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Factors Influencing the Occurrence of Multidrug-Resistant Tuberculosis (MDR-TB) in the Working Area of Langara Health Center, Konawe Kepulauan Regency

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ABSTRACT

Multidrug-Resistant Tuberculosis (MDR-TB) represents one of the most critical challenges in global tuberculosis prevention and control. MDR-TB occurs when Mycobacterium tuberculosis develops resistance to at least isoniazid and rifampicin, the two most potent first-line anti-tuberculosis drugs. This study aimed to identify the factors influencing the occurrence of MDR-TB in the working area of Langara Health Center, Konawe Kepulauan Regency in 2023. A quantitative descriptive study with a cross-sectional design was employed. The total sampling technique was applied, involving all 47 registered TB patients in the working area of Langara Health Center during 2023. Data were collected through medical records and validated questionnaires, and analyzed using univariate and bivariate analysis (T-test and F-test) with a significance level of $p < 0.05$. Results showed that medication regularity ($t = 11.246$; $p = 0.003$), drug side effects ($t = 6.128$; $p = 0.012$), contact history with TB patients ($t = 7.450$; $p = 0.006$), patient motivation ($t = 6.557$; $p = 0.011$), and knowledge ($t = 5.421$; $p = 0.016$) each significantly influenced MDR-TB occurrence. Simultaneously, all five variables significantly influenced MDR-TB occurrence ($F = 5.150$; $p = 0.003$). Healthcare workers should intensify health promotion activities to strengthen medication adherence, manage drug side effects, and improve patient motivation and knowledge regarding MDR-TB prevention.

Keywords: *Contact History, Drug Side Effects, Knowledge, MDR-TB, Medication Regularity, Patient Motivation.*

I. INTRODUCTION

Multidrug-Resistant Tuberculosis (MDR-TB) represents one of the most critical global challenges in the prevention and control of tuberculosis (TB). MDR-TB occurs when Mycobacterium tuberculosis develops resistance to at least isoniazid and rifampicin — the two most potent first-line anti-tuberculosis drugs (OAT). The emergence of MDR-TB creates significant barriers to effective TB control programs due to the difficulty of diagnosis, high treatment failure rates, and elevated mortality. Treatment requires substantially higher costs and longer duration compared to drug-sensitive TB (Wahyuni & Cahyati, 2020).

According to the World Health Organization (WHO), the estimated number of individuals diagnosed with TB in 2022 reached 10.6 million cases globally, with at least 1.6 million deaths — an increase from approximately 1.3 million in the previous year. Data from 2019 indicate that approximately 3.3% of new TB patients and 17.7% of previously treated TB patients were classified as drug-resistant. Total global TB incidence was estimated at 9.96 million cases, of which 465,000 were Rifampicin-Resistant/MDR-TB (TB RR/MDR-TB) (WHO, 2023). Indonesia ranks second globally in TB burden after India and fifth in MDR-TB burden. Indonesia's estimated MDR-TB proportion is 2.4% among new TB patients and 13% among previously treated patients, with a total incidence estimated at 24,000 cases or 8.8 per 100,000 population (Laila Rachmawati et al., 2023).

Several factors contribute to increasing MDR-TB cases, including low patient and family knowledge about the disease, poor medication adherence, OAT side effects, irregular treatment, insufficient drug doses, low patient motivation, inadequate drug supply, low bioavailability, and poor drug quality (Mashidayanti & Kartinah, 2020). The WHO has promoted the Directly Observed Treatment Short Course (DOTS) strategy since 1995, yet Indonesia's TB cure rate remains at only 42%, reflecting ongoing challenges in adherence (Annisatuzzakiyah et al., 2021).

At the local level, data from the Konawe Kepulauan District Health Office (2022) showed that the TB case achievement rate increased from 81.50% to 89.60%. Preliminary survey data from Langara Health Center showed 37 TB patients and 4 MDR-TB cases in 2023. Based on these findings, the majority of MDR-TB patients demonstrated

irregular medication use, experienced OAT side effects, had a history of contact with TB patients, and showed variable levels of motivation and knowledge. This study therefore aimed to identify and analyze the factors that influence the occurrence of MDR-TB in the working area of Langara Health Center, Konawe Kepulauan Regency.

