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Impact of Instrumental Support from Family on Medication Adherence among Tuberculosis Patients

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Abstract

Instrumental support is concrete and tangible, for instance, helping in providing food or accompanying patients to health care facilities. Its impact on medication adherence among tuberculosis (TB) patients in Indonesia needs to be explored. This study aimed to examine the instrumental support impact from family on TB patients' adherence to medication in Bogor City, West Java Province, Indonesia. A cross-sectional study involving 106 participants with an age average of 39.7 was conducted in 12 primary health cares (PHCs). The independent variables (age, sex, education, employment status, wealth index, and the distance between home and PHC) of instrumental support from family were assessed using MMAS-8. The dependent variable of medication adherence was assessed using a self-reported instrument. Multivariate binary logistic regression was used in the analysis and indicated that participants receiving family support were more likely to adhere to medication protocol (95% CI = 1.1–6.3; p-value = 0.029). Instrumental support from family was associated with medication adherence among tuberculosis patients in Bogor City, West Java Province, Indonesia. It is necessary to design further comprehensive interventions in the community setting to encourage the family to support tuberculosis patients following medication protocol.

Keywords: family support, instrumental support, medication adherence, tuberculosis

Introduction

Tuberculosis (TB) has become one of the top ten causes of death, with the number of cases reaching 10 million globally in 2018.¹ In Indonesia, where the third highest incidence of cases in the world occurs and increases every year, the number reached 563,879 in 2018.^{1,2} Bogor City, located in West Java Province, Indonesia, shared 1,059 cases of positive pulmonary TB in 2018.³ TB cases in Indonesia are still relatively high, with Bogor City contributing to the total figure.

As the number of TB cases increases annually, the world has attempted to find means to reduce the TB incidence rate. "The End TB Strategy" program is one such effort. The program has three indicators of success: the annual TB mortality, incidence of TB cases, and the percentage of households affected by financial problems due to TB.¹ Indonesia also has several programs to control TB, including the Directly Observed Treatment Short-Course (DOTS),⁴ initiated by World Health Organization (WHO) and *Temukan Obati Sampai Sembuh* (TOSS).² DOTS focuses on finding and healing patients, while the TOSS focuses on finding, diagnosing,

and treating TB patients to reduce the risk of TB transmission in the community.

The accomplishment of the DOTS and TOSS programs is indicated by the success rate of TB treatment in Indonesia (87.5%), which has reached the global target (85%) set in 2017.² However, the treatment success rate differs from the cure rate, indicating that only 42% of the Indonesian TB patients were cured in 2017.² Bogor City, which has a relatively high incidence of TB cases, has not yet reached the target for TB cure rates. In 2018, the TB cure rate only reached 81.22% compared to a target of 90%.³ The number of TB cases and the cure rate in Bogor City between 2014 and 2018 are indicators of patients' medication adherence. The data from Bogor City Health Office showed a lower cure rate than the target, indicating that not all TB patients in Bogor City adhered to their medication regimen.³

TB treatment takes at least six months, and the medication should be taken throughout this time.⁵ It means surveillance of TB drug consumption is needed to maintain treatment adherence. Adherence is the extent to which a person follows an agreed series of actions.⁶ A

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study indicated that one factor affecting adherence to TB medication is the involvement of a drug ingestion supervisor (DIS).⁷ The DIS is a component of the DOTS program, and its role can be carried out by the family member of TB patients undergoing treatment.⁸ Another study showed a significant relationship between the role of the family as DIS and the success rate of patients undergoing pulmonary TB treatment.⁹ The forms of support that can be provided are accompanying TB patients to the health care facilities for routine checks and taking TB medication, which is usually given once a week; preparing and reminding patients to take their TB medication each day; and providing encouragement to increase TB patients' self-efficacy and confidence that they will recover.^{9,10}

The role of DIS in TB patients' families is a form of family support. A study showing a significant relationship between family support and medication adherence identified four types of family support: instrumental, emotional, informational, and rewarding.¹¹ Instrumental support from family is simple support given through direct assistance, such as material aid or service.⁷ Instrumental support from family, which family members often provide during episodes of illness, can be financial, homework, and transportation assistance.¹² This support is proven to increase TB patients' adherence to their treatment.⁹ Although the instrumental support provided by family is usually less noticed than other forms of support (informational, emotional, and reward) given to TB patients, this type of support substantially increases patients' adherence to TB medication.¹³

