Predictors and health-related quality of life with short form-36 for multidrug-resistant tuberculosis patients in Jambi, Indonesia: A case-control study

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ABSTRACT

Background: Multidrug-resistant tuberculosis (MDR-TB) is another problem in TB elimination. In 2018, 484,000 people worldwide developed tuberculosis that was resistant to rifampicin, and 78% of those had MDR-TB. Estimation of risk factors to detect MDR-TB.

Methods: A case-control study assesses the estimate of the socio-demographic, house environment, diabetes mellitus, treatment behavior, and health-related quality of life (HRQOL). There were 28 cases of MDR-TB patients, and 56 control of drug-susceptible tuberculosis (DS-TB), in the treatment phase of October 1, 2019 to March 31, 2020.

Results: The analysis showed a diabetes mellitus (adjusted odds ratio [AOR] 4.06, 95% confidence interval [CI] 1.31–12.54), treatment adherence (AOR 3.67, 95% CI 1.26–10.69), and supervisor of drugs swallowing (AOR 3.55, 95% CI 1.06–11.86) as a risk predictor for MDR-TB, and HRQOL independently associated with the incidence of MDR-TB (crude odds ratio [COR] 4.08, 95% CI 1.19–13.98), whereas socio-demographic and house environment was not a risk factor in this study. Validity and reliability of the SF-36 questionnaire (intraclass correlation coefficient [ICC], 0.658–0.802; Cronbach's α coefficient, 0.864).

Conclusion: Diabetes mellitus, treatment adherence, supervisor of drugs swallowing as a risk predictor for MDR-TB. HRQOL of patients with MDR-TB was lower. The SF-36 questionnaire is valid and reliable to measure the HRQOL for TB/MDR-TB patients.

1. Introduction

Multidrug-resistant tuberculosis (MDR-TB) continues to be a public health threat. Drug resistance is a condition in which Mycobacterium Tuberculosis can no longer be killed using at least rifampicin and isoniazid. In 2018, 484,000 people worldwide developed tuberculosis resistant to rifampicin, and 78% of those had multidrug-resistant tuberculosis (MDR-TB). Based on data, 3.4% of new TB cases and 18% of previously treated patients had multidrug-resistant TB or rifampicin-resistant TB (MDR/RR-TB).¹

Indonesia is one of 30 countries with a high burden of MDR-TB worldwide. In 2018, there were 563,879 TB cases recorded in the program, with an estimated 24,000 MDR/RR TB cases (2.4% of new cases

and 13% of previously treated TB patients), but only 67% were treated coverage.¹ Until 2019, programmatic management of drug-resistant TB (PMDT) services in Indonesia has grown to 198 hospitals/health centers implementing drug-resistant tuberculosis services and 9754 treatment satellite locations in 34 provinces.²

In 2019, Jambi Province with a case detection rate (CDR) of 36.6% (4997 cases) and a case notification rate (CNR) of 138 per 100,000 population. Based on these data, it shows that the TB detection rate is the second-lowest after Bali Province. Most of the cases were male with 3.011 cases (60.26%), and the age composition of 45–54 years with 839 cases (16.79%).³ Low CDR/CNR affects low TB treatment coverage, rapid diagnosis, prompt appropriate, improved infection control, and drug resistance.^{4,5}

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MDR-TB is common in patients who experience a relapse or who have received previous treatment.⁶ Several factors are associated with high recurrence rates, such as socio-demographics, housing conditions, nutritional status, supervisor of drugs swallowing, comorbid diabetes mellitus (DM), and health-related quality of life (HRQOL).^{7–11} The estimation of this determinant is a hypothesis that will be proven in this study, assuming that these risk factors are predictors of MDR-TB. This study was conducted in areas with low case detection rates, high population density, and the treatment procedures recommended by WHO, namely the DOTS (directly observed treatment, short-course) strategy for TB patients and DOTS Plus in MDR-TB patients.²

This study aims to identify the socio-demographic characteristics, house environment, DM, treatment behavior, HRQOL with the incidence of MDR-TB, and to test the SF-36 questionnaire about HRQOL as an instrument for monitoring treatment progress in TB patients and to contribute to the government in early detection, treatment success and break the chain of TB transmission.

2. Methods

2.1. Design and subject

This study used a case-control study design conducted on MDR-TB patients (i.e. case) with DS-TB (i.e. control), identified a priori as potential risk factors for MDR-TB, including socio-demographic characteristics, house environment, treatment behavior, DM, and HRQOL.

