

The influence of treatment compliance, family support on the occurrence of positive Acid-Fast Bacilli (BTA) conversion in pulmonary TB patients

Irwan^{1*)}, Deliyana I. katili², Nadirah Rasyid Ridha³

^{1*)} Department of Public Health, Universitas Negeri Gorontalo, Gorontalo, Indonesia

²Puskesmas Kabila, Bone Bolango, Indonesia

³Faculty of Medicine, Hasanuddin University, Makassar, Indonesia

ABSTRACT

Pulmonary Tuberculosis is an infectious disease caused by the germ *Mycobacterium tuberculosis*, which is one of the diseases of the 10 causes of death in the world. Treatment of Pulmonary Tuberculosis is given in two stages: the initial (intensive) and advanced. BTA conversion at the end of intensive phase treatment is one of the indicators to see the progress of TB treatment. Low conversion can harm public health and the achievement of TB control and eradication programs. This study aims to determine the factors related to the conversion of a positive acid-resistant bacillus (BTA) in Pulmonary TB patients in the Tilango Health Center Working Area, Gorontalo Regency. Analytical type of observational research with a cross-sectional approach. The total sample of 22 respondents is patients still undergoing treatment for at least 2 months at the Tilango Health Center. The results showed a relationship between treatment compliance ($p=0.031$) and Pulmonary TB Positive BTA Conversion. At the same time, family support ($p=1,000$) and health worker encouragement ($p=1,000$) were not present with Pulmonary TB Positive BTA Conversion, and the most related factor was treatment compliance ($OR=0.079$). The conclusion is that there is a relationship between treatment compliance and positive BTA conversion of Pulmonary TB patients.

Keywords: Pulmonary Tuberculosis, Pulmonary TB Positive BTA Conversion, *Mycobacterium tuberculosis*

ABSTRAK

TBC paru merupakan penyakit infeksi yang disebabkan oleh kuman *Mycobacterium tuberculosis*, yang merupakan salah satu penyakit dari 10 penyebab kematian di dunia. Pengobatan Tuberkulosis Paru diberikan dalam dua tahap: awal (intensif) dan lanjut. Konversi BTA pada akhir pengobatan fase intensif merupakan salah satu indikator untuk melihat kemajuan pengobatan TB. Konversi yang rendah dapat membahayakan kesehatan masyarakat dan pencapaian program pengendalian dan pemberantasan TB. Penelitian ini bertujuan untuk mengetahui faktor-faktor yang berkaitan dengan konversi basil tahan asam positif (BTA) pada pasien TB Paru di Wilayah Kerja Puskesmas Tilango Kabupaten Gorontalo. Jenis penelitian observasional analitis dengan pendekatan cross-sectional. Total sampel 22 responden adalah pasien yang masih menjalani pengobatan minimal 2 bulan di Puskesmas Tilango. Hasil penelitian menunjukkan adanya hubungan antara kepatuhan pengobatan ($p=0,031$) dengan Konversi BTA TB Paru Positif. Pada saat yang sama, dukungan keluarga ($p = 1.000$) dan dorongan tenaga kesehatan ($p = 1.000$) tidak hadir dengan Konversi BTA TB Paru Positif, dan faktor yang paling terkait adalah kepatuhan pengobatan ($OR=0,079$). Kesimpulannya adalah bahwa ada hubungan antara kepatuhan pengobatan dan konversi BTA positif pasien TB Paru.

Kata kunci: TBC Paru, Konversi BTA Positif TB Paru, *Mycobacterium tuberculosis*

Corresponding author: Irwan

Department of Public Health, Universitas Negeri Gorontalo, Gorontalo, Indonesia

Email: irwan@ung.ac.id

INTRODUCTION

Sustainable Development Goals (SDGs) are sustainable development for 2030 with one of the goals of ending the tuberculosis epidemic globally with the target for 2030 being a 90% reduction in the number of tuberculosis deaths and an 80% reduction in the incidence rate of tuberculosis compared to the level in 2015. The achievement indicators for 2020 are a 35% reduction in the number of deaths from tuberculosis and a 20% decrease in the incidence rate of tuberculosis. The strategy also includes an indicator of 2020 achievements that no tuberculosis patients and their households face catastrophic costs due to tuberculosis (Suarnianti et al., 2021).