Usually, instrumental support involves material provision. Therefore, as the family needs to have a certain amount of money, its financial circumstances may affect its provision of instrumental support.¹² Poor financial circumstances, for example, affect a family's ability to buy medicine, fulfill daily needs such as food and clothing, and access health facilities.^{12,14,15} Most TB patients come from the middle to lower economic class.² It is perceived that TB patients from families with low socioeconomic status may encounter obstacles to providing instrumental support from family, which may affect their adherence. TB patients mostly lack awareness of the fact that their instrumental support from family may influence their adherence. It is also known that the family's financial circumstances can lead to their inability to provide good instrumental support, which can be examined further. This study aimed to examine the impact of instrumental support from family, including financial support, homework and transportation assistance, and medication adherence among TB patients in Bogor City.

Method

This cross-sectional study was conducted between

June and July 2021 in Bogor City, West Java Province, Indonesia. Participants were included in the study if they met the following criteria: (a) TB patients who had received TB treatment for two months or more; and (b) living with their families in Bogor City. The participants who had communication problems and could not read, write, or speak in Indonesian language were excluded. The medical records were used to select participants who met the eligibility criteria. The study was conducted in 12 primary health cares (PHCs) with high TB cases in Bogor City.⁶ Purposive sampling was used to determine the respondents from each PHC. The sample size of 106 participants was required for logistic regression to detect the correlation of 0.5 with an alpha of 0.05. Considering a non-completion rate of 30%, a total of 106 participants was included in this study.

The data were collected by inviting participants to come to the PHC and complete questionnaires whose items related to the participants' characteristics, instrumental support from family, and adherence to TB medication. However, a home visit was conducted for those participants who found it difficult to visit the PHC. A structured questionnaire about instrumental support from family was developed based on a previous study, including age, sex, education, employment status, wealth index, and distances between home and PHC,^{11,16-18} and then combined and modified into 20 items. A 4-point Likert scale was used, with a categorical division using quartiles: the "Poor" category includes any score in the 0–60 range, the "Moderate" category comprises the 61–74 range, and the "Good" ranges from 75 to 80. This study's questionnaire was highly reliable, with a Cronbach's alpha value of 0.743.

A patient is considered to meet medication adherence by the American Medical Association if they take 80% of their prescribed medicine(s).¹⁹ Patients taking less than 80% of their prescribed medication(s) are considered nonadherent.¹⁹ This outcome was based on self-reported data concerning whether the patients still took TB medication.¹⁹ A Morisky Medication Adherence Scale (MMAS) questionnaire was used to measure medication adherence. This instrument consisted of eight items. The scale was categorized as "high adherence" (total score of 8), "moderate adherence" (total score of 6–7), and "low adherence" (total score of 0–6). An Indonesian language version of the MMAS was found to have good reliability with a Cronbach's alpha of 0.731.²⁰

Data were analyzed using SPSS Version 23 (IBM Corp. 2020). Descriptive analyses were carried out on the variables, including participants' characteristics, instrumental support from family, and medication adherence, using means and standard deviation (SD) for continuous data and frequencies and percentages for categorical data. Bivariate analysis was performed to deter-

mine the relationship between the dependent variable (medication adherence) and the independent variable (instrumental support from family) using the univariate logistic regression model. To examine the relationship of participants' characteristics with instrumental support from family and medication adherence, multivariable logistic regression modeling was used. The adjusted odds ratio (AOR) was calculated to examine the strength of the association by entering the variables one by one into the model to avoid the collinearity of all factors.

Result

A total of 106 individuals participated in the survey, with a response rate of 100%. Overall, the mean age of participants was 39.7, with a standard deviation (SD) of 14.9. More than half the participants were males and attending primary education (≤senior high school). Most participants were unemployed and did earn less than the regional minimum wage in Bogor City (<IDR3,843,000). Over half the participants lived more than five kilometers from the PHC (Table 1). The results indicated that more than half the participants received instrumental support from their families. The analysis also found that 76 participants (71.7%) were adherent to the medication protocol (Table 1).