The population and samples were taken using a two-stage cluster sampling method. In 2019, Jambi Province had the lowest CDR and CNR among 34 provinces in Indonesia,³ with an administrative area consisting of 11 districts/cities and regional topography in low and medium lands (85.5%). Of the 4997 TB cases, 138 (2.8% of new cases) were with MDR-TB, the highest proportion was in Jambi City, which was 1052 TB cases with 32 cases (2.85% of new cases) with MDR-TB. The characteristics of MDR TB patients in the district are almost the same as Jambi City, namely living in urban areas, the ratio of cases to a population density of 1 case:90–100 people/km,² treatment procedures recommended by WHO, namely the DOTS strategy for TB patients and DOTS Plus MDR patients and national guidelines from the Ministry of Health of the Republic of Indonesia regarding the integration of TB control services and TB patients with drug resistance for all regions of Indonesia.²

Stage 1. This study chose the Jambi City as the primary sampling unit with administrative considerations of the area consisting of 11 sub-districts, geographical areas separated by a large river (Batanghari River), demographics consisting of various racial and cultural characteristics (local and immigrant), high population mobilization, and community responsiveness with studies on health is still low. In the first stage, 6 clusters were selected from 11 clusters (sub-districts) which were selected using probability proportional to size (PPS) with the following steps: Step 1, calculate the total number of TB patients; Step 2, make a list of primary sampling units and their population sizes; Step 3, separate from all TB patients to the primary sampling unit, and each cluster has its population size [a]; Step 4, calculate the cumulative number of population sizes, with the final cumulative number equal to the total number of TB patients [b]; Step 5, determine the number of clusters to be sampled (6 clusters) [c]; Step 6, calculate the sampling interval [SI] obtained by dividing the total number of TB patients by the number of clusters [c]; Step 7, choose a random number between 1 and the SI (the random start [RS]) to select the first cluster sample (a cluster containing the cumulative population), Excel command [=INT(RAND()*SI)]; Step 8, calculates the next cluster series: RS, RS+1*SI, ..., RS+(c-1)*SI (step 7–8 it will be known which cluster is selected); Step 9, calculate the probability of each cluster being sampled [Probability 1=(a*c)/b].

Stage 2. In the second stage of sampling, we needed to select a starting individual in each of the first-stage clusters. The starting individuals were randomly selected using a simple random sampling (SRS)

as much as the minimum sample size required in this study. The steps taken are as follows: Step 1, calculate the minimum sample size in this study; Step 2, perform individual collection (TB patients) with the same number in each cluster at the first stage [d], and the final number of individuals was equal to the sample size required in this study; Step 3, calculate the probability of each individual being sampled in each cluster (Probability 2 = d/a); Step 4, calculate the inverse of the probability of each individual being sampled in the population [overall weight = 1/(Probability 1*Probability 2)]. This study included all TB patients who received TB treatment in all public health centers and hospitals in Jambi City between October 1, 2019 to March 31, 2020.

The sample size was calculated using the Epi-Info 7.2.4.0 statistical software. Diabetes Mellitus as a predictor variable for TB incidence with a prevalence of 6.5%, OR 6.8,¹² 80% power and 95% confidence level, with a ratio of 1:2 between cases and controls. Accordingly, the sample size with the addition of 10% for non-response was calculated to be 84 (28 cases and 56 controls). The case was all patients with culture-confirmed TB, resistant to rifampicin, and isoniazid (MDR-TB). Controls were TB patients with sputum smear-negative, declared cured (drug-susceptible tuberculosis [DS-TB]), they recruited two controls for each case; these were matched body mass index (BMI). All cases and controls met the inclusion criteria and were willing to participate in this study by signing informed consent.

2.2. Measuring tool

The instrument used was a structured questionnaire based on the patient's treatment card (TB Form), which included information on age, gender, education, occupation, monthly income, treatment adherence, and supervisor of drugs swallowing. Patient medical records, blood sugar laboratory examination data, and/or diagnosis of DM. The meter measuring the house area (m²) of TB patients. Digital Thermometer Hygrometer ATH-02, measuring the level (%) of humidity in the house. Short Form-36 (SF-36), HRQOL assessment of TB/MDR-TB patients consisting of eight scales with a scale score range from 0 to 100 (percent of maximum sum score); it covers four physical health perceptions (physical functioning-PF [10 items], physical role-RP [4 items], bodily pain-BP [2 items], general health-GH [5 items]), and four mental health concepts (vitality-VT [4 items], social functioning-SF [2 items], role emotional-RE [3 items], and mental health-MH [5 items]). Successively, two global measures, depending on the height scales, have been derived and referred to as physical component summary (PCS) and mental component summary (MCS). Scores for all dimensions are expressed on a scale of 0–100, where higher scores indicate better health and well-being.¹³ HRQOL measurements were performed on TB patients during the treatment phase.

