



ORIGINAL ARTICLE

FACTORS ASSOCIATED WITH THE OCCURRENCE OF PRIMARY MULTIDRUG-RESISTANT TUBERCULOSIS IN MEDAN

Faktor Yang Berhubungan Dengan Kejadian Tuberkulosis Multidrug-Resistant Primer di Kota Medan

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ABSTRACT

Background: Tuberculosis (TB) treatment failure may lead to multidrug-resistant tuberculosis (MDR-TB). This failure can be detrimental to patients, not only causing death, but can also be transmitted to others, and those who are infected directly fall into the category of MDR-TB so that it can be referred to as primary MDR-TB. MDR-TB is the biggest problem in the prevention and eradication of TB worldwide. MDR-TB is a type of *Mycobacterium tuberculosis* resistance to at least the first two TB drugs of choice, including Isoniazid and Rifampicin. **Purpose:** This study aimed to determine the association between education, contact history, and knowledge regarding the occurrence of primary MDR-TB. **Methods:** This study used a cross-sectional study conducted at Community Health Center in Medan from November 2021 to February 2022. A total of 47 TB patients were selected for this study through purposive sampling methods. The dependent variable was primary MDR-TB occurrence while the independent variables consisted of several characteristics, namely education, contact history, and knowledge. The data were analyzed using chi-square. **Results:** in this study, sex ($p=0.56$; $PR=1.12$; 95% $CI= 0.30<1,12<4,14$;) and education ($p=0.40$; $PR=0.56$; 95% $CI= 0.14<0.56<2.19$) was not associated, while age ($p=0.02$; $PR=0.16$; 95% $CI=0.02<0.16<0.94$), contact history ($p<0.001$; $PR=7.94$; 95% $CI=2.11<7.94<29.83$) and poor knowledge ($p=0.01$; $PR=5.00$; 95% $CI= 1.31<5.00<18.96$) were associated with an occurrence of primary MDR-TB. **Conclusion:** the prevalence of primary MDR-TB increases with age, contact history, and poor knowledge.

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ABSTRAK

Latar Belakang: Kegagalan dalam pengobatan tuberculosis dapat menyebabkan multidrug-resistant tuberculosis (MDR-TB). Kegagalan ini dapat merugikan pasien, tidak hanya menyebabkan kematian tetapi dapat menularkan kepada orang lain dan mereka yang tertular secara langsung masuk dalam kategori MDR-TB sehingga dapat dikatakan sebagai MDR-TB primer. MDR-TB merupakan masalah terbesar dalam pencegahan dan pemberantasan TB di dunia. MDR-TB adalah jenis resistensi mycobacterium tuberculosis terhadap setidaknya dua obat pilihan pertama TB, termasuk Isoniazid dan Rifampisin. **Tujuan:** Penelitian ini bertujuan untuk mengetahui hubungan antara pendidikan, riwayat kontak dan pengetahuan dengan kejadian TB-MDR primer. **Metode:** Penelitian ini merupakan studi potong lintang yang dilakukan di Puskesmas di Medan pada bulan November 2021 hingga Februari 2022. Sebanyak 47 pasien TB dipilih untuk penelitian ini. Variabel dependen adalah TB MDR primer. Variabel independen adalah karakteristik, pendidikan, riwayat kontak dan pengetahuan. Data dianalisis menggunakan chi-square. **Hasil:** Dalam penelitian ini, jenis kelamin ($p=0.56$; $PR=1.12$; $95\% CI= 0.30<1.12<4.14$;) dan pendidikan ($p=0.40$; $PR=0.56$; $95\% CI= 0.14<0.56<2.19$) tidak berhubungan, sedangkan usia ($p=0.02$; $PR=0.16$; $95\% CI=0.02<0.16<0.94$), riwayat kontak ($p=0.00$; $PR=7.94$; $95\% CI=2.11<7.94<29.83$) dan pengetahuan yang kurang ($p=0.01$; $PR=5.00$; $95\% CI= 1.31<5.00<18.96$) berhubungan dengan kejadian TB-MDR primer. **Simpulan:** prevalensi TB-MDR primer meningkat dengan umur, riwayat kontak dan pengetahuan yang buruk.