Participants' Characteristics, Instrumental Support from Family, and Medication Adherence

The univariate model indicated that none of the participants' characteristics (age, sex, education, employment status, wealth index, and distance from home to PHC) were associated with medication adherence. The findings showed that participants receiving instrumental support from family had a higher AOR of following the medication protocol (Table 2).

Instrumental Support from Family Associated with Medication Adherence

The findings of this study stated that most TB patients in Bogor City earned less than the regional minimum wage (Table 1); hence, individuals from families with low economic levels were at an increased risk of TB infection. After all, it was possible that these individuals' needs, such as nutrition or adequate housing, were not met. The low economic level could affect medication adherence among TB patients because they could not access treatment. The multivariate analysis indicated that instrumental support from family was associated with medication adherence. From the analysis, participants receiving support from their families were more likely to adhere to the medication protocol, with an odds ratio of 2.7 (95% CI = 1.1–6.3; p-value = 0.029).

Table 1. Distribution of Participants' Characteristics (n = 106)

Variable	Category	n	%	Mean (SD)
Age				39.7 (14.9)
Sex	Male	61	57.5	
	Female	45	42.5	
Education	≤Senior high school	101	95.3	
	Higher education	5	4.7	
Employment status	Employed	41	38.7	
	Unemployed	65	61.3	
Wealth index	<IDR3,843,000	98	92.5	
	≥IDR3,843,000	8	7.5	
Distance from home to PHC	≥5 kilometers	45	40.6	
	<5 kilometers	63	59.4	
Instrumental support from family	Support	57	53.8	
	Not support	49	46.2	
Medication adherence	Adhere	76	71.7	
	Not adhere	30	28.3	

Notes: SD = Standard Deviation, IDR = Indonesian Rupiah PHC = Primary Health Care

Table 2. The Relationship of Participant Characteristics and Instrumental Support from Family with Medication Adherence (n = 106)

Variable	Category	n (%)	Medication Adherence			
			Crude OR	AOR	95% CI	p-value
Age			0.024	1.024	0.993–1.056	0.126
Sex	Male	61 (57.5)				
	Female	45 (42.5)	0.414	1.513	0.650–3.522	0.337
Education	≤Senior high school	101 (95.3)				
	Higher education	5 (4.7)	0.477	1.611	0.173–15.03	0.676
Employment status	Employed	41 (38.7)				
	Unemployed	65 (61.3)	0.271	0.763	0.323–1.802	0.537
Wealth index	<IDR3,843,000	98 (92.5)				
	≥IDR3,843,000	8 (7.5)	1.079	2.942	0.346–24.998	0.323
Distance from home to PHC	≥5 kilometers	45 (40.6)				
	<5 kilometers	63 (59.4)	0.033	0.968	0.409–2.291	0.941
Instrumental support from family	Support	57 (53.8)				
	Not support	49 (46.2)	0.974	2.648	1.106–6.344	0.029

Notes: SD = Standard Deviation, OR = Odds Ratio, AOR = Adjusted Odds Ratio, IDR = Indonesian Rupiah, PHC = Primary Health Care

Discussion

Most TB patients earned less than the minimum wage in Bogor City (IDR3,843,000), and previous study showed that most TB patients earned less than the minimum wage.^{7,11} The monthly income earned by an individual can determine their economic level. A study identified that individuals with low economic levels have a higher risk of TB infection.²¹ The low individual economic level is closely related to a family's ability to carry out economic functions, meaning that their ability to fulfill family needs is also low.²¹ Fulfilling family needs can mean fulfilling healthy nutrition requirements or having a decent place to live in a fair and healthy physical condition.⁷ This study found that a lower income affected an individual's economic level in such a way that it affected their ability to meet family needs. If a family's needs, such as their nutritional and living condition requirements, cannot be fulfilled, their vulnerability to being infected with TB will increase.^{18,21-23}

