

Health Belief Model and PRECEDE PROCEED on the Risk Factors of Multidrug Resistant Tuberculosis in Surakarta, Central Java

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ABSTRACT

Background: Tuberculosis (TB) is one of the lethal infectious diseases in the world. One of the current biggest challenges of Tuberculosis control is the widespread emergence of Multidrug Resistant Tuberculosis (MDR-TB). There are several potential risk factors of MDR-TB that can be explained by Health Belief Model and PRECEDE PROCEED model framework. This study aimed to analyze factors associated with MDR-TB using Health Belief Model and PRECEDE PROCEED.

Subjects and Method: This was an analytic observational study with case control design. The study was conducted at Dr. Moewardi Hospital and BBKPM, Surakarta, from September to November 2017. The study subjects were selected using fixed disease sampling, consisting of 76 MDR-TB patients and 228 TB patients. The dependent variable was MDR-TB. The independent variables were educational level, self-efficacy, drug-taking adherence, smoking, nutritional status, perceived susceptibility, perceived barrier, perceived severity, perceived benefit, and drug-taking supervisor. The data were collected using questionnaire and analyzed by path analysis.

Results: The risk of MDR-TB was increased by lack of drug-taking adherence ($b = -1.69$; 95% CI = -2.28 to -1.09; $p < 0.001$), poor nutritional status ($b = 1.32$; 95% CI = 0.72 to 1.92; $p < 0.001$), and smoking ($b = 1.32$; 95% CI = 0.72 to 1.92; $p < 0.001$). Drug-taking adherence was increased by perceived susceptibility ($b = 0.91$; 95% CI = 0.18 to 1.63; $p = 0.015$), perceived severity ($b = 1.01$; 95% CI = 0.28 to 1.74; $p = 0.007$), perceived benefit ($b = 1.69$; 95% CI = 0.97 to 2.41; $p < 0.001$), drug-taking advisor ($b = 2.16$; 95% CI = 1.44 to 2.88; $p < 0.001$), self efficacy ($b = 1.58$; 95% CI = 0.86 to 2.31; $p < 0.001$), and low perceived barrier ($b = -1.10$; 95% CI = -1.82 to -0.38; $p = 0.003$).

Conclusion: The risk of MDR-TB is increased by the lack of drug-taking adherence, poor nutritional status, and smoking.

Keyword: Health belief model, PRECEDE-PROCEED, MDR-TB

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BACKGROUND

Tuberculosis (TB) is one of the lethal infectious diseases in the world (WHO, 2016a). Indonesia ranks second among countries with the highest TB cases in the world with 10% of the global number (WHO, 2016b). Tuberculosis treatment and control is getting more difficult because of the increasing cases of resistant TB bacteria (Hoza, Mfinanga and König, 2015). MDR TB turns to be a new challenge in TB control program since the diagnosis establishment is difficult and the mortality

rate and failure rate are high (WHO, 2015). In Indonesia there are 17 provinces with TB treatment success rate $< 85\%$, one of them is Central Java Province. TB cases in Surakarta was the third highest in Central Java Province's *Case Notification Rate* (CNR) in 2016 with a total of 85 per 100,000 population (Kementerian Kesehatan RI, 2016).

Ding *et al.* (2017) explains that insufficient knowledge and perception is one of the factors that increasing the incidence of MDR TB. Zhang *et al.* (2016)

reveals that inappropriate or inadequate treatment becomes the main determinant of MDR TB incidence. It is associated with patients' adherence in the medication process. The adherence is affected by various sides whether it is from within themselves or healthcare providers. Skrahina *et al.* (2013) mentioned that there are other factors that may affect MDR TB namely alcohol consumption and smoking. In addition according to Patiung *et al.* (2014) one of the factors related to the TB patients is nutritional status. One of the models recommended to explain and understand health behavior including TB patients' drug taking adherence is *Health Belief Model* (HBM) (Tola *et al.*, 2016). In addition to HBM, *PRECEDE PROCEED* model is also good to be used in understanding health behavior.