2.3. Statistical analysis

Data processing used statistical software SPSS for windows version 23.0 (IBM Corp., Armonk, NY, USA). Descriptive analysis methods were conducted to obtain the distribution of case and control data separately, bivariate analysis to determine the value of crude association between independent and dependent variables ($p < 0.25$, crude odds ratio [COR], 95% confidence interval [CI]). Before the logistic regression analysis, a multicollinearity test was performed first. From the bivariate analysis, significantly related variables were included in the backward stepwise logistic regression procedure for multivariate logistic analysis ($p < 0.05$, adjusted odds ratio [AOR], 95% CI). The logistic regression equation obtained was tested with the indicator value of the Goodness-of-fit test, Nagelkerke R Square, and ROC Curve (AUC).

3. Results

3.1. Determinants of the MDR-TB incidence

Socio-demographic characteristics of the 84 respondents showed that in the case group a mean ($\pm$ SD) age of 43.4 ± 15.2 years, and 46.6 ± 13.1 years in the control group, and the majority in the 26–45 years group (37/84, 44.0%). Most of the males were 21 (75%) in the case group, 40 (71.4%) in the control group. Overall cases and controls, 51 (60.7%) patients with secondary education, 28 (33.3%) as laborers, and 45 (53.6%) monthly income ($\geq 1,500,000$) were more dominant in this study (Table 1).

Almost all of the study participants 66.7% had a household density $\geq 8 \text{ m}^2$ and 50 patients (59.5%) with house humidity by the requirement (40%–70%). DM and treatment behavior factors are known 62 patients (73.8%) had no history of DM, 59 patients (70.2%) had treatment adherence and 66 patients (78.6%) had adequate supervisor of drugs swallowing in the study (Table 1).

Based on bivariate analysis, socio-demographic and environmental characteristics were not associated with MDR-TB. DM (COR 3.45, 95% CI 1.25–9.51), treatment adherence (COR 4.09, 95% CI 1.52–11.03), supervisor of drugs swallowing (COR 3.33, 95% CI 1.14–9.78) and HRQOL (COR 4.08, 95% CI 1.19–13.98) were significantly associated with the incidence of MDR-TB (p -value < 0.25) (Table 1).

3.2. Health-related quality of life for MDR-TB patients

In the calculation of 8 scales, physical component summary (PCS) and mental component summary (MCS) (Mean $\pm$ SD), it is known that the case group (59.1 ± 20.8), PCS (58.0 ± 21.1) and MCS (60.1 ± 21.3), and the control group (68.3 ± 14.6), PCS (69.3 ± 15.9), MCS (67.4 ± 14.7). With the median value (8 scale) in the case and control groups (lowest = 50; highest = 82.5).

An overview of the HRQOL of respondents between the case group and the control group with the distribution of the median value (score) of 8 scales, PCS and MCS is depicted on the Box and Whisker Plot graph (Fig. 1). Based on the median value (score) of the lowest HRQOL = 50, normatively as a cut-off-point difference in HRQOL per respondent provided that if the score ≥ 50 is classified as “positive” criteria, while a score < 50 is classified as “negative” criteria. From the data description, most of the cases in the $n = 20$ (71.4%) and control $n = 51$ (91.1%) groups had a positive HRQOL (Table 1).

Furthermore, the final assessment of HRQOL with SF-36 was tested for validity by assessing the intraclass correlation coefficient (ICC) and reliability testing by assessing Cronbach's α coefficient. Based on the results of the analysis, it is known that the ICC value ($0.658\text{--}0.802$) $> r$ product-moment ($r = 0.279$). Thus, the value of 8 scales (35 items) is declared valid (Table 2). Cronbach's α coefficient value was $0.864 > 0.70$ so that the SF-36 questionnaire was reported reliable in the final HRQOL assessment of TB/MDR-TB patients (Table 2).