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INTRODUCTION

Primary multi-drug resistant tuberculosis (MDR-TB) is a distinct reservoir of transmission, which is associated with other chronic diseases associated with higher transmission of MDR-TB. Primary MDR-TB is a new case of TB including patients never treated for TB, patients in treatment with a basic regimen, evolving to failure and subsequent diagnosis of drug-resistant TB, and patients in treatment with a basic regimen, who underwent culture and a drug sensitivity test at the beginning of treatment with subsequent diagnosis of drug-resistant TB (1). Tuberculosis is an infectious disease that is very dangerous and can lead to death. This disease is carried by the *Mycobacterium tuberculosis* (TB) germ. Most TB bacteria attack the lungs, but can also impact other parts of the body. TB is increasingly uncontrollable in some countries due to the large number of patients who experience treatment failure, especially patients with acid-resistant bacteria (BTA) positive, therefore, the World Health Organization (WHO) launched an eradication strategy known as Directly Observed Therapy Short-Course (DOTS) although the program still experiences many obstacles (2).

To date, tuberculosis remains a global public health problem and a worldwide concern. Before the coronavirus (COVID-19) pandemic, tuberculosis was still the main cause of death ahead of HIV/AIDS. In 2020, an expected 9.9 million people worldwide were infected with tuberculosis, which is equivalent to 127 cases per 100,000 population. The number of cases in adult men was 5.6 million cases, the number of cases in adult women was 3.3 million cases, and in children was 1.1 cases. cases of tuberculosis are in the Southeast Asia region with 4.3 million people, equivalent to 650 cases per 100.000 population (3).

In 2020, there were 351,936 cases of pulmonary tuberculosis in Indonesia. The discovery of tuberculosis cases in 2020 in North Sumatra is under the Case Notification Rate (CNR) of 138 per 100.000 population (4). North Sumatra is the sixth province with the highest number of tuberculosis cases in Indonesia, with 20,246 cases. Based on data from North Sumatera Health Office or Medan City, the number of tuberculosis cases amounted to 12,105 cases in 2019 with a Case Notification Rate (CNR) of 531 cases per 100,000 population (5).

Failure to treat TB leads to MDR-TB. MDR-TB not only causes death but also transmits the disease to others. People who get infected from people with MDR-TB will immediately fall into the category of MDR-TB or referred to as primary MDR-TB (6). MDR-TB requires longer treatment time and considerable costs. MDR-TB cases raise concerns about direct transmission of resistant *mycobacterium tuberculosis* bacteria, leading to primary resistance in infected people (1).

MDR-TB is a major issue in global TB prevention and eradication. Multidrug-resistant tuberculosis is a type of mycobacterium tuberculosis resistance to at least the first two anti-TB drugs, namely Isoniazid and Rifampicin, which are the two most effective drugs. WHO said that there were approximately 500,000 new cases of rifampicin-resistant (RR) TB in 2018. Globally, 3.40 percent of new TB cases and 18 percent of those receiving TB treatment were MDR-TB. Of the 558,000 new cases of MDR-TB, 230,000 died (3). MDR-TB is a major obstacle in the eradication of tuberculosis in the world. MDR-TB cases are a specific form of TB that is resistant to the two most effective types of OAT (anti-tuberculosis drugs) that are used primarily when the mycobacterium tuberculosis bacteria cannot be treated with several first-line drugs, at least isoniazid and rifampicin. The drug is a type of anti-tuberculosis drug (7).

Drug resistance in mycobacterium tuberculosis strains is the ability of bacteria to adapt to the ability of OAT used. There are multiple levels of drug resistance, namely rifampicin monoresistant (a strain resistant to rifampicin), MDR-TB (a strain resistant to both rifampicin and isoniazid), and XDR TB (MDR-TB that is also resistant to fluoroquinolones and at least one of the second-line injectable antituberculosis drugs) (8). Multidrug Resistant Tuberculosis (MDR-TB) or Rifampicin Resistant (RR) TB in the world is estimated at 3.30% of new cases, while in previously treated cases it is estimated at 20% and 9.70% of MDR/RR TB has the opportunity to become Extensive Drug-Resistant Tuberculosis (XDR) (3). Standardized management of MDR-TB patients in Indonesia began with DOTS (directly observed treatment short-course) Plus. The pilot trial was conducted in two areas, East Jakarta and Surabaya in mid-2009. Later, the program transformed to PMDT (programmatic management of drug-resistant TB) (2).