The purpose of the study was to analyze factors associated with MDR TB by using *Health Belief Model and PRECEDE PROCEED* model.

SUBJECTS AND METHOD

1. Study design

It was analytic observational study with case control design. The study was conducted in Dr. Moewardi Hospital and BBKPM (Community Lung Health Center) Surakarta in November 2017.

2. Population and sample

The case population was patients of MDR-TB in Dr. Moewardi hospital. Meanwhile the control population was tuberculosis patients in BBKPM Surakarta and Dr. Moewardi Hospital.

The sampling technique used was fixed disease sampling. There were a total of 304 study subjects, the number of case sample was 76 patients of MDR TB dan the number of control sample was 228 patients of tuberculosis. Inclusion criteria were study subjects ≥ 15 years of age and able to

answer questionnaires well. The exclusion criteria was patient with mental disorder.

3. Study variables

The dependent variable was MDR TB. The independent variables included drug-taking adherence, smoking, nutritional status, perceived susceptibility, perceived severity, perceived benefit, perceived barrier, support from drug taking advisor, educational level and alcohol consumption.

4. Operational definition of variables

Drug-taking adherence was defined as patients' compliance to take anti TB drug regularly and completely. The data were collected by questionnaires. The measurement scale was categorical, coded 0 for no and 1 for yes.

Perceived susceptibility was defined as negative or positive perception toward individual's risk of contracting MDR TB. The data were collected by questionnaires. The measurement scale was continuous, but for the purpose of data analysis, the scale was transformed into dichotomous, coded 0 for low perceived susceptibility and 1 for high perceived susceptibility.

Perceived severity was defined as an individual subjective perception toward the severity of the consequence of MDR TB. The data were collected by questionnaires. The measurement scale was continuous, but for the purpose of data analysis, the scale was transformed into dichotomous, coded 0 for low perceived severity and 1 for high perceived severity.

Perceived benefit was defined as patients' belief toward the advantages of the treatment to reduce the risk of MDR TB. The data were collected by questionnaires. The measurement scale was continuous, but for the purpose of data analysis, the scale was transformed into dichotomous, coded 0 for low perceived benefit and 1 for perceived benefit.

Perceived barrier was defined as patients' belief toward the obstacles to undergone the treatment thus may result in the risk for MDR TB incidences. The data were collected by questionnaires. The measurement scale was continuous, but for the purpose of data analysis, the scale was transformed into dichotomous, coded 0 for low perceived barrier and 1 for perceived barrier.

Support from drug-taking advisor was defined as someone who ensures regularity or TB drug-taking adherence during patients' TB treatment period of time. The data were collected by questionnaires. The measurement scale was continuous, but for the purpose of data analysis, the scale was transformed into dichotomous, coded 0 for weak support and 1 for strong support.

Self efficacy was defined as a belief within oneself to conduct a behavior of drug-taking adherence in reducing the risk of MDR TB incidences. The data were collected by questionnaires. The measurement scale was continuous, but for the purpose of data analysis, the scale was transformed into dichotomous, coded 0 for low self-efficacy and 1 for high self-efficacy.

Nutritional status was defined as assessment on patients' nutritional states based on anthropometric assessment covering body weight and height and it was measured by body scale and microtoise stature meter. The nutritional status was measured by body mass index (BMI) calculated from body weight (kgBW) / body height (m²), transformed into dichotomous scale, coded 0 if $18.5 \leq \text{BMI} < 25.0$ (normo-weight) and 1 if BMI < 18.5 (underweight) or ≥ 25.0 (overweight or obese).

Educational level was defined as the last formal education attained to get a certificate. The data were collected by questionnaires. The measurement scale was categorical, but for the purpose of analysis

transformed into dichotomous, coded 0 for <Senior high school and 1 for \geq Senior high school.

Alcohol consumption was defined as a behavior to consume drinks that contained ethyl alcohol or ethanol whether it was in the past or present days. The data were collected by questionnaires. The measurement scale was categorical, coded 0 for not drinking alcohol and 1 for drinking alcohol.