3.3. Risk predictors for MDR-TB

Candidate variables included in the logistic regression multivariate analysis using the backward likelihood ratio method were variables with a significance level of $p < 0.25$, namely diabetes mellitus, treatment adherence, supervisor of drugs swallowing, and HRQOL (Table 1). Based on the asymptotic correlation matrix which is the parameter estimation correlation matrix. In this matrix it is known that 2 correlation coefficients are less than 0.10, the other 3 are between (0.11 and 0.19), only one coefficient is 0.31, this means that we do not have serious problems with multicollinearity between explanatory variables that used in the model. The results of the analysis showed diabetes mellitus (AOR 4.06, 95% CI 1.31–12.54), treatment adherence (AOR 3.67, 95% CI 1.26–10.69), supervisor of drugs swallowing (AOR 3.55, 95% CI 1.06–11.86). In contrast, HRQOL was not included in the final modeling

Table 1

Bivariate analysis of socio-demographic characteristics, environment, DM, treatment behavior, and HRQOL with the incidence of MDR-TB in Jambi, Indonesia, 2020.

Variables	Total N (col. %) 84 (100)	MDR-TB n (col.%) 28 (100)	DS-TB n (col.%) 56 (100)	p- value	COR (95% CI)
Age (years $\pm$ SD)	45.5 $\pm$ 13.8	43.4 $\pm$ 15.2	46.6 $\pm$ 13.1	0.33	NA
Age (years)					
<25	7 (8.3)	3 (10.7)	4 (7.1)		Reference
26–45	37 (44.0)	13 (46.4)	24 (42.9)	0.73	1.50 (0.16, 14.42)
46–65	34 (40.5)	10 (35.7)	24 (42.9)	0.93	1.08 (0.17, 6.73)
>65	6 (7.2)	2 (7.2)	4 (7.1)	0.85	0.83 (0.13, 5.30)
Sex					
Male	61 (72.6)	21 (75)	40 (71.4)	0.93	1.20 (0.43, 3.37)
Female	23 (27.4)	7 (25)	16 (28.6)		Reference
Educational					
None/primary	24 (28.6)	5 (17.9)	19 (33.9)	0.65	0.53 (0.09, 2.88)
Secondary	51 (60.7)	20 (71.4)	31 (55.4)	1.00	1.29 (0.29, 5.76)
More than secondary	9 (10.7)	3 (10.7)	6 (10.7)		Reference
Occupation					
Laborer	28 (33.3)	9 (32.1)	19 (34.0)	0.80	0.83 (0.19, 3.58)
Merchant	21 (25.0)	10 (35.7)	11 (19.6)	0.54	1.60 (0.36, 7.11)
Housewife	12 (14.3)	1 (3.6)	11 (19.6)	0.26	0.16 (0.02, 1.73)
Unemployed	12 (14.3)	4 (14.3)	8 (14.3)	0.88	0.88 (0.16, 4.87)
Government employee	11 (13.1)	4 (14.3)	7 (12.5)		Reference
Monthly income (Rupiah)					
<1,500,000	39 (46.4)	15 (53.6)	24 (42.9)	0.49	1.54 (0.62, 3.83)
$\geq 1,500,000$	45 (53.6)	13 (46.4)	32 (57.1)		Reference
Household density					
<8 m ² per person	28 (33.3)	12 (42.9)	16 (28.6)	0.29	1.88 (0.73, 4.83)
$\geq 8 \text{ m}^2$ per person	56 (66.7)	16 (57.1)	40 (71.4)		Reference
Humidity					
<40% and/or >70%	34 (40.5)	14 (50)	20 (35.7)	0.31	1.80 (0.72, 4.52)
40%–70%	50 (59.5)	14 (50)	36 (64.3)		Reference
DM					
Yes	22 (26.2)	12 (42.9)	10 (17.9)	0.03*	3.45 (1.25, 9.51)
No	62 (73.8)	16 (57.1)	46 (82.1)		Reference
Treatment adherence					
Irregular	25 (29.8)	14 (50)	11 (19.6)	<0.01*	4.09 (1.52, 11.03)
Regular	59 (70.2)	14 (50)	45 (80.4)		Reference
Supervisor of drugs swallowing					
Inadequate	18 (21.4)	10 (35.7)	8 (14.3)	0.04*	3.33 (1.14, 9.78)
Adequate	66 (78.6)	18 (64.3)	48 (85.7)		Reference
HRQOL					
Negative	13 (15.5)	8 (28.6)	5 (8.9)	0.03*	4.08 (1.19, 13.98)
Positive	71 (84.5)	20 (71.4)	51 (91.1)		Reference

MDR-TB, multidrug-resistant tuberculosis; DS-TB, drug-susceptible tuberculosis; COR, crude odds ratio; CI, confidence interval; SD, standard deviation; NA, not applicable; Rupiah, one dollar is approximately equivalent to 14,650 rupiahs; DM, diabetes mellitus; HRQOL, health-related quality of life.