According to WHO 2016, Indonesia is the 4th largest country with MDR-TB cases in the world

after India, China, and Russia (8). In Indonesia, around 2.40% out of 13 % of TB patients who have been treated are suffering from MDR-TB. The incidence of MDR-TB cases is estimated to be around 24,000 or equivalent to 8.8 cases per 100,000 population (4).

Monitoring of TB patients is a serious problem during the COVID-19 pandemic. The Indonesian Ministry of Health has stipulated that MDR-TB patients must receive rapid, standardized, and quality treatment. Failure to treat TB results in continued transmission to the surrounding environment. This is exacerbated by the fact that the infected person will immediately fall into the MDR-TB group, known as primary MDR (9). Failure to treat TB results in continued transmission to the surrounding environment. This is exacerbated by the fact that the infected person will immediately fall into the MDR-TB group, known as primary MDR (1).

Based on the description above, the author attempted to research the relationship between patient contact and knowledge with the incidence of primary MDR-TB in Medan City, which aimed to determine whether there was a relationship between patient contact and knowledge with the incidence of primary MDR-TB in Medan City.

METHODS

The method in this research was an analytic study with a cross-sectional design. Data collection was conducted through interviews by using an instrument containing a history of TB treatment before being diagnosed with MDR-TB, a history of contact with people with MDR-TB, and scored questions to determine the level of knowledge about MDR-TB. Primary MDR-TB includes patients never treated for TB, patients receiving basic regimen treatments that evolve to failure and subsequent diagnosis of drug-resistant TB, and patients in treatment with a basic regimen, who underwent culture and a drug sensitivity test at the beginning of treatment with subsequent diagnosis of drug-resistant TB.

The education level category was divided into two categories based on the categorization of education according to Arikunto in the research procedure book. Age grouping was divided into productive and unproductive age groups based on the Central Statistical Agency (BPS). Knowledge was measured using the interview method with an instrument in the form of a questionnaire. Respondents were asked to answer several

questions about MDR-TB. If the value of all answers is below the minimum value then it falls into the poor knowledge category.

The population used in this study were MDR-TB patients undergoing MDR-TB treatment program at community health centers in Medan City. The sample in this study was some patients with MDR-TB who were undergoing treatment at the health center. The total population was 111 MDR-TB patients. Using the minimum sample size calculation, a minimum sample size of 31 patients was obtained. However, in this study, 47 MDR-TB patients were taken as samples.

The sampling technique used in this study was purposive sampling technique with one inclusion criterion of respondents residing in the working area of the community health centers in Medan city. The dependent variable was primary MDR-TB, referring to MDR-TB patients who had never been diagnosed with TB or undergone TB treatments before. The independent variables were characteristic, education level in the form of the last formal education of the patient, contact history with MDR-TB patients, and knowledge about primary MDR-TB.

The subjects of the study were MDR-TB patients undergoing outpatient treatment at health centers in Medan. Patient medical records were viewed to determine whether MDR-TB patients were to be included in the primary MDR-TB category or not. Patients were said to fall into the category of polymer MDR-TB if they had never suffered from TB or had never undergone TB treatment before. Interviews were conducted with the help of a questionnaire as a research instrument to obtain data on age, gender, history of contact with patients, education level, and knowledge level.

The collected data were then inputted into the application to facilitate the analysis process. Data from statistical software were analyzed using the chi-square method to determine the relationship between variables with a 95% confidence level, if the p-value <0.05 then it is stated to be related.

The ethical examination of this study was carried out with the approval of the Health Research Ethics Committee, Universitas Sumatera Utara with number 1147/KEPK/USU/2022. Written consents were sought from all the subjects at the time of admission for the use of their data for research purpose.

RESULTS

Table 1 shows that out of 47 respondents with MDR-TB, 40.40% suffered from primary MDR-TB and 28 people (59.60%) suffered from advanced MDR-TB.

Table 1
Proportion of Occurrence of MDR-TB in Medan City

Variable	n	%
Primary MDR-TB	19	40.40
MDR-TB	28	59.60

Based on Table 2, it is known that of the 47 respondents studied, 72.30% were male and 27.70% were female. Respondents were in the age group <42 years as many as 48.20% and ≥ 42 years as many as 53.20%. The highest level of education of the respondents was at the high school level, namely 55.30%. The majority of respondents did not work or as housewives, namely 51.10% and 14.90% with various jobs such as traders, honorary employees and freelance jobs.

