to improve treatment outcomes for people living with tuberculosis: a mixed methods systematic review and meta-analysis," *eClinicalMedicine*, vol. 61, p. 102057, 2023, doi: 10.1016/j.eclinm.2023.102057.
- [22] N. N. Juliasih, N. M. Mertaniasih, C. Hadi, Soedarsono, R. M. Sari, and I. N. Alfian, "Factors Affecting Tuberculosis Patients Quality of Life in Surabaya, Indonesia," *J. Multidiscip. Healthc.*, vol. 13, pp. 1475–1480, Nov. 2020, doi: 10.2147/JMDH.S274386.
- [23] BPS, "Tingkat Partisipasi Angkatan Kerja Menurut Jenis Kelamin," *Badan Pusat Statistik*, 2022. <https://pagaralamkota.bps.go.id/indicator/6/384/1/tingkat-partisipasi-angkatan-kerja-menurut-jenis-kelamin.html>
- [24] H. Mohmmmed, H. Said, M. Darraj, and A. Mohammed, "Demographic and clinical factors affecting health-related quality of life in patients with pulmonary tuberculosis in Jazan, Saudi Arabia," pp. 12–20, 2021, doi: 10.4103/ejcdt.ejcdt.
- [25] B. D. Pokam, P. Fokam, T. N. Njamen, P. W. Guemdjom, and A. E. Asuquo, "Assessment of Health-Related Quality of Life of Tuberculosis Patients in Fako Division, South-West Region of Cameroon," *J. Tuberc. Res.*, vol. 8, no. 3, pp. 93–110, Jul. 2020, doi: 10.4236/JTR.2020.83009.
- [26] C. C. Scarabottolo *et al.*, "Relationship of different domains of physical activity practice with health-related quality of life among community-dwelling older people: A cross-sectional study," *BMJ Open*, vol. 9, no. 6, pp. 1–10, 2019, doi: 10.1136/bmjopen-2018-027751.
- [27] M. F. Al-qahtani *et al.*, "Health-related quality of life of tuberculosis patients in the Eastern Province, Saudi Arabia," vol. 9, 2014, doi: <https://doi.org/10.1016/j.jtumed.2014.04.005>.
- [28] S. I. Taati, F. Kalemeera, and D. Kibuule, "Quality of DOTS Adherence Counselling among Hospitalized Tuberculosis Patients," *J. Tuberc. Res.*, vol. 07, no. 02, pp. 77–94, 2019, doi: 10.4236/jtr.2019.72008.