*indicates statistically significant at multivariate analysis ($p < 0.05$).

Fig. 1. Boxplot scores HRQOL with the SF-36.

(AOR 2.24, 95% CI 0.53–9.48) (Table 3).

The logistic regression equation is stated to be appropriate and qualified to predict the incidence of MDR-TB based on the Nagelkerke R Square = 0.277, and the Hosmer-Lemeshow goodness of fit test (chi-square = 7.031; $p = 0.134$). Based on discrimination parameters using the Receiver Operating Characteristic (ROC) curve (Area Under Curve [AUC] = 0.744, $p = 0.000$, 95% CI 0.620–0.867), the quality of the equation can be used to predict the incidence of MDR-TB (Fig. 2). This model predicted MDR-TB with a positive predictive value of 85.71% and a negative predictive value of 77.14%.

4. Discussion

This study has proven that to reduce MDR-TB incidence by controlling the determinants, namely diabetes mellitus, treatment adherence, and supervisor of drugs swallowing. HRQOL is an independent risk factor for the incidence of MDR-TB. It is known that there is a lower quality of life difference compared to those without MDR-TB.

None of the socio-demographic characteristics associated with the incidence of MDR-TB, such as age, sex, education, occupation, and monthly income conditions. Based on the data, the proportion of productive age (25–46 years), men, and many outside jobs have the vulnerability to MDR-TB, this is identical to the level of mobilization, high population density has implications for the probability of contact with TB/MDR-TB patients which is also greater. These results are

identical to the study in Mali, the age group ≤ 40 is more at risk.⁹ According to Murphy et al. men are more prone to treatment resistance.¹⁴ In East Shoa, Ethiopia, it is stated that unemployment is significantly

Table 3

Predictors for MDR-TB between DS-TB patients in Jambi, Indonesia, 2020.

Co-varieties	Categories	COR (95% CI)	p-value	AOR (95% CI)	p-value
Diabetes mellitus	Yes	3.45 (1.25–9.51)	0.03	4.06 (1.31–12.54)	0.02
	No	Reference		Reference	
Treatment adherence	Irregular	4.09 (1.52–11.03)	<0.01	3.67 (1.26–10.69)	0.02
	Regular	Reference		Reference	
Supervisor of drugs swallowing	Inadequate	3.33 (1.14–9.78)	0.04	3.55 (1.06–11.86)	0.04
	Adequate	Reference		Reference	
HRQOL	Negative	4.08 (1.19–13.98)	0.03	2.24 (0.53–9.48)	0.27*
	Positive	Reference		Reference	

At bivariable analysis co-varieties with $p < 0.25$ were candidate for multivariable analysis while at multivariable analysis, covarities with $p\text{-value} \leq 0.05$ were statistically significant.

*Variables not in the equation ($p > 0.05$).

Diagonal segments are produced by ties.

Fig. 2. Receiver Operating Characteristic (ROC).

Table 2

Precision short-form health survey (SF-36) for DS-TB/MDR-TB patients in Jambi, Indonesia, 2020.

Scale	Reliability		Validity									
	Cronbach's α coefficient (n = 84)		Scale									
PF	0.849	0.864	1									0.707
RP	0.859		0.300	1								0.699
BP	0.841		0.579	0.435	1							0.764
GH	0.838		0.535	0.473	0.599	1						0.785
VT	0.837		0.531	0.448	0.542	0.710	1					0.802
SF	0.847		0.446	0.383	0.475	0.492	0.562	1				0.717
RE	0.870		0.309	0.493	0.415	0.321	0.331	0.406	1			0.658
MH	0.843		0.550	0.350	0.507	0.633	0.800	0.591	0.302	1		0.762

PF, physical functioning; RP, role physical; BP, bodily pain; GH, general health; VT, vitality; SF, social functioning; RE, role emotional; MH, mental health; PCS, physical component summary; MCS, mental component summary; ICC, intraclass correlation coefficient.