The level of education of respondents regarding MDR-TB in the low education category was 83.00% and those in the high education category were 17.00%. The level of knowledge of respondents regarding MDR-TB in the low category was 57.40% and those in the high knowledge category were 42.60%.

Age

Based on Table 3, it is known that most of the primary MDR-TB patients were in the age group <65 years old, which means that 68.40% are in the productive age group and 31.60% are in the age group ≥ 65 years old or unproductive. The statistical tests resulted in the p-value of 0.02 ($p < 0.05$), meaning that there was a relationship between age and the incidence of primary MDR-TB and a prevalence ratio value of 0.16, indicating that patients at productive age or <65 years had a protective factor to MDR-TB 0.16 times greater than patients at unproductive age or ≥ 65 years.

Table 2

Characteristic Distribution Respondents of Occurrence of MDR-TB in Medan City

Variable	Frequency (n)	Percentage (%)
Sex		
Male	34	72.30
Female	13	27.70
Age		
<65 years old	39	83.00
≥65 years old	8	17.00
Education level		
Primary School	7	14.90
First Middle School	6	12.80
Secondary School	26	55.60
Tertiary Education	8	17.00
Occupation		
Not Working/ housewife	24	51.10
Public Servants	7	14.90
Self-employed	9	19.10
Others	7	14.90
Category Education		
Low	39	83.00
High	8	17.00
Knowledge		
Poor	27	57.40
High	20	42.60

Sex

Table 3 shows that most of the patients with primary MDR-TB were male as many as 73.70%. The results of the statistical test showed that the p-value was 0.56 ($p > 0.05$), meaning that there was no association between gender and the incidence of primary MDR-TB and a prevalence ratio of 1.12.

Contact History

Based on Table 3, it is known that as many as 68.40% of respondents with primary MDR-TB had been in contact with MDR-TB patients. The results of statistical tests obtained the p-value of 0.00 ($p < 0.05$), implying that there was a significant association between patient contact with the incidence of primary MDR-TB and a prevalence ratio value of 7.94 indicating that patients with a history of contact with patients had a risk of 7.94 times to suffer from primary MDR-TB compared to those who did not have a history of patient contact.

Education

Respondents with primary MDR-TB who had a lower level of education were 78.90%. The results of statistical tests obtained the p-value of 0.69 ($p > 0.05$), implying that there was no significant association between education level and the incidence of primary MDR-TB and the prevalence ratio value of 0.56.

Knowledge

Patients with primary MDR-TB who have knowledge in the poor category were 55.60% and who suffered from MDR-TB are 44.40%. The results of statistical tests obtained the p-value of 0.01 ($p < 0.05$), implying that there was a significant association between knowledge and the incidence of primary MDR-TB and the prevalence ratio value of 5.00 meaning that patients with low knowledge have a risk of 5.00 times to suffer from MDR-TB compared to those with high knowledge.

DISCUSSION

MDR-TB patients were almost twice as common in men as in women (10). Based on age group, most of the primary MDR-TB patients were ≥65 years old. Contrast with research conducted by Devi et al (11), it revealed that more than half of the respondents were in the age category <45.6 years, which amounted to 54.80%. Most TB patients were in the 41-50 year age group at 42.50% (12). The age of MDR-TB patients was the largest in the 30-45 year age group at 45.70% (10). A study conducted in Semarang found that most of the MDR-TB sufferers were in the age group <45 years by 55.70% (13). This study is different from the research of Aristiana and Wartono (14), which stated that most of MDR-TB patients were in the age group of 15-35 years. Respondents suffering from MDR-TB in the age group of 42-65 years were 27.40% (15). The difference in this study is due to the fact that respondents aged ≥65 years had a smaller proportion than those aged < 65 years, so that ages ≥65 years had a higher risk of developing primary MDR-TB due to a decreased immune system.