The comparative analysis of family income to instrumental support from family obtained in this study found that TB patients earning higher than the regional minimum wage of Bogor City (\geq IDR3,843,000) had better instrumental support from family than those earning less. Tuberculosis patients with a low economic level have a lower level of family support than those with a higher economic level.²⁴ On the basis of this explanation, the form of instrumental support provided can be assumed. For example, to meet TB patients' nutritional needs, a family needs to provide high-protein food. However, some families had economic limitations on what food they could provide, meaning that they could not fulfill the nutritional needs of TB patients. Insufficient nutrition can have a negative impact on the healing process.²⁵⁻²⁷

This study also analyzed the ratio of income to medication adherence in TB patients. The analysis showed that TB patients earning greater than the regional minimum wage (\geq IDR3,843,000) adhered more closely to treatment than those who earned less. Tuberculosis patients earning less than the minimum wage were 1.7 times less likely to comply than those earning greater than the minimum wage.⁷ However, income is not a benchmark for medication adherence because TB treatment at the PHCs is granted free of charge.¹¹ In light of this explanation, a high adherence by TB patients with a high income might occur because those patients have better facilities for their treatment process. For example, it assumed that TB patients earning greater than or equal to the regional minimum wage had private vehicles, making it easier for them to obtain their TB medicament at the PHC, which might reduce the risk of skipping drug-taking if the patient runs out of drugs.

The results showed that some TB patients had not re-

ceived optimal instrumental support from family. A study stated that TB patients with a low economic level had a low level of family support, which could obstruct the healing process.⁷ The provision of suboptimal instrumental support could be seen in the family's ability to carry out family functions, including effective, economic, and family care functions. When an effective function is carried out correctly, each family member supports the TB patient, one aspect of which is instrumental support.¹⁴ The family's economic functions, if executed well, can provide TB patients with good nutrition, helping people with TB in the healing process.^{28,29} The family care function is tied to instrumental support from family for TB patients, including the family's contribution to care during TB treatment.³⁰ Therefore, the family's function is closely related to instrumental support.

Most TB patients had moderate or high adherence level, which means that TB patients were adhering to treatment. This finding was in line with two studies reporting that more than 60% of TB patients complied with treatment.^{16,31} In contrast, another study found that only 48.9% of TB patients complied with treatment.¹¹ This difference occurs because medication adherence is influenced by several factors, including factors relating to the TB patients themselves, health care facilities, medication, and sociocultural features.^{7,15,32} However, the results also showed that there were still TB patients with a low adherence level. The failure of TB patients to adhere to their treatment could occur because the family had not performed its family functions optimally.⁷ Among the family's useful functions, medication adherence is helped by supporting and motivating TB patients.³⁰ The family care function can be executed to maintain a TB patient's medication adherence by reminding them to take their medication on time.¹⁷ Concerning the family's economic function, a high economic level can provide facilities for better treatment processes, such as facilitating transportation for health check-up.²⁹

This study proved a significant relationship between instrumental support from family and medication adherence by TB patients (p -value = 0.022, α = 0.05). The results of this study were in line with three studies that indicated a significant relationship between family support and medication adherence.^{11,16,31} However, two studies showed that instrumental support from family does not have a significant relationship with medication adherence.^{13,18} This difference might arise because each patient has different family conditions and backgrounds. At the same time, the provision of instrumental support can depend on the availability of materials, services, or time available for TB patients.¹³ Most participants in this study stated that families often perform instrumental support (Table 1), which included reminding patients to take their medicine, preparing the medicine, delivering,

or getting medicine at the health center facilities, and accompanying patients to take medication. Therefore, the better the instrumental support from family provided, the higher the level of compliance by TB patients.

Strength and Limitations

Family functions and the family's role as DIS were referred to most often in this study, suggesting that these two factors were related to instrumental support from family and medication adherence among TB patients. Further study may explore the relationship between the family's role as DIS and the ability to provide family support to TB patients. However, this study had some limitations. First, the COVID-19 pandemic made the schedule for TB patients to take their medication change from once a week to once every two weeks, so that fewer TB patients would visit the PHC. Therefore, visiting each patient's house was needed to collect the data. Another limitation was that the addresses of TB patients in the PHC records sometimes differed from the patients' residential addresses, which made data on the distance between home and PHC must be double-checked.