Smoking was defined as a behavior of actively smoking cigarette whether it was in the past or present days. The data were collected by questionnaires. The measurement scale was categorical, coded 0 for not smoking and 1 for smoking.

MDR TB was defined as resistant to the two first line medications rifampisin and isoniazid with or without the resistance to other TB medications. The data was measured by Xpert MTB/RIF.

5. Data analysis

The sample characteristics were described in frequency and percent, for categorical data. The bivariate analysis involving categorical data was run by cross tabulation with odds ratio as the measure of the association and Chi square as the statistical test. Multivariate analysis used path analysis to determine the direct and indirect effects of the relationships between study variables. Path analysis steps included model specification, model identification, model fit, parameter estimate, and model re-specification.

6. Research Ethics

The research ethical clearance was granted from the Research Ethics Committee at Dr. Moewardi Hospital, Surakarta, Central Java, Indonesia. Research ethics included issues such as informed consent, anonymity, confidentiality, and ethical clearance.

RESULTS

1. Sample characteristics Subjects

Sample characteristics were depicted in Table 1. The proportion of study subjects aged below or above 40 years is about equal. By sex distribution, male subjects slightly out-numbered female subjects. By employment status, about three quarters of

the study subjects were employed. About a third of the study subjects earned income \geq Rp 2,100,000. Most of the study subjects were married. About 10% of the study subjects had contact with a tuberculosis case. Most of the study subjects had no comorbidity.

Table 1. Sample distribution by age, sex, employment, income, marital status, tuberculosis contact, and comorbidities, for case group and control group.

No	Characteristics	Case		Control	
		N	%	N	%
1.	Age (years)				
	< 41	34	44.7	111	48.7
	\geq 41	42	55.3	117	51.3
2.	Sex Categories				
	Male	50	65.8	122	53.3
	Female	26	34.2	106	46.5
3.	Employment				
	Unemployed	13	17.1	54	23.7
	Employed	63	82.9	174	76.3
4.	Income (Rupiah)				
	Insufficient (<Rp 2,100,000)	56	73.7	152	66.7
	Sufficient (\geq Rp 2,100,000)	20	26.3	76	33.3
5.	Marital Status				
	Not Married	11	14.5	40	17.5
	Married	65	85.5	188	82.5
6.	Tuberculosis Contact				
	No Contact	58	76.3	205	89.9
	Contact	18	23.7	23	10.1
7.	Comorbidities				
	No	56	73.7	211	92.5
	Yes	20	26.3	17	7.5

2. Path Analysis

Multivariate analysis of the data employed path analysis model that was run on STATA 13 program. The path analysis proceeded in five steps:

- model specification,
- model identification,
- model fit,
- parameter estimate, and
- model re-specification

Model specification

Figure 1 depicts the path model specification that followed the conceptual framework.

Model identification

The number of observed variables was 12, endogenous variables were 4 and exogenous variables were 8, the number of degree of freedom (df) value was 54. Since the $df = 54 \geq 0$, it indicates that the sample size was sufficient to run a path analysis model.