Values are presented as correlation coefficient (r). At ICC with $r > 0.279$ were scale item validity, and cronbach's α coefficient with $r > 0.70$ were SF-36 questionnaire reliability.

associated with MDR-TB.¹⁵ That temporary, the level of education (secondary and none/primary) and monthly income below the average (<1,500,000 rupiahs) is a supporter of the low awareness (cognitive) and financial capacity of TB patients in supporting the treatment and healing process and preventing the risk of MDR-TB. In Sudan, the level of secondary education and above is more at risk of MDR-TB.¹⁶ In Peru, socioeconomic status (poverty) is related to MDR-TB.¹⁷

Socio-demographic factors are aspects of a person's/individual's ability to the perspective of healthy or sick behavior, the Indonesian government has intervened in minimizing these risks by improving the quality of services for TB patients such as increasing information media about tuberculosis, bringing health services closer to the community, providing mycobacterium tuberculosis confirmation examination facilities (GeneXpert MTB/RIF), provision of free tuberculosis drugs and management of tuberculosis and drug resistance.^{2,4} The results of this study and several different opinions will be a concern for further research in the future.

Occupancy density was not associated with MDR-TB incidence. The study results show that MDR-TB patients (57.1%) have a ratio of area to occupant the house has met the requirements ($\geq 8 \text{ m}^2$ per person). The density of occupancy that does not meet the requirements increases the transmission (household contact) does not have a direct effect on sensitive or not TB patients with rifampicin and isoniazid drug in tuberculosis patients. The results from a similar study in Amhara.⁸ And this is not much different from the humidity of 50% of MDR-TB patients with moisture content in the air ranging from 40% to 70%, humidity is related to occupancy density and occupancy area, cross tab data shows that of 14 MDR-TB patients with humidity meets the requirements, all have the occupancy density meet the requirements. Other studies have shown that indoor humidity facilitates deposition and evaporation of mycobacterium tuberculosis core droplets, thereby affecting infection risk.¹⁸ In Thailand, it is stated that humidity affects the incidence of TB.¹⁹ The occupancy's density and moisture increase the transmission and development of TB bacteria, but there is no direct indication of MDR-TB development.

Diabetes mellitus was significantly associated with MDR-TB. Increase in TB cases along with the increasing prevalence of DM.¹² The results of this study showed that patients with a history of DM were the biggest predictors of the incidence of MDR-TB with an adjusted (OR) of 4.06 (95% CI 1.31–12.54). In China stated that if TB sufferers have a history of DM, it will impact MDR-TB incidence. The use of rifampin because will reduce the effectiveness of oral antidiabetic drugs (sulfonylurea group) so that it is necessary to monitor blood glucose levels more closely or be replaced with other anti-diabetic drugs such as insulin which can regulate blood sugar well without affecting the effectiveness of anti-tuberculosis drug.¹⁰ Hyperglycemic status in a person affects immunity and drug absorption in the gastrointestinal system with the effect of further treatment failure.²⁰ However, the results of different studies in Sudan stated that a history of DM did not have a significant relationship with MDR-TB.⁷ Based on the preceding, it is hoped that further research on the identification of the relationship between diabetes mellitus and the incidence of MDR-TB is expected.

This study's results inform that non-adherence of TB patients in taking drugs is significantly associated with MDR-TB. Irregularity of new TB patients in taking medication (2RHZE/4RH) is caused by minor side effects such as nausea, vomiting, loss of appetite, bone pain, vertigo, hearing loss, and icterus that is felt and experienced by TB patients first in comorbid DM patients. The length of the treatment phase and the lack of family support such as parents, husband, wife, and children from TB patients can result in low motivation and mentality of patients so they ignore treatment. In the works of systematic reviews and meta-analysis of trial and observational studies, it is known that self-treatment of TB patients will result in lower treatment success and increase drug resistance.²¹ This indirectly has an impact on decreasing the effectiveness (sensitive) of anti-tuberculosis drug against mycobacterium tuberculosis, drug resistance (MDR-TB), restoring the healing process, and even

being fatal in TB patients. In Ethiopia, stated that poor adherence and treatment to MDR-TB sufferers had a longer recovery time.²² In a study in China, it was found that the non-adherence of MDR-TB patients was caused, among others, by side effects of drugs and comorbidities.⁶ To improve compliance, patients must play an active role with health workers in achieving and realizing the importance of the patient's health as well as good communication between health workers and the key to effective treatment. Patient adherence is obtained by handling MDR-TB in an integrated manner, real policies, and ongoing research support to prevent and control MDR-TB.