Table 3

Cross Tabulation of Associated between Age, Gender, Contact History, Education Level, and Knowledge with Primary MDR-TB

Variable	Primary MDR-TB				<i>p value</i>	PR (95% CI)
	Yes		No			
	n	%	n	%		
Age						
<65 years old	13	68.40	26	92.90	0.02	0.16 (0.02 - 0.943)
≥65 years old	6	31.60	2	7.10		
Sex						
Male	14	73.70	20	72.40	0.56	1.12 (0.30 - 4.14)
Female	5	26.30	2	28.60		
Contact History						
Contact	13	68.40	6	21.40	0.00	7.94 (2.11 - 29.83)
No Contact	6	32.60	22	78.60		
Education Level						
Lower education	4	21.10	9	32.10	0.69	0.56 (0.14 - 2.19)
Higher education	15	78.90	19	67.90		
Knowledge						
Poor knowledge	15	78.90	12	42.80	0.01	5.00 (1.31 - 18.96)
High knowledge	4	21.10	16	57.20		

Association between age and the occurrence of primary MDR-TB

Patients with primary MDR-TB are mostly in the productive age group or <65 years old. This can occur due to the high activity and mobility of the productive age group which provides a greater possibility of being infected and suffering from MDR-TB. Productive age and having many activities outside the home can cause patients to neglect treatment, for example neglecting to take proper medication and have other possibilities due to improper or incomplete treatment in the past due to lack of awareness which causes negligence so that patients become MDR-TB (16). MDR-TB patients are mostly in the productive age group, namely at the age of 15-55 years. Productive age is more at risk because of more activities than the elderly (17).

In contrast to this study, a case control study carried out in Amhara Region, Northern Ethiopia, where the age group that had a significant association with the occurrence of MDR-TB was in the age group of 26-45 years with a p-value of 0.03 (18).

Association between sex and the occurrence of primary MDR-TB

Patients with primary MDR-TB were mostly male at 73.70% while females were 26.30%. This finding is in line with research by Baya et al (6), whose participating patients were predominantly male at 76.20%. In line with research by Nurdin

(19), the proportion of male patients was 53.70%. In a cohort study conducted in Sao Paulo Brazil, most MDR-TB patients were male (60.00%) (20). The proportion of respondents suffering from MDR-TB was more in respondents who had male gender at 30.60% compared to respondents who had female gender 21.00% (15).

In line with research by Baya et al (6), this study revealed that no relationship was found between gender and the incidence of MDR-TB. Research conducted in South Sumatra showed that there was no significant relationship between gender and the incidence of MDR-TB with a p-value of 0.26. The finding was in parallel with research carried out by Ginanjar et al (15), which shows that there was no significant relationship between gender and the incidence of MDR-TB with a p-value of 0.79 and an odds ratio value of 0.78.

Men are more predisposed to MDR-TB disease. This vulnerability can be caused by high workloads, lack of rest, high mobilization, and unhealthy lifestyles such as smoking and consuming alcohol. These behaviors can be the risk factors that can degrade the immune system, making it susceptible to MDR-TB. Gender is a cultural concept that seeks to make differences in emotional characteristics, behavior, feelings, and behavior between men and women in a society (21).

The prevalence of pulmonary TB in males and females is similar until the age of adolescence,

however, after adolescence, the prevalence in male is higher than female. This is probably because until adolescence, contact only takes place in a smaller environment. After the age of adulthood, men have more contact with the wider environment outside the home compared to women, in addition to biological factors, also due to socio-cultural factors, including stigma towards TB (22). In this study, gender was not a factor that had a significant relationship with the incidence of primary MDR-TB because the sample size of men was more dominant than women so that the results of statistical calculations showed no relationship between gender and the incidence of primary MDR-TB.

Association between education and the occurrence of primary MDR-TB

Most patients with primary MDR-TB were at a low education level, 78.90%. The proportion of patients with high school education amounted to 21.10%. In this study, education level did not have a significant relationship with the occurrence of primary MDR-TB. This could be due to the fact that knowledge about tuberculosis can be found anywhere, so low and high education levels have the same opportunity to obtain knowledge about MDR-TB through various existing media. Currently, there are many media that provide information about the importance of TB treatment (15).

Contrast with research by Jaya et al (23), most respondents had a high school education level. Similar to research conducted by Wahyuni and Cahyati (22), it was found that the proportion of respondents with low education levels was 90.9%. In the research conducted by Buryanti and Fibriana (13), the proportion of respondents with low education was 84.30%.

According to research conducted by Prananda et al (24), the level of education does not affect the occurrence of MDR-TB with p-value of 0.40. Similar to research by Triandari and Rahayu (25), it was revealed that there was no relationship between education level and the occurrence of MDR-TB with p-value of 0.61.

