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Effectiveness of Drug Supervisors in Increasing Tuberculosis Prevention Actions and Consumption of Tuberculosis Drugs

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Abstract

National tuberculosis control continues to be carried out by intensification, acceleration, extensification and program innovation. One of the efforts with an effective Directly observed treatment shortcourse (DOTS) strategy. The main focus of this strategy is the discovery and cure of patients and breaking the chain of Tuberculosis transmission so as to reduce the incidence and increase Tuberculosis cure in the community. This research aimed to assess the efficacy of Drug Supervisors in reducing transmission and ensuring adherence to Tuberculosis medication throughout treatment. The study used a quasi-experimental design using a pre-posttest framework, comprising an intervention group of 14 participants and a control group of 14 participants. The group of subjects was observed before the intervention, namely direct supervision of taking medication (PMO) through the DOTS strategy by family/relatives/caregivers/officers on TB patients during the treatment period and observed again after the intervention. The sample was selected based on sub-district sample clusters using proportional allocation techniques. Bivariate analysis applied independent t test and mann whitney test (value $\alpha = 0.05$) because the distribution of the data obtained was not normal. This research revealed that patients receiving intervention in the form of drug monitoring by PMO experienced an increase in TB transmission prevention measures higher than the control group, thus compliance in taking medication was higher in the case group compared to the control group (p 0.01). This indicates that a PMO is essential for every patient receiving Tuberculosis therapy to prevent lack of follow-up and mitigate the influence on the onset of TB-MDR.

Keywords: Drug Supervisor (PMO), Tuberculosis Drug Consumption, Tuberculosis Prevention.

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1. INTRODUCTION

WHO Global Tuberculosis (TB) Report estimated 10 million people in the world have tuberculosis (TB) (Kementerian Kesehatan Republik Indonesia, 2021; Kementerian Kesehatan Republik Indonesia, 2022; WHO, 2021). Even during the coronavirus (COVID-19) pandemic, TB is still the leading cause of death from the single highest infectious agent above HIV/AIDS. New cases of tuberculosis reached 6.4 million, equivalent to 64% of tuberculosis incidences (Ashari, Muslimin, & Malongi., 2020). In 2020, the worldwide mortality due to tuberculosis (TB) reached 1.5 million, exceeding the fatalities attributed to HIV/AIDS (0.68 million) by more than twofold (Dirjen P2P Kemenkes RI, 2020; Kementerian Kesehatan Republik Indonesia, 2022), and TB deaths have been more severely affected by the COVID-19 pandemic in 2020 than HIV/AIDS (Astuti, Djajakusumah, & Ibnusantosa, 2020; Herawati, 2021; WHO, 2021).

TB is a disease caused by the Mycobacterium tuberculosis bacteria which is transmitted through the air, namely through droplets containing TB bacteria which are splashed into the air when the sufferer talks or sneezes or coughs, and are eventually inhaled by healthy people around the sufferer (Kementerian Kesehatan Republik Indonesia, 2024). The risk of TB transmission depends on the body's resistance and the number of germs in the room, where the number of germs in the room is also influenced by environmental conditions such as air humidity, ventilation area and also room density (Wanti et al., 2022). Apart from the influence of environmental conditions, the incidence of tuberculosis is also related to knowledge, preventive behavior and smoking behavior (Wanti et al., 2023). The environmental circumstances and preventative measures in Indonesia remain inadequate, leading to a heightened risk of tuberculosis transmission in the country.

Indonesia is one of the countries with the highest TB burden in the world with an estimated number of people falling ill with TB reaching 845,000 with a mortality rate of 98,000 or equivalent to 11 deaths per hour (Kementerian Kesehatan Republik Indonesia, 2022; WHO, 2021). Of these cases, only 67% were found, so there are as many as 283,000 TB patients who have not been treated and are at risk of becoming a source of transmission for those around them and can increase the number of cases (Kementerian Kesehatan Republik Indonesia, 2022; WHO, 2021).