The National Target of the National Medium-Term Development Plan (RPJMN) contained in Presidential Regulation Number 59 of 2017 concerning the SDGs sets the target of tuberculosis prevalence in 2019 to 245 per 100,000 population (Rita et al., 2021). Meanwhile, Permenkes Number 67 of 2016, concerning the management of tuberculosis, sets the target of the national tuberculosis prevention program, namely elimination in 2035 and Tuberculosis-Free Indonesia in 2050 (Sibua & Watung, 2021).

Tuberculosis is still a significant health problem globally. Tuberculosis causes about 10 million people to get sick yearly and is the world's top ten cause of death. Over the past 5 years, tuberculosis has become the most infectious disease and the cause of death (Mahendrani et al., 2020).

According to the World Health Organization in the Global Tuberculosis Report 2019, in 2018, there were an estimated 10 million cases of pulmonary Tuberculosis worldwide, of which 5.7 million were men, 3.2 million were women, and 1.1 million were children, and the tuberculosis sufferers, 9% of them were HIV sufferers. In the same year, 1.5 million people died of Tuberculosis, of which 251,000 were people with HIV. The eight countries that account for 64% of the world's new cases of Tuberculosis are India, China, Indonesia, the Philippines, Pakistan, Nigeria, Bangladesh, and South Africa (WHO, 2019).

Every year the number of tuberculosis cases in Indonesia increases. In 2018 the number of new cases of tuberculosis found in Indonesia was 566,623. This number is increasing compared to all tuberculosis cases seen in 2017, as many as 446,732 cases, and in 2016 which was 351,893 cases. Berdasarkan hasil laporan Data dan Informasi Kementerian Kesehatan tahun 2018, jumlah kasus tertinggi terdapat di Provinsi DKI Jakarta (34,4%), Sulawesi Utara (22,8%), Papua (22,5%), Kepulauan Riau (19,2%) dan Kalimantan Utara (18%). Persentase kasus tuberkulosis di lima provinsi tersebut sebesar 63% dari jumlah seluruh kasus baru di Indonesia (Susanti & Sunarto, 2012).

One of the indicators used to monitor and assess the treatment of pulmonary tuberculosis is achieving a conversion rate of at least 80% in the initial (intensive) phase, especially for new patients. The conversion rate is the percentage of Positive BTA Pulmonary Tuberculosis patients who have changed to a Negative BTA after undergoing a 2-month intensive treatment. Low conversion can hurt public health and the achievement of tuberculosis control and eradication programs. This is due to positive BTA pulmonary tuberculosis patients who experience conversion failure, at risk of transmitting BTA Positive Pulmonary Tuberculosis germs to others (Ziliwu & Girsang, 2022) (Shofiya & Sari, 2016).

The conversion of sputum from positive to negative is the most important thing about the efficacy of tuberculosis treatment. The delay in conversion/failure time after 2 months of treatment indicates a poor treatment response that will contribute to cases of being immune to tuberculosis drugs or Multidrug Resistant Tuberculosis (MDR) and may increase the likelihood that the patient will continue to increase the spread of tuberculosis disease, increase pain and even death (Wijayanti et al., 2023)(Adane et al., 2018).

RESEARCH METHOD

This research has been carried out in the Tilango Health Center Working Area, Gorontalo Regency. The time of the study was carried out in March-April 2022. This type of research is analytical and observational with a cross-sectional design. The sampling technique in this study was total sampling. The population in this study was all patients who underwent treatment for at least 2 months at the Tilango Health Center, Gorontalo Regency, which amounted to 22 people with a total sample of the entire population.

RESULTS AND DISCUSSION

Table 1. Analysis of the Relationship between Treatment Compliance and Pulmonary TB Positive BTA Conversion in the Tilango Health Center Work Area, Gorontalo Regency

Treatment Compliance	Pulmonary TB Positive BTA Conversion				Total		p- value	OR
	No Conversion		Conversion		n			
	n	%	n	%				
Good	5	22.7	9	40.9	14	63.6	0,031	0,079
Not Good Enough	7	31.8	1	4.5	8	36.4		
Total	12	54.5	10	45.5	22	100		

Source: Primary Data, 2022

Table 1 shows that the most Pulmonary TB Positive BTA Conversion in non-convertible patients is compliance with treatment in the poor category, namely 7 people (31.8%), and the least is compliance with treatment with the excellent type, which is 5 people (22.1%). Meanwhile, the most converted patients were adherence to therapy with the outstanding category, namely 9 people (40.9%), and the least was compliance with treatment with the wrong type, namely 1 person (4.5%).