There was no relationship between education level and the incidence of MDR-TB at the Semarang city health center with a p-value of 0.74 (13). Research conducted in Ethiopia showed that 179 people (39.60%) had low education and 111 people (45.90%) had MDR-TB (26). The higher the level of education of a patient, the greater the propensity is to adhere to treatment. Conversely,

the lower the level of education, the poorer the propensity is to comply with treatment. This shows the greater the respondent's level of comprehension about their disease (27). In contrast to this study, research conducted by Nurdin (19) in South Sumatra province revealed that there was a relationship between TB patients and low education. Patients with low education are almost 2 times more likely to develop MDR-TB compared to highly educated TB patients.

Different from the study, the proportion of respondents suffering from MDR-TB was higher among respondents with low education levels, which amounted to 35.50% compared to respondents with higher education, which amounted to 16.10%. There was a significant relationship between education and the incidence of MDR-TB with p-value of 0.00 and an odds ratio value of 0.07, meaning that respondents who have low education were 0.07 times more susceptible to MDR-TB than those with higher education (15). Higher levels of education do not always translate into better knowledge, which can lead to MDR-TB and may be caused by the absence of early prevention. Not all those with low education have poor knowledge about treatment, causing patients to become MDR-TB (16).

The level of education did not have a significant relationship because patients with primary education did not always have a low level of knowledge about tuberculosis, and those with higher education did not always have a high level of knowledge about tuberculosis. Currently, many media provide information about the importance of tuberculosis treatment (14).

Association between contact history and the occurrence of primary MDR-TB

History of contact with TB patients has a risk of 2.48 times to be infected compared to those who do not have a history of contact with TB patients (OR = 2.48, 95% CI 1.11-5.50) (6). Out of 66 MDR-TB cases, 64 patients had a history of contact with MDR-TB patients (27). The relationship between contact history and the incidence of MDR-TB in several studies was stated as a predictor of MDR-TB in East Shoa Ethiopia for 219 respondents with an OR value of 2.10, suggesting that respondents with a history of contact with TB patients are at risk of becoming MDR-TB 2.10 times higher than those without contact history (28).

Association between knowledge and the occurrence of primary MDR-TB

Poor knowledge of MDR-TB can make people not have protective attitude to prevent the spread of MDR-TB so that transmission can occur easily. Knowledge about the side effects of the drugs consumed also plays an important role in patients, so patients with poor knowledge about the side effects of drugs consumed when suffering from TB cause them not to continue treatment which results in suffering from MDR-TB (1). A good knowledge could accelerate healing if there is no self-awareness to take medicine regularly and lack of motivation of the patient. Thus, good knowledge can accelerate healing (15).

In contrast to research conducted at Ulin Banjarmasin Hospital, it shows that knowledge has no relationship with the incidence of MDR-TB as seen from the p-value obtained which is greater than 0.05. A high or low level of does not affect a person's risk of developing MDR-TB because there are a lot of knowledge information obtained by the patient when undergoing previous treatment. The information obtained comes from doctors, nurses, people around, or the curiosity of the patient himself to find out about the dangers of the disease suffered so that it triggers the process of healing (29). Education level did not have a significant relationship in this study because knowledge about MDR-TB does not depend on a person's level of education. People who are more frequently exposed to information about MDR-TB will have higher knowledge than those who are not exposed to information about MDR-TB. Good knowledge can accelerate healing. If there is no self-awareness and lack of knowledge to take regular medication and lack of motivation, the patient will suffer from MDR-TB (16). Strengthening the implementation of Find, Separate and Treat (Tempo) aims to improve the identification of suspected or actual TB patients in at-risk populations who are already attending services. The Tempo strategy should be a standard operating procedure in all health care facilities.

The majority of treatment monitoring for MDR-TB patients is done by the family, with only a small proportion supervised by health workers or trained TB cadres. Treatment monitoring for patients with MDR-TB is conducted by health workers and creates a social and economic burden for patients and families because MDR-TB patients must visit the health facility every day. New technologies should be used to conduct TB treatment monitoring such as the use of

technology-based information systems such as the use of software on mobile phones, short messages as reminders to take medication, and recording of treatment monitoring (30).

