Scientific Foundation SPIROSKI, Skopje, Republic of Macedonia
Open Access Macedonian Journal of Medical Sciences. 2022 Jul 21; 10(B):1736-1739.
https://doi.org/10.3889/oamjms.2022.8980
eISSN: 1857-9655
Category: *B - Clinical Sciences*
Section: *Pulmonology*

Factors Associated of Multidrug-Resistance Tuberculosis among Minangkabau Ethnicity in Indonesia

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Edited by: Slavica Hristomanova-Mitkovska
Citation: Kadri A, Machmud R, Putra A, Indrapriyatna AS. Factors Associated of Multidrug-Resistance Tuberculosis among Minangkabau Ethnicity in Indonesia. Open Access Maced J Med Sci. 2022 Jul 21; 10(B):1736-1739. https://doi.org/10.3889/oamjms.2022.8980
Keywords: MDR-TB; Risk factors; Minangkabau ethnicity; Indonesia
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Received: 13-Feb-2022
Revised: 06-Apr-2022
Accepted: 12-Jul-2022

Funding: This research did not receive any financial support
Competing Interests: The authors have declared that no competing interests exist

Abstract

BACKGROUND: Past tuberculosis therapy has been linked to an increased chance of developing multidrug-resistant tuberculosis (MDR-TB). Indonesia is placed 8th among the 27 nations with "high-burden" MDR-TB.

AIM: The purpose of this study was to determine the risk factors associated of multidrug-resistance tuberculosis among Minangkabau ethnicity in Indonesia.

METHODS: The authors conducted a case control study. Data were gathered in Dr. M Djamil General Hospital Padang, Lubuk Alung Hospital Pariaman and Primary Health Care in Padang Pariaman District from December 2019 to March 2020. In this study, there were 73 cases (MDR-TB) and 219 controls (Tuberculosis) who were matched by age and sex. The sampling technique in this research was convenience sampling. Data were gathered from medical records. Bivariate and multivariate analysis were investigated using Chi-square and logistic binary regression test. The data were analyzed using STATA version 14.2.

RESULTS: The risk factors for MDR-TB and cavitary pulmonary had the highest odds ratio (OR = 113.54 [95% CI 15.02–858.54]), followed by TB outside the lung (OR = 38,68 [95% CI 4.89–305.43]), nutritional status (OR = 10.92 [95% CI 5.79–20.56]), alcohol consumption (OR = 6.45 [95% CI 1.57–26.48]), working status (OR = 4.08 [95% CI 2.33–7.17]), level of education (OR = 2.79 [95% CI 1.61–4.85]), history of close contact to patients with MDR-TB, and TB (OR = 2.35 [95% CI 1.30–4.22]) and diabetes mellitus (OR = 2.12 [95% CI 1.15–3.91]). Multivariate analysis found that patients with a cavitary pulmonary were significant dominant factors for MDR-TB.

CONCLUSION: MDR-TB was predicted by previous tuberculosis therapy and cavitary pulmonary disease.

Introduction

Multidrug-resistance tuberculosis (MDR-TB) is known to be an emerging global health problem. In 2018, world data indicated that 0.5 million people had MDR-TB, with just one in every three persons receiving treatment. Only 56% of MDR-TB patients in the world are successful in therapy. Indonesia is one of the countries that also have major problems with MDR-TB [1], [2].

West Sumatra is one of the provinces in Indonesia with the majority ethnicity being Minangkabau. It is one of the ten provinces with the highest TB burden in Indonesia. MDR-TB develops when multidrug-resistant *M. tuberculosis* strains infect new patients or when past treatment causes single-drug-resistant bacteria to evolve [3]. MDR-TB reduces the effectiveness of first-line anti-TB medications, resulting in treatment failure and greater fatality rates, as well as spreading the illness [4].

Drug-resistant and MDR-TB epidemiological surveillance are a critical tool for planning TB control actions. A greater knowledge of the MDR-TB predictors might aid public health efforts by giving data on certain populations that can be focused [5]. Mapping the risk factors for MDR-TB, it is known that there are several contributing factors, namely, age, employment status, marital status, smoking history, alcohol consumption history, traditional medication history, history of contact with TB patients, cavitary pulmonary, nutritional status, TB outside the lung, and diabetes mellitus [6], [7], [8].

Despite the high prevalence of MDR-TB in Indonesia, only limited information evaluated predictors of MDR-TB and has described multidrug resistance. The purpose of this study was to determine the risk factors associated of multidrug-resistance tuberculosis among Minangkabau ethnicity in Indonesia.