The prevalence of TB sufferers in each region varies in Indonesia. Data from the Ministry of Health for TB cases in East Nusa Tenggara Province reached 138 per 100,000 population. Meanwhile, TB treatment coverage data (Treatment Coverage) only 28%, still far from the national target of 80%. Similarly, the success coverage of Drug-resistant TB Treatment is only 25% of the national TSR target of 75%. Ende Regency, East Nusa Tenggara Province, the number of TB cases in 2021 of 259 cases has increased since the last 2 years from 217 cases in 2020 and 156 cases in 2019 (Dinkes Kabupaten Ende, 2020; Dinas Kabupaten Ende, 2022).

The objective of the National TB Control Program is for Indonesia to achieve a tuberculosis-free status by 2050. In the stage of achieving this target, it is expected that in 2025 there will be a decrease in TB morbidity by 50% and a decrease in mortality due to TB by 70%. This encourages national tuberculosis control to continue to be carried out by intensification, acceleration, extensification and program innovation. One of the government's efforts is to issue a National Tuberculosis Program Policy which is currently contained in PMK RI No.67 of 2016 concerning TB control with an annex to TB control guidelines in 2016 (Dirjen P2P Kemenkes RI, 2020; Inayah & Wahyuno, 2019; Herawati, 2021).

The implementation of the policy includes the implementation of the DOTS strategy (Directly Observe Treatment Short Course). It is hoped that with an effective DOTS strategy in the future, national indicators can be achieved. The main focus of this strategy is the discovery and cure of patients and breaking the chain of TB transmission so as to reduce the incidence of TB in the community (Astuti, Djajakusumah, & Ibnusantosa, 2020; Inayah &

Wahyuno, 2019). Direct monitoring of medication (PMO) and effective monitoring and reporting can prevent chain of transmission and reduce morbidity Many unsuccessful treatment of TB patients is due to lack of monitoring and supervision of taking medication and adherence of patients to taking drugs (De Fretes, Mangma & Dese, 2021; Handayani et al., 2021).

However, seeing the still high number of cases of TB patients in Ende Regency and the awareness of patients about preventive behavior and the importance of TB treatment that is not optimal. Therefore, our research is here to answer these challenges by analyzing the DOTS (Directly Observe Treatment Short Course) strategy through monitoring drug taking (PMO) TB patients (Handayani et al., 2021; Pertiwi & Herbawani, 2021). The aim was to determine the effectiveness of Drug Taking Supervision (PMO) TB patients in Ende Regency, East Nusa Tenggara Province. The study has been conducted to find a pattern of DOTS strategies that are most effective and in accordance with the cultural habits of local people.

2. RESEARCH METHOD

The type of research used was quasi-experimental with a pre-posttest group design with an intervention group of 14 respondents and a control group of 14 respondents. The group of subjects was observed before the intervention, namely direct supervision of taking medication (PMO) through the DOTS strategy by family/relatives/caregivers/officers on TB patients during the treatment period and observed again after the intervention. The sampling method used cluster random sampling and distributed based on sub-district sample clusters using proportional allocation techniques. Medication adherence rates in pulmonary TB patients were measured by the MMAS-8 questionnaire (The Morisky Medication Adherence Scale). Twenty-eight patients with pulmonary TB were aged between 25-62 years. The selected respondents were patients diagnosed with Pulmonary TB disease who underwent treatment in accordance with inclusion criteria. The measuring instruments used are instruments on preventive measures for tuberculosis transmission and questionnaires on medication adherence during tuberculosis treatment. Bivariate analysis used the independent t-test and Mann-Whitney test (α = 0.05) due to the non-normal distribution of the acquired data. This research has also received ethical approval from the Section of the Research Ethics Committee of Poltekkes Kemenkes Kupang No.LB.02.03/1/0114/2023 dated February 1, 2023.

3. RESULTS AND DISCUSSION

Tuberculosis is an infectious disease found in all provinces in Indonesia. The national target for TB detection coverage in 2023 is 77.5%, but only 11 provinces have a case detection rate higher than the target, and NTT Province is one of the regions whose case detection rate is below the national target in 2023, which is only 52.6% (Kementerian Kesehatan Republik Indonesia, 2024).