Research Limitations

The limitations of this study lie on the patients. The patients studied were patients undergoing outpatient treatment at health centers in Medan. This study cannot be generalized to inpatients. This study also did not take into account genetic influences such as *Mycobacterium tuberculosis* genetic factors or patient genetic factors that might affect the patient's clinical course including side effects.

CONCLUSION

Based on the characteristics of MDR-TB patients, most of them were aged <65 years old, male, high school education level, daily activities were not working or as housewives. Bivariate analysis showed that there was a statistically significant association between patients' age (≥ 65 years), history of contact, and the level of knowledge with the incidence of primary MDR-TB in Medan City.

Socialization is still very much needed to increase public awareness about MDR-TB, because MDR-TB is still very rarely known in the community regarding its impacts, as well as the possibility of direct transmission that occurs to cause someone to suffer from primary MDR-TB. By conducting socialization about MDR-TB, the community will know that having close contact will cause them to be infected with MDR-TB so that they have more awareness to maintain health protocols for MDR-TB patients. as well as at an age that is more susceptible to infection to better maintain or avoid contact with people with MDR-TB, as well as people with MDR-TB to always maintain health protocols so as not to spread it to others.

CONFLICT OF INTEREST

The authors declare that there are no competing interests in this study and we affirm the veracity of the results.

AUTHOR CONTRIBUTIONS

RAH: develops proposals, designs studies, and carries out statistical tests. CUW: revises this paper from the abstract to the results of the paper.

SS: assists in drafting proposals until the completion of this paper, and revision of this paper.

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REFERENCES

- Bhering M, Kritski A. Primary and acquired multidrug-resistant tuberculosis: Predictive factors for unfavorable treatment outcomes in Rio de Janeiro, 2000–2016. *Rev Panam Salud Pública*. 2020;44.
- Ministry of Health Republic Indonesia. National guidelines for controlling tuberculosis. Jakarta Kementerian Kesehatan RI. 2014;
- WHO. Global tuberculosis report 2021 [Internet]. Geneva; 2021. Available from: <https://iris.who.int/bitstream/handle/10665/346387/9789240037021-eng.pdf?sequence=1>
- Ministry of Health Republic Indonesia. Indonesia's health profile in 2020 [Internet]. Jakarta; 2021. Available from: <https://www.kemkes.go.id/id/profil-kesehatan-indonesia-2020>
- North Sumatra Provincial Health Service. Health profile of North Sumatra province in 2019 [Internet]. 2019. Available from: <https://dinkes.sumutprov.go.id/unduh/downloadfile?id=1568>
- Baya B, Achenbach CJ, Kone B, Toloba Y, Dabita DK, Diarra B, et al. Clinical risk factors associated with multidrug-resistant tuberculosis (MDR-TB) in Mali. *Int J Infect Dis*. 2019;81:149–55.
- Muhammad M, Fadli F. Analysis of factors causing Multi-Drug Resistance (MDR) in tuberculosis sufferers. *J Publ Kesehat Masy Indones*. 2019;6(2):62–7.
- WHO. Guidelines for treatment of drug-susceptible tuberculosis and patient care. Geneva: <https://www.afro.who.int/sites/default/files/2017-06/9789241550000-eng.pdf>; 2017.
- Ministry of Health Republic Indonesia. Technical instructions for managing drug-resistant tuberculosis in Indonesia [Internet]. Jakarta: Cited August; 2020. Available from: https://tbindonesia.or.id/wp-content/uploads/2021/06/TBRO_Buku-Juknis-Tuberculosis-2020-Website.pdf
- Janan M. Risk factors associated with an increase in the prevalence of MDR TB in Brebes Regency in 2011-2017. *J Kebijakan Kesehat Indones JKKI*. 2019;8(2):64–70.
- Devi AU, Cahyo K, Shaluhiah Z. Factors related to the behavior of MDR TB patients in preventing MDR TB transmission in the work area of Semarang City Community Health Centers. *J Kesehat Masy*. 2019;7(1):442–52.
- Zulaikhah ST, Ratnawati R, Sulastri N, Nurkhikmah E, Lestari ND. The relationship between knowledge, behavior and home environment with the incidence of pulmonary tuberculosis transmission in the working area of the Bandarharjo Community Health Center, Semarang. *J Kesehat Lingkungan Indones*. 2019;18(2):81–8.
- Buryanti S. Factors influencing the incidence of MDR TB in the city of Semarang. *J Heal Sci Gorontalo J Heal Sci Community*. 2021;5(1):146–54.
- Aristiana CD, Wartono M. Factors that influence the incidence of multidrug resistance tuberculosis (MDR-TB). *J Biomedika Dan Kesehat*. 2018;1(1):65–74.
- Ginanjar Y, Astika T, Supriyatna N. Analysis of the influence of psychosocial and other risk factors on the incidence of MDR TB. *Bina Gener J Kesehat*. 2019;11(1):46–54.
- Simorangkir L, Sinaga SP, Ginting F, Rupang ER. An overview of the factors causing Multidrug-Resistant Tuberculosis (MDR-TB) at Haji Adam Malik Hospital Medan in 2022. *Elisabeth Heal J*. 2022;7(1):59–73.
- Emmi Bijawati SKM, Munawir Amansyah SKM, Nurbiah SKM. The risk factors for treatment of multidrug resistance tuberculosis (MDR-TB) patients in Labuang Baji General Hospital Makassar in 2017. *J Nas Ilmu Kesehat*. 2018;1(1).
- Ambaye GY, Tsegaye GW. Factors associated with multi-drug resistant tuberculosis among TB patients in selected