II. LITERATURE REVIEW

2.1. Multidrug-Resistant Tuberculosis (MDR-TB)

MDR-TB is defined as TB caused by Mycobacterium tuberculosis strains that are resistant to at least isoniazid (INH) and rifampicin (RIF), the two most potent first-line OAT agents. MDR-TB presents the greatest threat to TB elimination globally because it requires second-line drugs that are more expensive, more toxic, and must be taken over a significantly longer period (18–24 months). Key risk factors for MDR-TB development include prior TB treatment history, irregular OAT consumption, and contact with known MDR-TB patients (Kemenkes, 2020).

2.2. Medication Regularity

Medication regularity refers to the consistent consumption of prescribed medications at the correct time and dose throughout the full treatment course (Mustaqin et al., 2017). Irregular medication use is a primary driver of drug resistance development, as incomplete or intermittent dosing allows Mycobacterium tuberculosis to acquire and accumulate resistance mutations. Factors supporting medication regularity include free medication and healthcare services, accessible health facilities, and strong patient motivation for recovery (Sirait et al., 2020).

2.3. Drug Side Effects

Drug side effects are undesired and potentially harmful reactions caused by a pharmacological treatment (Depkes RI, 2014). OAT agents are known to produce both minor and major adverse effects. Common side effects include skin itching and redness (rifampicin), dizziness and headache (isoniazid), joint pain (pyrazinamide), visual disturbances (ethambutol), nausea, decreased appetite, red-colored urine, and tingling sensations. These side effects frequently reduce patient adherence and may lead to treatment discontinuation, ultimately contributing to resistance development.

2.4. Contact History

Contact history with TB patients refers to the prior or ongoing proximity to an active TB or MDR-TB case, which creates an elevated risk of transmission and potential acquisition of resistant strains. Household contacts of MDR-TB patients are at particularly high risk, estimated at up to 24 times greater risk of MDR-TB compared to those without contact history (Buryanti & Fibriana, 2021). Transmission occurs primarily through respiratory droplets in poorly ventilated environments.

2.5. Patient Motivation and Knowledge

Motivation — both intrinsic (arising from within the patient) and extrinsic (from family, healthcare workers, or community) — plays a critical role in treatment completion. Low motivation contributes significantly to treatment non-adherence and the subsequent development of MDR-TB (Sarwani & Nurlaela, 2012). Knowledge about TB, its transmission, treatment, and consequences of non-adherence is equally important. Patients with limited knowledge are less likely to complete treatment, follow instructions, and seek timely care (Dikta Utama, 2021).

III. RESEARCH METHOD

This study employed a quantitative descriptive design with a cross-sectional approach. The research was conducted at Langara Health Center (UPTD Puskesmas Langara), Konawe Kepulauan Regency, Southeast Sulawesi, from June 24 to July 8, 2024. The total sampling technique was applied, involving all 47 registered TB patients at Langara Health Center in 2023, as the total population was below 100 (Sugiyono, 2012). The final analytical sample comprised 37 TB patients who fully met the inclusion criteria and completed the study instruments.

Data were collected through medical record review for demographic information and structured questionnaires for all independent variables. Questionnaire validity was assessed using Pearson Product Moment correlation ($r_{h}{}^{e}{}_{tuni} > r_{ta}{}^{b}{}_{he} = 0.325$; $\alpha = 0.05$), and reliability was confirmed using Cronbach's Alpha ($\alpha > 0.60$). All questionnaire items for all five variables were valid and reliable (Cronbach's Alpha range: 0.649–0.781).

Data analysis was performed using SPSS software. Univariate analysis described frequency distributions of each variable. Bivariate analysis used the T-test (partial effect) and F-test (simultaneous effect) with a significance threshold of $p < 0.05$. The T-test assessed individual influence of each independent variable on MDR-TB occurrence, while the F-test assessed the combined simultaneous influence of all five variables.

IV. RESEARCH RESULT AND DISCUSSION

4.1. Research Result

4.1.1. Respondent Characteristics

A total of 37 TB patients participated in this study. Tables 4.1–4.4 present the demographic distribution of respondents.