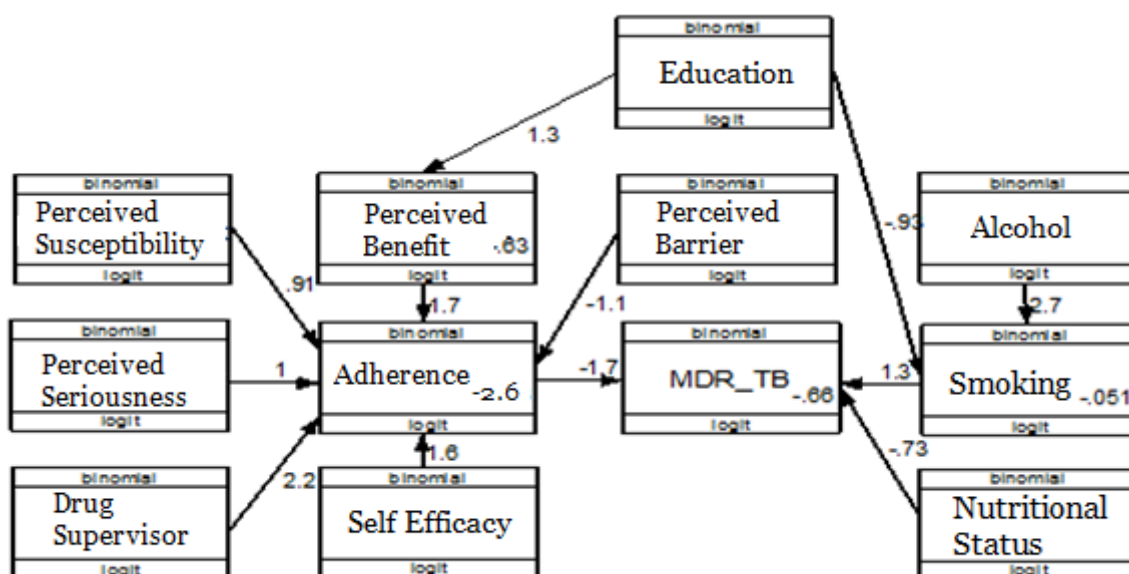


Figure 1. Path Analysis on Risk Factors of *Multidrug Resistant Tuberculosis*

Table 2. The result of path analysis on risk factors of *multidrug resistant tuberculosis*

Dependent Variable	Independent Variables	Path Coefficient	CI 95%		p
			Lower Limit	Upper Limit	
Direct Effect					
MDR TB	← Adherence (Obedient)	-1.69	-2.28	-1.09	<0.001
	← Smoking (yes)	1.32	0.72	1.92	<0.001
	← Nutritional status (normal)	-0.73	-1.33	-0.13	0.018
Indirect effect					
Adherence	← Susceptibility (high)	0.91	0.18	1.63	0.015
	← Severity (high)	1.01	0.28	1.74	0.007
	← Benefit (high)	1.69	0.97	2.41	<0.001
	← Barrier (high)	-1.10	-1.82	-0.38	0.003
	← Support of Drug-taking advisor (high)	2.16	1.44	2.88	<0.001
Smoking	← Self efficacy (high)	1.58	0.86	2.31	<0.001
	← Alcohol (yes)	2.67	1.77	3.57	<0.001
	← Education (high)	-0.93	-1.43	-0.42	<0.001
Benefit	← Education (high)	1.34	0.86	1.81	<0.001
N Observation= 304					
Log likelihood = -613.77					

There was an association between adherence and MDR TB and it was significant. People who were obedient were less likely to endure MDR TB (b= -1.69; CI 95%= -2.28 up to -1.09; p<0.001). There

was an association between smoking and MDR TB and it was significant. People who used to smoke were likely to endure MDR TB (b= 1.32; CI 95%= 0.72 to 1.92; p <0.001). There was an association between

nutritional status and MDR TB and it was significant. People with sufficient nutritional status were less likely to endure MDR TB ($b = -0.13$; CI 95% = -1.33 to -0.13; $p = 0.018$). There was an association between perceived susceptibility and drug taking adherence and it was significant. People with high perceived susceptibility were more likely to be obedient ($b = 0.91$; CI 95% = 0.18 to 1.63; $p = 0.015$). There was an association between perceived severity and drug-taking adherence and it was significant. People with high perceived severity were more likely to be obedient ($b = 1.01$; CI 95% = 0.28 up to 1.74; $p = 0.007$).