- treatment centers of Amhara Region: a case-control study. *Ethiop J Health Sci*. 2021;31(1).
19. Nurdin N. Analysis of individual determinant factors for Multidrug Resistant Tuberculosis (MDR TB) in South Sumatra Province. *J Kesehatan Komunitas*. 2020;6(1):63–7.
 20. Savioli MTG, Morrone N, Santoro I. Primary bacillary resistance in multidrug-resistant tuberculosis and predictive factors associated with cure at a referral center in São Paulo, Brazil. *J Bras Pneumol*. 2019;45.
 21. Nugroho FS, Shaluhiyah Z, Adi S. Description of the treatment behavior of mdr TB patients in the intensive phase at Dr Moewardi Hospital, Surakarta. *J Kesehatan*. 2018;11(1):32–42.
 22. Wahyuni T, Cahyati WH. Multidrug Resistant Tuberculosis (MDR-TB). *HIGEIA (Journal Public Heal Res Dev)*. 2020;4(Special 3):636–48.
 23. Jaya IPGO, Bagiada IM, Kurniari PK. Characteristics of pulmonary tuberculosis sufferers at Sanglah Hospital Denpasar Lung Polytechnic in January 2016-July 2017. *Intisari Sains Medis*. 2020;11(3):1056–61.
 24. Prananda V, Andayani N, Inggriyani CG. The relationship between education level and the incidence of Multidrug Resistant Tuberculosis (MDR-TB) in RSUDZA Banda Aceh. *J Kedokt Nanggroe Med*. 2018;1(4):7–13.
 25. Triandari D, Rahayu SR. Kejadian Multi Drug Resistant Tuberculosis at RSUP dr. Kariadi. *HIGEIA (Journal Public Heal Res Dev)*. 2018;2(2):194–204.
 26. Alene KA, Viney K, McBryde ES, Gray DJ, Melku M, Clements ACA. Risk factors for multidrug-resistant tuberculosis in northwest Ethiopia: a case-control study. *Transbound Emerg Dis*. 2019;66(4):1611–8.
 27. Elduma AH, Mansournia MA, Foroushani AR, Ali HMM, MA A, Elegail S, et al. Assessment of the risk factors associated with multidrug-resistant tuberculosis in Sudan: a case-control study. *Epidemiol Health*. 2019;41.
 28. Desissa F, Workineh T, Beyene T. Risk factors for the occurrence of multidrug-resistant tuberculosis among patients undergoing multidrug-resistant tuberculosis treatment in East Shoa, Ethiopia. *BMC Public Health*. 2018;18(1):1–6.
 29. Mashidayanti A, Nurlely N, Kartinah N. Risk factors that influence the incidence of Tuberculosis with Multidrug-Resistant Tuberculosis (MDR-TB) at Ulin Regional Hospital, Banjarmasin. *J Pharmascience*. 2020;7(2):139–48.
 30. Ministry of Health Republic Indonesia. National strategy for controlling Tuberculosis in Indonesia 2020-2024. Jakarta; 2020.