Table 4.1. Distribution of Respondents by Gender

Gender	n	Percentage (%)
Male	23	62.2
Female	14	37.8
Total	37	100

Source: Primary data, processed 2024

Table 4.2. Distribution of Respondents by Age Group

Age Group (years)	n	Percentage (%)
26–35	7	18.9
36–45	13	35.1
46–55	10	27.0
56–65	5	13.5
66–75	2	5.4
Total	37	100

Source: Primary data, processed 2024

Table 4.3. Distribution of Respondents by Occupation

Occupation	n	Percentage (%)
Housewife (IRT)	8	21.6
Fisherman	8	21.6
Self-employed	7	18.9
Farmer	6	16.2
Driver	3	8.1
Livestock farmer	3	8.1
Teacher	2	5.4
Total	37	100

Source: Primary data, processed 2024

Table 4.4. Distribution of Respondents by Education Level

Education Level	n	Percentage (%)
Senior High School (SMA)	15	40.5
Education Level	**n**	**Percentage (%)**
Junior High School (SMP)	10	27.0
Elementary School (SD)	8	21.6
University	2	5.4
No formal education	2	5.4
Total	37	100

Source: Primary data, processed 2024

4.1.2. Instrument Validity and Reliability

Validity testing showed all questionnaire items for the five variables (medication regularity, drug side effects, contact history, patient motivation, and patient knowledge) had $r_{h^{e}tuni} > r_{ta^{b}he}$ (0.325), confirming validity. Reliability testing using Cronbach's Alpha confirmed all variables were reliable (range: 0.649–0.781, all > 0.60), as summarized in Table 4.5.

Table 4.5. Reliability Test Results

Variable	Cronbach's Alpha	Result
Medication Regularity	0.649	Reliable
Drug Side Effects	0.729	Reliable
Contact History	0.781	Reliable
Patient Motivation	0.681	Reliable
Patient Knowledge	0.761	Reliable

Source: Primary data, processed 2024

4.1.3. Bivariate Analysis — Partial Effect (T-test)

The partial T-test assessed the individual influence of each independent variable on MDR-TB occurrence. Results are presented in Table 4.6.

Table 4.6. Partial T-test Results

Variable	$t_{h^{e}tuni}$	$t_{ta^{b}he}$	p-value	Result
Medication Regularity	11.246	3.633	0.003	Significant
Drug Side Effects	6.128	3.633	0.012	Significant
Contact History	7.450	3.633	0.006	Significant
Patient Motivation	6.557	3.633	0.011	Significant
Patient Knowledge	5.421	3.633	0.016	Significant

Source: Primary data, processed 2024

4.1.4. Simultaneous Effect (F-test)

The F-test assessed the simultaneous influence of all five independent variables on MDR-TB occurrence. Results showed $F_{h^{e}tuni} = 5.150 > F_{ta^{b}he} = 2.51$ with $p = 0.003$ (< 0.05), indicating that all five variables simultaneously and significantly influenced MDR-TB occurrence in the working area of Langara Health Center.

Table 4.7. Simultaneous F-test Results

Variables	$F_{h^{e}tuni}$	$F_{ta^{b}he}$	p-value	Result
All 5 variables simultaneously	5.150	2.51	0.003	Significant

Source: Primary data, processed 2024

4.2. Discussion

4.2.1. Respondent Characteristics

Male respondents constituted the majority (62.2%), consistent with findings by Buryanti & Fibriana (2021) showing that males have greater outdoor activities and higher exposure to TB transmission risk, partly attributable to higher rates of smoking and alcohol consumption. Females, while less represented (37.8%), present nearly comparable risk in quantitative terms.

The predominant age group was 36–45 years (35.1%), followed by 46–55 years (27.0%) — both within the productive age range. This is consistent with Sunarmi & Kurniawaty (2022), who noted that productive-age individuals are more vulnerable due to higher social mobility, greater inter-personal contact, and cumulative physical strain reducing immune competence. Regarding occupation, housewives and fishermen were the most common categories (21.6% each), reflecting the socioeconomic context of coastal Konawe Kepulauan where these occupations dominate. Most respondents had completed senior high school education (SMA, 40.5%), though a substantial proportion had only elementary education (21.6%) or no formal schooling (5.4%), which influences health literacy and TB management capacity (Buryanti & Fibriana, 2021).

4.2.2. Effect of Medication Regularity on MDR-TB

Medication regularity demonstrated the strongest individual influence on MDR-TB occurrence (t = 11.246; p = 0.003). This finding aligns with Sirait et al. (2020), who emphasized that treatment efficacy is fully contingent upon consistent medication adherence. Fitri (2018) similarly demonstrated a significant influence of medication regularity on MDR-TB. When patients discontinue or irregularly consume OAT, Mycobacterium tuberculosis populations survive drug pressure, select for resistant mutants, and propagate — culminating in MDR-TB. Factors that support regularity in this population included free OAT provision, accessible health services, and patient desire for recovery. Ipah Setyowati et al. (2021) corroborated this, finding that medication adherence significantly influenced pulmonary TB outcomes at RSI Sultan Agung Semarang.