There was an association between perceived benefit and drug taking adherence and it was significant. People with high perceived benefit were more likely to be obedient ($b = 1.69$; CI 95% = 0.97 to 2.41; $p < 0.001$). There was an association between perceived barrier and drug taking adherence and it was significant. People with high perceived barrier were less likely to be obedient ($b = 1.10$; CI 95% = -1.82 to -0.38; $p = 0.003$). There was an association between support from drug taking advisor and drug taking adherence and it was significant. People with high support from drug taking advisor were more likely to be obedient ($b = 2.16$; CI 95% = 2.16 to 2.88; $p < 0.001$). There was an association between self efficacy and drug taking adherence and it was significant. People with high self efficacy were more likely to be obedient ($b = 1.58$; CI 95% = 0.86 to 2.31; $p < 0.001$). There was an association between alcohol consumption and smoking and it was significant. People who had ever consume alcohol were more likely to smoke ($b = 2.67$; CI 95% = 1.77 to 3.57; $p < 0.001$). There was an association between educational and smoking. People with high educational level were less likely to smoke ($b = -0.93$; CI 95% = -1.43 hingga -0.42; $p < 0.001$). There

was an association between educational level and perceived benefit and it was significant. People with high educational level were more likely to have high perceived benefit ($b = 1.34$; CI 95% = 0.86 hingga 1.81; $p < 0.001$).

DISCUSSION

1. The association between drug taking adherence and MDR TB

WHO (2014) reveals that if TB patients are not obedient in taking anti TB medications, thus the failure of TB healing will be the final result to worry about, furthermore the emergence of TB bacillus which is resistant to TB medications. The result of analysis of the study showed that there was direct association between patients' adherence in taking TB medications with MDR TB incidences that was negative in nature and significant. It was supported by a study of Hirpa *et al.* (2013) which mentioned that the most dominant factor and might directly influence MDR TB was TB patients' disobedience to the treatment.

Zhdanov *et al.*, (2017) stated that medication disobedience which often occur in the first two months active phase caused by patients have feel better and stop the treatment. It may trigger the recurrence and resistance to TB medications. Khan *et al.*, (2017) and Patel *et al.* (2017) mentioned TB patients who are obedient to the treatment are reported to have lower risk of MDR TB. It is generated by complete and as recommended treatment therefore there is no recurring tuberculosis that may generate the occurrence of sensitivity to medications.

2. The association between smoking and MDR TB

The result of the study showed that there was a direct association between smoking and MDR incidences that was positive and significant. The result of the study was in accordance with the previous study that

stated there were an effect of smoking habit at the present days as well as smoking history toward the occurring MDR condition (Molalign and Wencheke, 2015). It is found that smoking reduces body immune. Not only it worsens the TB condition to become resistant to medications, it also leads to the risk of recurrence when TB has been treated (Mollel and Chilongola, 2017). As the result of severity level on smoking group, it may generate the increasing risk of resistance to medications therefore it increase mortality rate. Furthermore, the result of the study showed that almost one fifth burden caused by tuberculosis disease may be prevented by eliminating smoking behavior (Bonacciet *al.*, 2013). Belchior *et al.*, (2016) added that smoking may worsen the manifestation of TB disease.

3. The Association between Nutritional Status and MDR TB

Nutrition is needed in the process of repairing tissues and preventing disease. The association between TB and malnutrition has been indentified for long. Malnutrition reduce body immune, therefore it increase the possibility for medications resistant TB (WHO, 2013). The analysis result showed there was a direct association between nutritional status and MDR TB incidences that was negative and significant. It is supported by a study by Hicks *et al.* (2014) which revealed one one the factors influence MDR TB incidences and even continued to death namely poor nutritional status on TB patients. Putri *et al.* (2014) mentioned that poor nutritional status caused treatment of the patients became less effective and prevent the occurrence of sputum culture conversion in the initial phase of MDR TB treatment. It is elaborated by Park *et al.* (2016) and Tang *et al.* (2013) that poor nutritional status is often discovered on patients who endure resistance to TB medication because of the

decreasing body immune that disturb immune system toward *mycobacterium tuberculosis*. Imunitas tubuh pasien yang tidak baik akan berpengaruh pada semakin parahnya penyakit atau menjadi resisten terhadap obat tuberkulosis (Sun *et al.*, 2017).