Based on the results of the hypothesis test using the fisher exact test between treatment compliance and Lung TB Positive BTA Conversion obtained $p\text{-value} = 0.031 < \alpha (0.05)$, it can be concluded that there is a relationship between treatment compliance and Pulmonary TB Positive BTA Conversion.

Based on the Calculation of the Risk Estimate obtained $OR = 0.079$, the relationship of compliance with treatment is not good, with the Positive BTA Conversion of Pulmonary TB being strong. This shows that poor adherence to treatment influences positive BTA conversion in patients with pulmonary TB.

Table 2. Analysis of the Relationship between Family Support/PMO and Pulmonary TB Positive BTA Conversion in the Tilango Health Center Working Area, Gorontalo Regency in 2022

Family Support/PMO	Pulmonary TB Positive BTA Conversion				Total		p-value
	No Conversion		Conversion				
	n	%	n	%	n	%	
Good	11	50.0	9	40.9	20	90.9	1,000
Not Good Enough	1	4.5	1	4.5	2	9.1	
Total	12	54.5	10	45.5	22	100	

Source: Primary Data, 2022

Table 2 shows that Pulmonary TB Positive BTA Conversion in non-convertible patients is the most family support/PMO with a suitable category of 11 people (50.0%), and the least is family support/PMO with a lousy sort of 1 person (4.5%). Meanwhile, the most converted sufferers were family support/PMO, with a suitable category of 9 people (40.9%), and the least was family support/PMO, with a wrong type of 1 person (4.5%).

Based on the hypothesis test results using the fisher exact test between family support and Pulmonary TB Positive BTA Conversion obtained $p\text{-value} = 1,000 > \alpha (0.05)$, it can be concluded that there is no relationship between family support/PMO and Pulmonary TB Positive BTA Conversion.

Table 3. Analysis of the Relationship between The Encouragement of Health Workers and the Conversion of Pulmonary TB Positive BTA

Health Workers' Encouragement	Pulmonary TB Positive BTA Conversion				Total		<i>p-value</i>
	No Conversion		Conversion				
	n	%	n	%	n	%	
Good	11	50.0	10	45.5	21	95.5	1.000
Not Good Enough	1	4.5	0	0.0	1	4.5	
Total	12	54.5	10	45.5	22	100.0	

Source: Primary Data, 2022

Based on table 3 shows that the most Pulmonary TB Positive BTA conversion in non-convertible patients is the encouragement of health workers with a suitable category of 11 people (50.0%), and the least is the encouragement of health workers with a less appropriate type of 1 person (4.5%). Meanwhile, the most converted patients were the encouragement of health workers, with a proper category of 10 people (45.5%), and the least was family support/PMO, with a poor sort of 0 (0.0%).

Based on the results of the hypothesis test using the fisher exact test between the encouragement of health workers and the Pulmonary TB Positive BTA Conversion obtained a $p\text{-value} = 1,000 > \alpha (0.05)$, it can be concluded that there is no relationship between the encouragement of health workers and the Conversion of Positive BTA of Pulmonary TB.

DISCUSSION

Relationship of Treatment Compliance with Positive BTA Conversion of Pulmonary TB Patients

From the results of the study, it was found that the most Pulmonary TB Positive BTA Conversion in patients who did not convert complied with treatment in the poor category, namely 7 people (31.8%), while the least complied with treatment with the ideal type, namely 5 people (22.7%).

From the results of the hypothesis test using the fisher exact test between treatment compliance with the Pulmonary TB Positive BTA Conversion obtained a $p\text{-value} = 0.031 < \alpha (0.05)$, it can be concluded that there is a relationship between treatment compliance and Pulmonary TB Positive BTA Conversion.

This study's results align with Hadifah et al. (2019), which shows a significant relationship between the regularity of ingesting OAT in TB patients and the failure of BTA conversion (Hadifah et al., 2019).

The non-compliance of TB patients to swallow OAT completely is influenced by several causes, including oat side effects (decreased appetite), long-term consumption of OAT to provide psychological pressure for patients, and TB sufferers who feel cured or disappear symptoms within 1-2 months after treatment so that patients are lazy to continue treatment (Pameswari et al., 2016).

Souza et al. (2018) stated that the prevention of Pulmonary TB transmission is due to the regularity of good treatment. Treatment adherence is essential to maintain the treatment program's effectiveness, which is the "cornerstone" for reducing TB transmission. Irregular drug consumption can be high in effect against failures in treatment (D'Souza et al., 2018).