The number of TB case detections has increased from 2020 to 2023, namely from 41.7 in 2020 to 77.5 in 2023, but there are still many provinces with low TB case detection coverage (Kementerian Kesehatan Republik Indonesia, 2024). This shows that there are still many TB cases that have not been discovered and have not been given TB treatment by health workers, thus possibly causing a high risk of TB transmission in the community.

Table 1. Distribution of Characteristics of Tuberculosis Patients in the Treatment Group and Control Group

Variable	Category	Intervention Group		Control Group	
		N	%	N	%
Gender	Male	9	64.3	10	71.4
	Female	5	35.7	4	28.6
Marital status	Married	6	42.8	5	35.7
	Single	8	57.1	9	64.3

Variable	Category	Intervention Group		Control Group	
		N	%	N	%
Level of education	High school/equivalent	10	71.4	11	78.6
	University/Higher education	4	28.6	3	21.4
Occupation	Civil servants/army /police	0	0	1	7.1
	Private employees	2	14.3	2	14.3
	Farmers/Fishermen	1	7.1	4	28.7
	Honorary	2	14.3	1	7.1
	Self-employed	5	35.7	5	35.7
	Not working	4	28.6	1	7.1
Total		14	100	14	100

This research was conducted in 28 respondents of Tuberculosis patient consist of 14 people with intervention and 14 people without intervention, as seen in Table 1. Table 1 shows the characteristics of the intervention group (a group of TB patients undergoing treatment and being assisted by PMO) and the group without intervention, namely TB patients undergoing treatment and not being assisted by PMO. Furthermore, Table 1 indicates that tuberculosis cases mostly occur among males and also in the unmarried population. The national TB statistics for 2023 indicates that TB cases are mostly found in males, comprising 57.9%, while women account for just 42.1% (Kementerian Kesehatan Republik Indonesia, 2024).

Apart from TB cases being more common in men, previous research found that 62% of cases missing from observation were male (Muthiah et al., 2019). Due to the large number of Research in Southeast Sulawesi revealed that multidrug-resistant tuberculosis (MDR TB) infections were more prevalent in males than in women, and there was also a significant incidence of recurrent pulmonary tuberculosis among men (Aini & Rufia, 2019; Bayan et al., 2022; Fitria et al., 2017). This is different from the conditions in Bandung City, where cases of Tuberculosis in 2021 were more in women, namely 52% (Zulfa & Prihartono, 2023).

Likewise, a study in Portugal and Jambi City also found that TB cases were high in men, namely 68.5% in Portugal and 57.1% in Jambi City respectively (Marçôa et al., 2018; Sari, Haflin, & Rahmaniyah, 2020). Research on suspected TB patients who came to the Hospital Laboratory in Kupang City also found that of the 47 patients who tested positive for AFB, 61% were male (Wuan et al., 2020). This is explained because men have more risky behavior than women. The dominance of TB cases in men due to comorbidities and behavioral risk factors in men is also higher. The level of alcohol consumption is higher in men than in women in all age groups. Lung cancer and Chronic Obstructive Pulmonary Disease (COPD) are more common in men. Smoking is the most important risk factor for COPD and lung cancer and is also associated with pulmonary TB. In general, men smoke more than women. As a result, smoking is a greater contributor to the burden of TB disease for men (Marçôa et al., 2018).

The effect of smoking on TB has been found to have a relative risk (RR) of 2.3 – 2.7 higher in the smoking group compared to the non-smoking group (Narasimhan et al., 2013). Alcohol is well known to be a strong risk factor for TB disease. A systematic review of 18 case-control studies and 3 cohort studies concluded that the risk of developing active TB infection was substantially increased among people who drank more than 40 g of alcohol per day (RR = 2.94, 95% CI = 1.89–4.59). Smoking rates are high among men in TB endemic countries including Indonesia, and this also results in an increased risk of developing TB disease. The increased risk was due, among other things, to changes in the immune system, particularly in altering signaling molecules responsible for cytokine production (Peer, Schwartz, & Green, 2023). In terms of clean and healthy living behavior, habits such as washing hands after

activities, wearing masks, and other transmission prevention behaviors are less common in men than in women.