4. The association between perceived susceptibility and MDR TB through drug taking adherence

Rosenstock *et al.*, (1988) stated that HBM is one of the oldest model that discuss the preparation to conduct health behavior based on several individual beliefs and perception. The result of analysis showed that there was an indirect association between perceived susceptibility with MDR TB incidences through variable of patients' adherence in taking TB medications. Direct association between perceived susceptibility and drug taking adherence was positive and significant. The study result was in accordance with the previous finding that mentioned individual belief role in HBM influenced individual decision in increasing health behaviors, one of them was adherence in taking TB medications (Johari *et al.*, 2014; Tola *et al.*, 2016).

5. The association between severity perception and MDR TB through drug taking adherence

HBM elaborates perceived severity within an individual and may influence individual in taking action (Simpson, 2015). The result of analysis showed that there was an indirect association between perceived severity and MDR TB incidences through TB drug taking adherence. Direct association between perceived severity and drug taking adherence was positive and significant. Individual action to conduct treatment and prevention for a disease will be encouraged by the severity of the disease. The bigger the risk of the disease the more likely the individual feel threatened. The

threat encourages individual action to conduct prevention and treatment for the disease (Tang *et al.*, 2015; Woimo *et al.*, 2017).

6. The association between perceived benefit with MDR TB through drug taking adherence

In accordance with HBM model an individual has a perception on the benefit to be experienced if conducting behavior change (Burke, 2015). The result of analysis showed that there was an indirect association between perceived benefit and MDR TB incidences through variable of patients' TB drug taking adherence. Direct association between perceived benefit and drug taking adherence was positive and significant. It is in accordance with a study by Horne *et al.* (2013) which mentioned that patients who believe that the undergone treatment will give positive impact for themselves will be more obedient toward the treatment. In addition, someone with high perception toward the benefit of tuberculosis treatment will reduce any obstacles or barriers they experience. Based on a study by Viegas *et al.* (2014), perceived benefit may get improved by making excellent communication between health personnel and TB patients. It is expected that with good communication, health personnel may give the appropriate education about the benefits and importance of regular treatment.

7. The Association between Perceived Barrier and MDR TB through Drug Taking Adherence

Based on HBM concept individuals have perception concerning the experienced barriers that it may influence individuals to not change their behavior (Burke, 2015). The result of analysis showed that there was indirect association between perceived barrier and MDR TB through variable of patients' TB drug taking adherence. Direct

association between perceived barrier and drug taking adherence was negative and significant. It is supported by a study by Baral *et al.* (2014); Boru *et al.* (2017); Herrero *et al.* (2015) which elaborated that barriers may reduce adherence in undergoing TB treatment. In broad line the barriers are financial and social barrier. Further, when patient's belief toward barriers or obstacles is reduced or disappears then the adherence will be increasing. It is proven by the improvement on treatment regularity when TB treatment is given for free. Treatment regularity is believed and expected to reduce the incidences of resistance to TB medications (Eastment *et al.*, 2017; Tupasi *et al.*, 2017; Zhang *et al.*, 2015). Shringarpure *et al.* (2016) mentioned that geographic location also influence patients' adherence in TB treatment. The road condition makes it difficult to go to healthcare facilities or because the distance is too far makes TB patients are reluctant to have medical examination in reliable health care facilities.

8. The association between support from drug-taking advisors and MDR TB through drug-taking adherence.

Cues to Action is a part of HBM which is anything that encourage decision in changing behavior (Hoorn *et al.*, 2016). The result of the test showed that there was an indirect association between the support from drug-taking advisor and MDR TB incidences through variable of patients' TB drug-taking adherence. Direct association between support from drug-taking advisor and drug-taking adherence was positive and significant. It is in accordance with the result of previous study which stated that there was a significant association between support from drug-taking advisors during treatment and drug-taking adherence. It

was elaborated by Craig and Zumla (2015) and Deshmukh *et al.* (2015) that after in depth interview with the patients they found a phenomenon that patients who were not supported or encouraged by their family to take TB medications were likely to be in despair in undergoing their treatment.

Good knowledge concerning tuberculosis disease needs to be accompanied by the support from closest people or drug-taking advisor. Tuberculosis patients who live alone and far from their family or neighbors will be more likely to stop tuberculosis treatment before its time. (Ali and Prins, 2016; Khanal *et al.*, 2017).