This is to the theory proposed by Murtantiningsih & Wahyono (2010), which states that currently, all sufferers theoretically must be cured, as long as the person concerned is diligent in seeking treatment until it is declared complete, except if, from the beginning, the Tuberculosis bacillus faced is resistant to various tuberculosis that is commonly used. This is easy to understand because if the patient does not diligently take medicine, the final result is a failure to cure coupled with the onset of multiresistant TB bacillus. In general, treatment failure is caused by too harsh treatment, rough treatment, and poor combination of drugs (Murtantiningsih & Wahyono, 2010).

Based on the results of statistical analysis, 14 patients were treated obediently (63.6%), but only 10 people who converted patients (36.4%). This is because the sample is too small, and according to research (Sari et al., 2022), treatment adherence is not the only variable that causes positive BTA conversion. There are other factors, such as the nutritional status of the sufferer. This is supported by (Mahendrani et al., 2020), which states that TB sufferers with less nutritional status will experience metabolic changes in the body, such as catabolism to activate the work of the immune system so that anabolism occurs where amino acids cannot be built into a more complex protein arrangement so that the body lacks the energy that takes up fat stores in the body which has an impact on cells and tissues. There is a decrease in the hormone leptin in the blood, so the patient's appetite decreases and causes TB sufferers to fail to convert.

Based on interviews with respondents, 7 people (31.8%) were not good at compliance with treatment. The most common thing sufferers do is not to take medicine after feeling side effects such as nausea, vomiting, and heartburn, and not always following the instructions and recommendations of health workers in treatment. This happens because the patient already feels milder after running the therapy for 2 months. Usually, at this time, the symptoms have begun to disappear, and the sufferer feels better. This non-compliance also affects not only the sufferer and his family but also on the community due to increased drug resistance.

Relationship of Positive BTA Conversion of Pulmonary TB Patients with Family Support/PMO

From the study results, it was found that the conversion of Pulmonary TB Positive BTA in non-convertible patients was the most family support/PMO with a suitable category of 11 people (50.0%). At the same time, the least was family support/PMO, with a lousy sort of 1 person (4.5%).

Based on the hypothesis test results using the fisher exact test between family support and Pulmonary TB Positive BTA Conversion obtained $p\text{-value} = 1,000 > \alpha (0.05)$, it can be concluded that there is no relationship between family support/PMO and Pulmonary TB Positive BTA Conversion.

This research is in line with Murtantiningsih & Wahyono's (2011) cross-sectional approach that shows no relationship between family support/PMO and the incidence of Pulmonary TB Positive BTA Conversion. From statistical tests obtained $p\text{-value values} = 0.073$ and $1.000 (p > 0.05)$ (Murtantiningsih & Wahyono, 2010).

The family or Drug Control (PMO) 's role in implementing the DOTS method is very influential in determining the patient's attitude toward the regularity of treatment. If the supervision of the frequency of treatment is carried out properly and correctly, the frequency and recovery will be higher (Evawaty et al., 2019).

Several studies that support this prove that the role of PMO in the success of treatment is very important because sufferers during a long course of treatment are likely to have a sense of boredom having to take medication every day, so it is feared that there will be a dropout of medicine or forgetting to take medicine because of despair that the disease does not heal. The role of PMO is expected to prevent drug withdrawal because if it occurs for subsequent treatment, it takes longer. The implementation of the role of PMO properly is to ensure perseverance, regularity of treatment, avoiding treatment breaks out before the drug runs out, preventing treatment recovery, and monitoring the consumption of food for people with Pulmonary TB, in this case, protein (Pameswari et al., 2016). This is in line with Napitupulu's research (2020) that the role of PMO in the success of treatment has a close relationship. There is a relationship in line with the better the PMO in carrying out its duties, the more successful in treating pulmonary TB disease will be, and the connection is quite strong. Usually, the PMO is taken from the closest family member (Napitulu, 2020).

Supervision and attention from health workers and trusted family affect the compliance of Pulmonary TB sufferers in undergoing treatment which takes a long time. Although the drug guidelines are good, the treatment results are generally disappointing if the patient does not seek treatment regularly (Putri, 2020).

From the results of the study, as many as 11 people (50.0%) sufferers received family support/PMO with a suitable category. At the same time, 1 person (4.5%) with family support/PMO was not good because a family never replaced the sufferer to take drugs/re-examine sputum if they could not.