Materials and Methods

Study design and research sample

The authors conducted a case–control study. Data were gathered in Dr. M Djamil General Hospital

Padang, Lubuk Alung Hospital Pariaman and Primary Health Care in Padang Pariaman District from December 2019 to March 2020. In this study, there were 73 cases (MDR-TB) and 219 controls (Tuberculosis) who were matched by age and sex. The sampling technique in this research was convenience sampling. The inclusion criteria in this study were MDR-TB patients with Gene-Xpert examination and TB with chest X-ray and sputum examination. Exclusion criteria are known that research data are not completely available.

Data collection technique

This study passed the ethical review by the ethics committee of the Faculty of Medicine, Universitas Andalas, Indonesia. Data were gathered through medical records review. Data collection was carried out through interviews by doctors or team members who treated patients at Dr. M Djamil General Hospital Padang, Lubuk Alung Hospital Pariaman and Primary Health Care in Padang Pariaman District, by the written informed consent.

Operational definition

The dependent variable was MDR-TB by measuring individuals who had a positive Mycobacterium TB culture and were being tested for treatment sensitivity to first-line antituberculosis medications [2]. The independent variables were sex (male; female) [9], age (≥ 45 years; < 45 years) [9], level of education (low, < high school; high, ≥ high school) [10], working status (working; not working) [9], history of close contact to patients with MDR-TB and TB (yes; no) [11], smoking (yes; no) [11], alcohol consumption (yes; no) [11], cavitary pulmonary (yes; no) [12], diabetes mellitus (yes; no) [11], nutritional status (underweight, <18.5 kg/m^2; normal, > 18.5–22.9 kg/m^2) [12], and TB outside the lung (yes; no) [12].

Data analysis

Bivariate and multivariate analysis were investigated using Chi-square and Logistic binary regression test. $p < 0.05$ was considered statistically significant. The data were analyzed using STATA version 14.2.

Results

Factors associated of multidrug-resistance tuberculosis among Minangkabau ethnicity in Indonesia (Table 1).

Table 1 showed the risk factors for MDR-TB, cavitary pulmonary had the highest odds ratio (OR = 113.54 [95% CI 15.02–858.54]), followed by TB outside the lung (OR = 38,68 [95% CI 4.89–305.43]), nutritional status (OR = 10.92 [95% CI 5.79–20.56]), alcohol consumption (OR = 6.45 [95% CI 1.57–26.48]), working status (OR = 4.08 [95% CI 2.33–7.17]), level of education (OR = 2.79 [95% CI 1.61–4.85]), history of close contact to patients with MDR-TB and TB (OR = 2.35 [95% CI 1.30–4.22]), and diabetes mellitus

Table 1: Factors associated of multidrug-resistance tuberculosis among Minangkabau ethnicity in Indonesia

Risk factors	Groups		p-value	OR (95% CI)
	MDR-TB (f/%) (n = 73)	TB (f/%) (n = 219)		
Sex				
Male	47 (64.4)	149 (68.0)	0.666	0.85 (0.49–1.48)
Female	26 (35.6)	70 (32.0)		Ref
Age (years)			0.323	
≥45	51 (69.9)	137 (62.6)		1.39 (0.79–2.45)
<45	22 (30.1)	82 (37.4)		Ref
Level of education				
Low	47 (64.4)	86 (39.3)	<0.001*	2.79 (1.61–4.85)
High	26 (35.6)	133 (60.7)		Ref
Working status			<0.001*	
Working	49 (67.1)	73 (33.3)		4.08 (2.33–7.17)
Not working	24 (32.9)	146 (66.7)		Ref
History of close contact to patients with MDR-TB and TB			0.006*	
Yes	54 (74.0)	120 (54.8)		2.35 (1.30–4.22)
No	19 (26.0)	99 (45.2)		Ref
Smoking			0.413	
Yes	35 (47.9)	91 (41.6)		1.29 (0.76–2.21)
No	38 (52.1)	128 (58.4)		Ref
Alcohol consumption			0.009*	
Yes	6 (8.2)	3 (1.4)		6.45 (1.57–26.48)
No	67 (91.8)	216 (98.6)		Ref
Cavitary pulmonary			<0.001*	
Yes	25 (34.2)	1 (0.5)		113.54 (15.02–858.54)
No	48 (65.8)	218 (99.5)		Ref
Diabetes mellitus			0.023*	
Yes	22 (30.1)	37 (16.9)		2.12 (1.15–3.91)
No	51 (69.9)	182 (83.1)		Ref
Nutritional status			<0.001*	
Underweight	41 (56.2)	23 (10.5)		10.92 (5.79–20.56)
Normal	32 (43.8)	196 (89.5)		Ref
TB outside the lung			<0.001*	
Yes	11 (15.1)	1 (0.5)		38.68 (4.89–305.43)
No	62 (84.9)	218 (99.5)		Ref

CI: Confidence interval; MDR TB: Multidrug-resistant tuberculosis; TB: Tuberculosis; OR: Odds Ratio; *p < 0.05 considered statistically significant

(OR = 2.12 [95% CI 1.15–3.91]), while sex, age, and smoking are not associated with MDR-TB.