Most of TB cases in this study found in the unmarried group, but the percentage of TB patients who were lost from surveillance was high among those who were married (68%) (Muthiah et al., 2019). Based on education, this study found that TB cases are mostly found in people with high school education, which is different from previous research that found TB cases were mostly found in people with elementary school education (Ismah, & Novita, 2017).

Meanwhile, based on work, in Ende City, it was found that most of the TB sufferers were self-employed and the least were civil servants/police/soldiers. This condition is different from research in Bandung and in Jambi which found that TB cases were mostly found in housewives (Sari, Haflin, & Rahmaniyah, 2020; Zulfa & Prihartono, 2023). Tuberculosis disease occurs mainly due to many factors, including individual characteristics, immunity, environmental factors and behavior, so that each location with different characteristics of each factor will cause different risk factors in the occurrence of TB.

Although the types of work of TB sufferers vary in each location, most TB cases are in informal sector workers, including housewives, self-employed people, taxi driving, waste picking, street vending, etc. Informal work is work that takes place outside the formal norms established by the state. Informal workers are workers in the informal sector whose employment relationship, in law or practice, is not subject to national labor law, income tax, social protection or the right to certain employment benefits. Workers in the informal sector do not have the opportunity for work that provides a fair income, which is commensurate with their productivity. Inequities also occur in terms of workplace security and social protection, and prospects for personal development and social integration are not better (ILO, 2021). Access and coverage of health services for informal workers, especially occupational health services, are still very lacking, resulting in poor health outcomes for informal sector workers. The nature and location of work, and income below the minimum wage are usually barriers to accessing health information and care services, both TB-specific services and general health services (ILO, 2021).

Table 2. Distribution of respondents in intervention and control group.

Variable	Mean	Median	SD	Min-Max
Intervention Group				
Age	37.94	35.00	15.062	15-76
TB Prevention Practices	45.80	42.00	6.428	33-68
Adherence to taking medication	94.00	92.00	15.246	61-128
Control Group				
Age	42.05	41.00	15.062	37-55
Prevention Practices	47.20	44.80	6.428	35-62
herence to taking medication	96.00	94.00	15.246	61-128

Table 2 shows respondents based on age, prevention practices and medication adherence during TB treatment. The average age in the treatment group was 37.94 years, while in the untreated group, it was 42.05 years. This study found that TB sufferers were mostly found in the productive age group; this is the same as TB data in Indonesia in 2020, where most TB was found in the 45-54 year age group (Kementerian Kesehatan Republik Indonesia, 2021) and also TB data in Bandung in 2021, which found 56% of TB cases in the 18-40 year age group (Zulfa & Prihartono, 2023). It was further discovered in Southeast Sulawesi that MDR TB cases were also often found in productive age groups, namely 15-55 years (Aini & Rufia, 2019).

The productive age group has more mobility either due to work demands or other activities. The more they meet and gather with many people, the higher the risk of contracting TB germs. The large number of TB cases in this productive age group has an impact on decreasing the working days and work productivity of this group and has a direct impact on family income (Zulfa & Prihartono, 2023), because men are usually the ones who are

economically responsible in the family, especially for sufferers who work in the private sector, self-employed, farmers and other informal workers because if they do not work then they will not receive income according to the number of working days lost.

Table 3 shows changes in TB transmission prevention measures in the intervention group and control group. During treatment, not all TB patients were supervised by supervisors to complete their medication intake, so in this study, interventions were given to the intervention group in the form of TB transmission education, supervision and assistance during TB treatment. The PMOs were researchers, enumerators and health workers who had been agreed upon since the beginning of treatment. The PMO's task here was to provide education on TB transmission prevention at the beginning of treatment and every month when taking medication to the health center, and monthly home visits were made to the intervention group. Every month, an evaluation was also carried out on actions to prevent TB transmission and in taking medication in both the control and treatment groups, and after 6 months of assistance, there were changes in practices of TB transmission prevention, as shown in Table 3.

Table 3. The Statistic Result of the Tuberculosis Transmission Prevention Practices in The Intervention and Control Group (n = 28).