Family emotional support /PMO in people with Pulmonary TB is needed because the PMO's job is to encourage patients to want to seek treatment regularly and remind patients to re-examine sputum at the appointed time. With good PMO performance, patients are more motivated to undergo treatment regularly. However, from the results of this study, there is no relationship between family support/PMO and Pulmonary TB Positive BTA Conversion (17,20).

Relationship of Positive BTA Conversion of Pulmonary TB Sufferers with Encouragement of Health Workers

The study results found that the conversion of Pulmonary TB Positive BTA in patients who did not convert the most was the encouragement of health workers with a suitable category, namely 11 people (50.0%). At the same time, the least was the encouragement of health workers with a lousy type, namely 1 person (4.5%).

Based on the results of the hypothesis test using the fisher exact test between the encouragement of health workers and the Positive BTA Conversion of Pulmonary TB obtained a p-value = 1,000 > α (0.05), it can be concluded that there is no relationship between the encouragement of health workers and the Conversion of Positive BTA of Pulmonary TB.

This study's results align with research conducted by Murtantiningsih & Wahyono (2011) with a cross-sectional approach that shows no relationship between the encouragement of health workers and the incidence of Pulmonary TB Positive BTA Conversion. From statistical tests obtained p-values = 0.074 and 1.000 ($p > 0.05$) (Murtantiningsih & Wahyono, 2010).

The encouragement of health workers is another factor that influences the patient's treatment compliance behavior. They can affect the patient's behavior by conveying their enthusiasm for specific actions and continuously giving a positive reward to the patient who has been able to adapt to his treatment program. Elements of health worker performance influence the quality of health services, including health services for tuberculosis patients, which will directly or indirectly affect the regularity of treating patients and ultimately also determines the results of treatment (19).

From the interviews, it is known that health workers always conduct counseling about TB, ask about the condition and progress of treatment of patients, remind patients of the consequences of not taking the medication regularly, recommend taking the medication regularly, and explain the schedule of taking medicine. This is very helpful for the treatment process and motivates regular treatment.

CONCLUSIONS AND SUGGESTIONS

There is a relationship between treatment compliance with the Positive BTA Conversion of Pulmonary TB Patients in the Tilango Health Center Work area, Gorontalo Regency, obtained a p-value = 0.031. So, the factor most related to positive BTA conversion of people with pulmonary TB is adherence to treatment with an OR value = 0.079.

ACKNOWLEDGMENTS

Thank you to the parties who have helped with this research so that this research is carried out well and smoothly.

REFERENCES

- Adane, K., Spigt, M., & Dinant, G.-J. (2018). Tuberculosis Treatment Outcome and Predictors in Northern Ethiopian Prisons: a Five-Year Retrospective Analysis. *BMC Pulmonary Medicine*, 18(1), 37. <https://doi.org/10.1186/s12890-018-0600-1>
- D'Souza, K. A., Zaidi, S. M. A., Jaswal, M., Butt, S., Khowaja, S., Habib, S. S., & Malik, A. A. (2018). Factors Associated With Month 2 Smear Non-Conversion Among Category 1 Tuberculosis Patients in Karachi, Pakistan. *Journal of Infection and Public Health*, 11(2), 283–285. <https://doi.org/10.1016/j.jiph.2017.06.009>
- Evawaty, E., Yunding, J., Irwan, M., & Idawati, I. (2019). Hubungan Peran Pengawas Minum Obat (PMO) Terhadap Kualitas Hidup Pasien TB Paru. *Jurnal Ilmiah Maju*, 2(2), 33–41.
- Hadifah, Z., Subronto, Y. W., & Ikhsan, M. R. (2019). Faktor Risiko Gagal Konversi BTA pada Pasien Tuberkulosis Paru Fase Intensif di Kota Yogyakarta. *Buletin Penelitian Kesehatan*, 47(2), 83–88. <https://doi.org/10.22435/bpk.v47i2.1002>
- Mahendrani, C. R. M., Subkhan, M., Nurida, A., Prahasanti, K., & Levani, Y. (2020). Analisis Faktor yang Berpengaruh Terhadap Konversi Sputum Basil Tahan Asam Pada Penderita Tuberkulosis. *Al-Iqra Medical Journal: Jurnal Berkala Ilmiah Kedokteran*, 3(1), 1–9. <https://doi.org/10.26618/aimj.v3i1.4037>