Conclusion

This study reveals that good family support will elevate TB patients' adherence. Tuberculosis patients in Bogor City mostly live close to PHC, and many of them receive good support from their families. Therefore, most TB patients in Bogor City adhere to their treatment.

Recommendation

The findings may have implications for the nursing service concerning the provision of education regarding the importance of the family's role in providing instrumental support for medication adherence by TB patients. Efforts to increase instrumental support can be made by increasing the family's role as DIS in monitoring TB patients' ingestion of drugs. The instrumental support provided can be adjusted to the economic level of the patient's family; for example, when delivering education on providing nutritious food, health care providers can talk about nutritious food which is available at an affordable price. The form of instrumental support provision can be adjusted to the family's financial circumstances, so that the need for instrumental support can be fulfilled.

Abbreviations

TB: Tuberculosis; DOTS: Directly Observed Treatment Short-Course Strategy; WHO: World Health Organization; TOSS: Temukan Obati Sampai Sembuh; DIS: Drug Ingestion Supervisor; PHC: Primary Health Care; MMAS: Morisky Medication Adherence Scale; SD: Standard Deviation; AOR: Adjusted Odds Ratio; IDR: Indonesian Rupiah; COVID-19: coronavirus disease 2019.

Ethics Approval and Consent to Participate

This study protocol was reviewed by the ethical test by the school administration number UN2.F12.D/HKP.02.07/2019. The ethical test carried out has met the established criteria. The criteria referred to include, among others, accompanying an explanation of the benefits of research, explaining the rights of the respondent, maintaining the privacy of the respondent, holding the aspect of justice, and upholding the principle of openness by explaining the research procedure and informed consent. In this study, written informed consent was obtained from the participants who agreed to participate after the authors had explained the purposes of the study.

Competing Interest

The authors declare that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

Availability of Data and Materials

The generated dataset is available to share from the corresponding author upon a reasonable request.

Authors' Contribution

AYN participated in conceptualizing, designing, analyzing, and revising the manuscript. SWR participated in collecting the data, analyzing, and writing the manuscript. MHH participated in analyzing and writing the result in manuscript. The authors discussed the results of the study. All authors read and approved the final manuscript.

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References

1. World Health Organization. Global tuberculosis report 2022. Geneva: World Health Organization; 2022.
2. Kementerian Kesehatan Republik Indonesia. Infodatin tuberkulosis 2018 - Dicari para pemimpin untuk dunia bebas TBC. Jakarta: Kementerian Kesehatan Republik Indonesia; 2018.
3. Dinas Kesehatan Kota Bogor. Profil Kesehatan 2018. Bogor; Dinas Kesehatan Kota Bogor; 2019.
4. World Health Organization. Communicable diseases cluster. What is DOTS?: a guide to understanding the WHO-recommended TB control strategy known as DOTS. Geneva: World Health Organization; 1999.
5. World Health Organization. Guidelines for treatment of drug-susceptible tuberculosis and patient care, 2017 update. Geneva: World Health Organization; 2017.
6. Chapman H. Nursing theories 4: adherence and concordance. *Nursing Times*. 2018; 114 (2): 50.
7. Wulandari DH. Analisis faktor-faktor yang berhubungan dengan kepatuhan pasien tuberkulosis paru tahap lanjutan untuk minum obat di RS Rumah Sehat Terpadu tahun 2015. *Jurnal Arsi*. 2015; 2 (1): 17–28.
8. Menteri Kesehatan Republik Indonesia. Peraturan Menteri Kesehatan