Group	**n**	***mean(±SD)* TB Transmission Prevention Practices**		***MD***	***p-value***
		Pre	**Post**		
Intervention	14	45.8(±8.71)	52.4(±8.64)	6.60[a]	0.01
Control	14	47.2(±7.79)	49.5(±9.16)	2.33[b]	0.03

**If the superscript in the MD column is different, the test results will have different meanings.* ($p<0.05$).

Tuberculosis prevention practices before the intervention was given to the intervention group were lower than TB prevention practices in the group that was not given intervention. However, after the intervention was given routinely every month for 6 months, there was a change in TB prevention practices in the intervention group and the change was positive and statistically significant.

Tuberculosis prevention behaviors include wearing masks, washing hands frequently, not throwing phlegm carelessly and also not sharing toiletries and clothes, and routinely drying mattresses and pillows used by TB sufferers. In addition, the placement of TB sufferers' bedrooms allows ultraviolet rays from the sun to enter the room directly so that they can kill TB germs in the room. Changing behavior itself is not easy, because there are several things that can influence this behavior, namely cultural factors and the behavior of their families (Gunawan et al., 2022).

Drug supervisor (PMO) helps not only positively influences the enhancement of TB transmission prevention behavior but also significantly improves TB medicine consumption behavior compared to the control group, as seen in Table 4. This aligns with other studies indicating that positive conduct in tuberculosis patients correlates with their medication adherence (Batbual et al., 2021).

Table 4. The Statistic Result of TB Drug Consumption Practices in the Intervention and Control Groups (n=28).

Group	**n**	**Adherence to taking medication**		***p-value***
		mean	***SD***	
Intervention	14	96.2	±7.39	0.01
Control	14	87.8	±8.28	

Table 4 shows that there was a change in the practice of taking TB medication, where the average was better in the intervention group compared to the non-intervention group, and this was statistically significant with p = 0.01. This study is the same as previous studies that with the presence of PMO, it increases the chances of successful TB treatment because patients become better at taking TB medication. The presence of PMO also minimizes the number of patients who drop out of medication which can have an impact on the emergence of MDR-TB or resistance to TB drugs (Pertiwi & Herbawani, 2021).

Considering the importance of the role of PMO in TB treatment, it is necessary to provide education and training first for the PMO before carrying out their duties, because without good knowledge support from the PMO, the PMO will not be able to carry out their duties as PMO properly (De Fretes, Mangma & Dese, 2021). If the PMO is not equipped with knowledge and skills as a PMO in advance, it is still possible for TB treatment to fail even though they are accompanied by a PMO. This was also proven in a study in Bandung where 88% of TB patients who were lost to follow up had a PMO (Muthiah et al., 2019). This could happen because the patient may have high mobility so that it is difficult to follow the existing treatment schedule, or the PMO does not work well because the PMO may have less knowledge and understanding of TB treatment. This study found that with the presence of a PMO, the actions of TB patients changed for the better in preventing TB transmission and in taking TB drugs, so it is hoped that with this PMO it can reduce lost of follow-up and also reduce the number of treatment failures including reducing the occurrence of TB-MDT. The role of the PMO during taking TB drugs includes educating and assisting TB patients who are undergoing treatment, namely ensuring that the amount of medicine is taken according to the dose and time determined by health workers, and taking medicine to the health center as agreed with health workers, and always taking actions to prevent TB transmission. The PMO must work with the family and existing health workers, because compliance in taking medication has many factors including knowledge of patients and the community regarding TB, and also family support (Dewi, 2021). Based on research conducted by Yanti et al., (2024), TB treatment success with PMO can reach 88-90%. It is better if PMO is community or family based, that is, PMO can be from family members or from community members, because this can provide flexibility for patients and PMOs involved, especially in areas with limited health workers.

4. CONCLUSION

This research revealed that patients receiving TB therapy had enhanced engagement in reducing Tuberculosis spread and adherence to TB medication. This indicates that a PMO is essential for every patient receiving Tuberculosis therapy to prevent lack of follow-up and mitigate the influence on the onset of TB-MDR.

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