- Murtantiningih, & Wahyono, B. (2010). Faktor-Faktor Yang Berhubungan Dengan Kesembuhan Penderita Tuberkulosis Paru. *Jurnal Kesehatan Masyarakat*, 6(1), 44–50.
- Napitulu, M. (2020). Hubungan Peran Pengawas Menelan Obat (PMO) dengan Keberhasilan Minum Obat Pasien Tuberkulosis Paru Di Wilayah Kerja Puskesmas Ulak Tano. *Jurnal Komunikasi Kesehatan Masyarakat*, 2(1), 41–47.
- Pameswari, P., Halim, A., & Yustika, L. (2016). The Level of Compliance of Tuberculosis Patients at Mayjen H. A Thalib Kerinci Hospital. *Jurnal Sains Farmasi & Klinis*, 2(2), 116. <https://doi.org/10.29208/jsfk.2016.2.2.60>
- Putri, M. H. (2020). Dukungan Keluarga Sebagai Faktor Penting Dalam Kepatuhan Minum Obat Pada Pasien Tuberkulosis Paru. *Wellness And Healthy Magazine*, 2(1), 127–134. <https://doi.org/10.30604/well.74212020>
- Rita, E., Suryatih, A., Widiastuti, E., & Isro, A. (2021). Penanggulangan Tuberkolosis Pada Masa Pandemi Di Kelurahan Kwitang Dengan Peningkatan Kemampuan Kader. *Jurnal Pengabdian Masyarakat Teknik*, 3(2), 77–82. <https://doi.org/10.24853/jpmt.3.2.77-82>
- Rumimpunu, R., Maramis, F. R. R., & Kolibu, F. K. (2018). Hubungan antara Dukungan Keluarga dan Dorongan Petugas Kesehatan dengan Kepatuhan Berobat Penderita Tuberkulosis Paru di Puskesmas Likupang Kabupaten Minahasa Utara. *Jurnal KESMAS*, 7(4), 1–15.
- Sari, J. D. K., Setyani, F. A., & Suparmi, L. (2022). Faktor-Faktor yang Berhubungan Dengan Konversi BTA di Rumah Sakit Swasta Yogyakarta. *Jurnal Kesehatan Masyarakat*, 15(1), 19–26.
- Shofiya, S., & Sari, N. (2016). Hubungan Dukungan PMO dan Keteraturan Minum Obat dengan Kegagalan Konversi TB Paru. *Jurnal Keperawatan Muhammadiyah*, 1(2), 1–10.
- Sibua, S., & Watung, G. I. V. (2021). Hubungan Dukungan Keluarga dengan Kepatuhan Berobat Penderita Tuberkulosis di Kabupaten Bolaang Mongondow Timur. *Aksara: Jurnal Ilmu Pendidikan Nonformal*, 7(3), 1443–1450. <https://doi.org/10.37905/aksara.7.3.1443-1450.2021>
- Suarnianti, S., Selan, C. H., & Sumi, S. S. (2021). Literature Review : Evaluasi Peer Group Support dan Family Support Terhadap Kepatuhan Pengobatan Pada Pasien Tuberkulosis Paru. *2-TRIK: TUNAS-TUNAS Riset Kesehatan*, 11(1), 51. <https://doi.org/10.33846/2trik11111>
- Susanti, A. V., & Sunarto. (2012). Faktor Risiko Kejadian Menarche Dini Pada Remaja Di SMP N 30 Semarang. *Journal of Nutrition*, 1(1), 115–126.
- WHO. (2019). *Global Tuberculosis Report*. WHO.
- Wijayanti, W., Pamangin, L. O. M., & Wopari, B. (2023). Hubungan Dukungan Keluarga Sebagai Pengawas Menelan Obat (PMO) Dengan Kepatuhan Minum Obat Pasien Tuberkulosis. *Journal Health & Science: Gorontalo Journal Health and Science Community*, 7(2), 240–251. <https://doi.org/10.35971/gojhes.v7i2.19024>
- Ziliwu, J. B. P., & Girsang, E. (2022). The Relationship Of Knowledge And Attitudes Towards Medication Adherence In Tuberculosis Patients In Medan Pulmonary Specialty Hospital. *Jambura Journal of Health Sciences and Research*, 4(3), 999–1006. <https://doi.org/10.35971/jjhsr.v4i3.16540>