Multivariate analysis for prediction of MDR-TB (Table 2).

Table 2: Multivariate analysis for prediction of MDR-TB

Variables	B	SE	p-value	OR (95% CI)
Working status	1.61	0.89	0.003	5.04 ((2.01–7.25)
Alcohol consumption	0.71	0.62	0.915	1.30 (0.95–1.51)
Cavitary pulmonary	5.57	1.28	<0.001	26.16 (4.21–29.12)
Diabetes mellitus	1.81	0.55	0.001	6.06 (2.03–7.10)
Nutritional status	2.65	0.57	<0.001	13.44 (4.10–14.22)
TB outside the lungs	4.83	1.13	<0.001	12.80 (3.51–14.50)

Table 2 showed that patients with a cavitary pulmonary were significant dominant factors for MDR-TB (OR = 26.16, 95% CI (4.21–29.12).

Discussion

The risk factors for MDR-TB and cavitary pulmonary had the highest odds ratio (OR = 113.54 [95% CI 15.02–858.54]), followed by TB outside the lung (OR = 38,68 [95% CI 4.89–305.43]), nutritional status (OR = 10.92 [95% CI 5.79–20.56]), alcohol consumption (OR = 6.45 [95% CI 1.57–26.48]), working status (OR = 4.08 [95% CI 2.33–7.17]), level of education (OR = 2.79 [95% CI 1.61–4.85]), history of close contact to patients with MDR-TB and TB (OR = 2.35 [95% CI 1.30–4.22]), and diabetes mellitus (OR = 2.12 [95% CI 1.15–3.91]). Multivariate analysis found that patients with a cavitary pulmonary was significant dominant factors for MDR-TB.

The lung cavity plays a role in the occurrence of MDR-TB, because it is related to the extent of the cavity in the parenchyma with the longer time of sputum conversion. Lung cavities are established risk factors for extending the time that it takes for a culture to convert, as well as conditions that can lead to treatment failure [10], [13]. Malnutrition is known to produce a decline in the body's immunity, increasing susceptibility to MDR-TB. Nutritional deficiency weakens a person's immune system, making sickness more likely [13].

Other studies have discovered a link between MDR-TB and alcohol consumption, working status, and educational level [11], [13], [14], [15]. People who use alcohol have a lower immune system, making them more vulnerable to MDR-TB [13]. Furthermore, patients who work will forget to take their TB medications as a result of their work activities [14]. Aside from that, because education is linked to the capacity to receive health information, the patient's education plays an essential role in the incidence of MDR-TB [15].

Contact with TB patients has been proven to increase the risk of MDR-TB considerably. The quantity of exposure and the length of time spent exposed define the risk of TB germ transfer [16]. Patients with diabetes mellitus have previously been proven to be resistant to traditional regimens, resulting in poor treatment outcomes due to delayed bacterial conversion, significant side effects, and medication interactions [17].

Based on the findings of this study, it may be possible to predict whether a person is at risk for MDR-TB, which is critical for early identification and reducing MDR-TB prevalence. Calculating risks really helps health professionals and the community in doing routine screenings for MDR-TB early detection and assisting health care providers in identifying those at risk of MDR-TB [18].

The community is now experiencing multidrug-resistant tuberculosis diagnosis delays, which can be caused by patient ignorance (patient delay), doctor or medical personnel ignorance (doctor delay), or hospital delay. Due to the low impression of MDR-TB risk, the majority of individuals tend to underestimate their own risks, which may have a significant impact on the early detection methods and attention to medical symptoms to influence MDR-TB discovery [9], [19], [20].

Early diagnosis of MDR-TB risk helps to reduce MDR-TB-related morbidity and mortality. Aside from that, the early detection of MDR-TB reduces the huge cost effect of someone being diagnosed with MDR-TB in a bad state that necessitates further treatment, which requires a significant amount of money and has a low recovery rate, compared to someone who is aware of the risk of MDR-TB early on and takes preventative measures as soon as possible.

This study has some limitations that should be recognized. First, because this was a retrospective study of normally provided data, additional potential confounders could not be investigated. Second, data were collected from a single government treatment center and analyzed in a hospital setting. As a result, we are unable to extrapolate the findings to other locations or portions of Indonesia.

Conclusion

MDR-TB was predicted by previous tuberculosis therapy and cavitary pulmonary disease. Early diagnosis of MDR-TB risk helps to reduce MDR-TB-related morbidity and death.

Acknowledgment

The authors would like to thank the participants who have participated in this research.

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