9. The association of self efficacy and MDR TB through drug-taking adherence

Self-efficacy is one of the components of HBM. If individuals do not believe or confident that they can carry out behavior change, then they cannot do it (Simpson, 2015). The result of analysis showed that there was an indirect association between MDR TB incidences through variable of patients' TB drug-taking adherence. Direct association between self efficacy and drug-taking adherence was positive and significant. It is supported by the previous study that stated low self efficacy will give impact to treatment disobedience (Diefenbach-Elstob *et al.*, 2017; Muhammed *et al.*, 2015). Also added by Sanchez-Padilla *et al.* (2014) that patients' knowledge concerning to TB treatment needs to be supported by TB patients' belief of being able or capable to undergo TB treatment obediently so that it will not drop out. Self Efficacy can be established from the surrounding environment.

10. The association of alcohol consumption and MDR TB through smoking

Habit of consuming alcohol can give impact to one's habit or behavior that tend to

smoke (Pedro *et al.*, 2017). Result of the study showed that there was an indirect association between alcohol consumption and MDR TB incidences through variable of smoking. Direct association between alcohol consumption and smoking was positive and significant. It is in accordance with the result of previous study which stated that alcohol consumption is one of the predispositions of smoking behavior (Kuchukhidze *et al.*, 2014; Zhang *et al.*, 2017). Based on the findings by Skrahina *et al.* (2013) alcohol abuse and alcohol use disorder is identified to contribute in TB development and also the result of TB treatment. However, association between alcohol and MDR TB is possibly not direct causal association. Gaete and Araya (2017) and Jawad *et al.*, (2014) discovered study result that one who smokes, after being traced, is a former alcohol drinker or even is still an alcohol drinker. Alcohol consumption and smoking behavior are adjacent phenomena.

11. The association between educational and MDR TB through Smoking

The result of analysis showed that there was an indirect association between educational level and MDR TB incidences through smoking. Direct association between educational level and smoking was negative and significant. It is in accordance with a study conducted before, that educational level had big influence toward smoking behavior. With good educational level it is expected that people will have the awareness toward the danger of smoking for themselves and other people (Silva *et al.*, 2017). Those who have low educational level are more likely to be smokers. It is because one with higher educational level will accept and comprehend information about the danger of smoking more easily. (Yaya *et al.*, 2017). From a study by Pärna

et al. (2014) it is discovered that smoking activity among men and women with high educational level is likely to be decreasing significantly.

12. The association between educational level and MDR TB through perceived benefit and drug-taking adherence

The result of analysis showed that there was an indirect association between educational level and MDR TB through variable of perceived benefit and drug-taking adherence. Direct association between educational level and perceptions was positive and significant. It is in accordance with the result of previous study that mentioned that there was an association between educational level and perceived benefit in which it influenced adherence toward treatments (Fagundez *et al.*, 2016).

High educational level improve patients' awareness and perception toward the big benefit of the importance of appropriate tuberculosis treatment (Chung-Delgado *et al.*, 2015). Perception on the benefit is influenced by TB patients' characteristics; one of them is educational level. In which perceived benefit itself in the end will influence treatment adherence that ends with TB drug resistance (Ma *et al.*, 2015) dan (Ndwiga, Kikuvu and Omolo, 2016).

Based on the result of path analysis it can be concluded that MDR TB risk is decreasing along with the improvement of drug-taking adherence, nutritional status. MDR TB risk is increasing with the increasing of smoking. MDR TB risk is decreasing with the improvement of perceived susceptibility, perceived severity, perceived benefit, support from drug-taking advisor, and self efficacy through drug taking adherence. MDR TB risk is increasing along with the increasing of perceived barrier, through drug-taking

adherence. MDR TB risk is increasing along with the increasing of alcohol consumption through smoking. MDR TB risk is decreasing along with the improving educational level through smoking. MDR TB risk is decreasing along with the improving educational level through perceived benefit and drug taking adherence.

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