The supervisor of drugs swallows significantly on the success of MDR-TB treatment. The supervisor of drugs swallowing is the closest family member to the TB patient such as parents, husband, or wife who are assigned to supervise and encourage TB patients to consume tuberculosis drug regularly and remind them to re-check sputum after completing treatment. Some of the supervisors swallow inadequate drugs in carrying out their functions for the reason that many daily activities take up time so that they sometimes forget to remind time and supervise taking tuberculosis drug. As a result of the Ethiopian study, a treatment control function improved treatment success and reduced treatment failure.²³ Based on studies in 12 countries, community-based DOTS implementation stated drug ingestion supervisors improved adherence and curative treatment.²⁴ Therefore, policymakers need to rethink effective strategies to increase treatment success.

HRQOL was independently associated with the incidence of MDR-TB but not as an estimate of the incidence of MDR-TB. The low HRQOL in MDR-TB patients is caused by the duration and side effects of treatment, physical and social limitations and anxiety about the disease can directly affect the physical component summary (PCS), and the mental component summary (MCS), which has an impact on failure in the early or late phase of treatment. The results of a prospective cohort study in four of the five main MDR-TB centers in Yemen stated that HRQOL is often neglected in the treatment of MDR-TB sufferers.¹¹ In South Africa, information was obtained that MDR-TB sufferers complained of taking drugs (MCS) and physical weakness (PCS). HRQOL measurements can be used as discrimination, evaluation, and prediction of problems and solutions for handling physical and mental aspects during the treatment phase of TB patients in supporting treatment therapy, the healing process, and reducing the risk of MDR-TB. These results can be used as preliminary findings that the assessment of mental and physical components is used as another integrative action in the next phase of treatment and supports treatment success.²⁵

Finally, an interesting consideration is the choice of outcome variable made in this analysis. Multivariate logistic analysis revealed that history of DM, irregular treatment, the inadequate role of supervisor drug swallowing, and low (negative) HRQOL were predictors of the incidence of MDR-TB in Jambi, Indonesia, but otherwise if one or more of these risk factors could be controlled, it will certainly have an impact on treatment success (DS-TB), based on discrimination parameters using the ROC, the quality of the equation can be used to predict the incidence of MDR-TB. This model predicted MDR-TB with a positive predictive value of 85.71% and a negative predictive value of 77.14%. Another fact shows that the SF-36 questionnaire is a valid and reliable instrument in measuring HRQOL, intense communication with TB patients about HRQOL during the treatment phase can reduce the risk of MDR-TB events. Consequently, the Ministry of Health of the Republic of Indonesia, which is the government agency responsible for TB disease prevention and control policies in Indonesia, should be more innovative in the aspect of integrated strategic changes in TB disease control. The successful control of risk factors, early detection, monitoring and systematic problem solving during the treatment phase (DOTS), and intense communication about HRQOL in TB patients will lead to The End TB in Indonesia and globally.

5. Conclusion

The results showed that a history of diabetes mellitus, medication adherence, and drugs swallowing were risk factors and a model for estimating MDR-TB incidence. There is a difference in low HRQOL in patients with MDR-TB. For this reason, health workers are more intense in the management of comorbidities and DOTS strategies in the detection and treatment phase of TB sufferers. It is also necessary to integrate quality of life assessments in TB control programs, which will be crucial in the success of treatment, breaking the transmission of MDR-TB transmission and incidence in Jambi Province, Indonesia. For this follow-up, we will monitor the progress.

5.1. Suggestions

The other solution to achieve successful control of TB and MDR-TB, is necessary to increase the capacity and access of The Molecular Rapid Test Tuberculosis with GeneXpert MTB/RIF to confirm the diagnosis and drug resistance in all health care centers, strict monitoring of blood sugar levels while undergoing tuberculosis treatment, and include HRQOL measurement procedures using the SF-36 questionnaire, and involve psychologists to improve HRQOL, compliance and supervisory functions for TB/MDR-TB patients.

Ethical statement

The study was conducted following seven WHO 2011 standards, referring to the 2016 CIOMS guidelines. It had been approved by the Health Research Ethics Commission of the Ministry of Health of the Republic of Indonesia on April 28, 2020, with reference number LB.02.06/2/45/2020.

Declaration of competing interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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