4.2.3. Effect of Drug Side Effects on MDR-TB

Drug side effects significantly influenced MDR-TB occurrence (t = 6.128; p = 0.012). The most frequently reported side effects among respondents were joint pain (86.49%), red-colored urine (81.08%), numbness/tingling (78.38%), decreased appetite (70.27%), dizziness (67.57%), visual disturbances (59.46%), headache (59.46%), abdominal pain (54.05%), nausea (56.76%), and skin itching (64.86%). These findings are consistent with Rezki (2017) and Nurhayati (2015), who documented similar OAT side effect profiles. These adverse reactions — particularly joint pain from pyrazinamide, visual disturbances from ethambutol, and gastrointestinal effects from rifampicin — represent significant barriers to treatment completion, increasing the likelihood of premature discontinuation and consequent drug resistance development.

4.2.4. Effect of Contact History on MDR-TB

Contact history with TB patients significantly influenced MDR-TB occurrence (t = 7.450; p = 0.006). This is consistent with Buryanti & Fibriana (2021), who found that individuals with a history of contact with MDR-TB patients faced a 24-fold greater risk of developing MDR-TB. In a household setting, shared living space, inadequate ventilation, and high-frequency close contact create conditions for Mycobacterium tuberculosis transmission, including MDR strains. Lema & N. A. (2012) similarly reported that of 66 MDR-TB cases, 64 patients had a prior contact history with MDR-TB patients. These findings underscore the critical need for systematic contact tracing and preventive interventions for household contacts of TB/MDR-TB patients.

4.2.5. Effect of Patient Motivation on MDR-TB

Patient motivation significantly influenced MDR-TB occurrence (t = 6.557; p = 0.011). Intrinsic motivation — the patient's internal drive for recovery — and extrinsic motivation from family, healthcare providers, and community support are both essential for sustaining treatment over the 18–24-month MDR-TB regimen. Sarwani & Nurlaela (2012) found that low motivation is a significant risk factor for MDR-TB. In contrast, Mashidayanti & Kartinah (2020) did not find motivation to be a significant factor, suggesting contextual variability. In the Langara setting, given geographic remoteness and limited healthcare access, patient motivation appears particularly critical in driving treatment-seeking behavior and adherence.

4.2.6. Effect of Patient Knowledge on MDR-TB

Patient knowledge significantly influenced MDR-TB occurrence (t = 5.421; p = 0.016). This is consistent with Dikta Utama (2021) and Suryaningnorma (2016), both of whom found significant associations between patient knowledge and TB-related health behavior. Patients with adequate knowledge understand the necessity of completing the full treatment course, recognize symptoms of drug resistance, and engage more effectively with healthcare providers. In this study, respondents with SMA-level education (40.5%) demonstrated comparatively better knowledge retention, consistent with Widiati & Majdi (2021), who noted that higher education correlates with greater capacity to receive, process, and apply health information. Low-knowledge patients are at higher risk of misconceptions — particularly the belief that cessation of symptoms signifies cure — leading to premature treatment discontinuation.

V. CONCLUSION AND SUGGESTIONS

5.1. Conclusion

Based on the results and discussion, the following conclusions are drawn:

1. Medication regularity significantly influenced MDR-TB occurrence in the working area of Langara Health Center, Konawe Kepulauan Regency (t = 11.246; p = 0.003).

2. Drug side effects significantly influenced MDR-TB occurrence ($t = 6.128$; $p = 0.012$).
3. Contact history with TB patients significantly influenced MDR-TB occurrence ($t = 7.450$; $p = 0.006$).
4. Patient motivation significantly influenced MDR-TB occurrence ($t = 6.557$; $p = 0.011$).
5. Patient knowledge significantly influenced MDR-TB occurrence ($t = 5.421$; $p = 0.016$).
6. All five variables simultaneously and significantly influenced MDR-TB occurrence ($F = 5.150$; $p = 0.003$).

5.2. Suggestions

1. Healthcare workers at Langara Health Center should intensify active health promotion, particularly through community education on medication regularity, recognition and management of OAT side effects, risk of TB contact transmission, motivation enhancement strategies, and improving TB-related knowledge.
2. Systematic contact tracing programs should be implemented for all household and close contacts of MDR-TB patients to identify at-risk individuals and initiate early preventive or therapeutic interventions.
3. Future researchers are encouraged to explore additional variables influencing MDR-TB occurrence — such as nutritional status, comorbidities, and treatment supervision quality — using larger and more diverse samples.

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