- Nomor 67 Tahun 2016 Tentang Penanggulangan Tuberkulosis. Jakarta: Kementerian Kesehatan Republik Indonesia; 2016.
9. Jufrizal J, Hermansyah H, Mulyadi M. Peran keluarga sebagai pengawas minum obat (PMO) dengan tingkat keberhasilan pengobatan penderita tuberkulosis paru. *J Ilmu Keperawatan*. 2016; 4 (1): 25–36.
 10. Jakaria. Keberhasilan pengobatan dalam kepatuhan minum obat TB paru di Puskesmas Dramaga Kabupaten Bogor Provinsi Jawa Barat [Undergraduate Thesis]. Depok: Universitas Indonesia; 2017.
 11. Sutini E. Hubungan dukungan keluarga terhadap kepatuhan minum obat pada klien TB di Puskesmas Pancoran Mas [Undergraduate Thesis]. Depok: Universitas Indonesia; 2016.
 12. Chen LC, Chen TC, Huang Y Bin, Chang CS. Disease acceptance and adherence to imatinib in Taiwanese chronic myeloid leukaemia outpatients. *Int J Clin Pharm*. 2014; 36 (1): 120–7.
 13. Arifin VN, Juariah, Nur A, Uzair FM. The relationship of social support with medication adherence pulmonary tuberculosis patients through DOTS strategy in Pidie Aceh Indonesia. In IOP Conference Series: Materials Science and Engineering. IOP Publishing Ltd; 2019; 4691.
 14. Cross CJ, Nguyen AW, Chatters LM, Taylor RJ. Instrumental social support exchanges in African American extended families. *J Fam Issues*. 2018; 39 (13): 3535–63.
 15. Goldsmith LJ, Kolhatkar A, Popowich D, Holbrook AM, Morgan SG, Law MR. Understanding the patient experience of cost-related non-adherence to prescription medications through typology development and application. *Soc Sci Med Internet*. 2017; 194: 51–9.
 16. Maulidia DF. Hubungan antara dukungan keluarga dan kepatuhan minum obat pada penderita tuberkulosis di wilayah Ciputat tahun 2014 [Undergraduate Thesis]. South Tangerang: Universitas Islam Negeri Syarif Hidayatullah Jakarta; 2014.
 17. Tamamengka D, Kepel B, Rompas S. Fungsi afektif dan perawatan keluarga dengan kepatuhan pengobatan TB paru. *J Keperawatan*. 2019; 7 (2): 1-10.
 18. Chen X, Du L, Wu R, Ji H, Zhang Y, Zhu X, et al. The effect of family, society and national policy support on treatment adherence among newly diagnosed tuberculosis patients: a cross-sectional study. *BMC Infectious Diseases*. 2020; 20: 623.
 19. Hugtenburg JG, Timmers L, Elders PJ, Vervloet M, van Dijk L. Definitions, variants, and causes of nonadherence with medication: a challenge for tailored interventions. *Patient Prefer Adherence*. 2013; 7: 675-82.
 20. Riani DA. Validasi 8-item morisky medication adherence scale versi Indonesia pada pasien hipertensi dewasa di Puskesmas Kabupaten Sleman dan Kota Yogyakarta [Thesis]. Yogyakarta: Universitas Gadjah Mada; 2017.
 21. Masithoh AR. Hubungan tingkat ekonomi dengan kejadian tuberkulosis paru di Puskesmas Kaliwungu Kecamatan Kaliwungu Kabupaten Kudus. *J Ilmu Keperawatan Kebidanan*. 2013; 4 (2): 35–44.
 22. Narasimhan P, Wood J, MacIntyre CR, Mathai D. Risk factors for tuberculosis. 2013; 2013: 828939.
 23. Nurjana MA. Faktor risiko terjadinya tubercolosis paru usia produktif (15-49 tahun) di Indonesia. *Media Penelitian dan Pengembangan Kesehatan*. 2015; 25 (3): 163–70.
 24. Manan, I. Gambaran dukungan dan peran keluarga sebagai PMO dalam pencegahan TB MDR di wilayah kerja Puskesmas Gang Kelor Kota Bogor Tahun 2017. 2018; 10 (2).
 25. Kant S, Gupta H, Ahluwalia S. Significance of nutrition in pulmonary tuberculosis. *Crit Rev Food Sci Nutr*. 2015; 55 (7): 955–65.
 26. Ren Z, Zhao F, Chen H, Hu D, Yu W, Xu X, et al. Nutritional intakes and associated factors among tuberculosis patients: a cross-sectional study in China. *BMC Infect Dis*. 2019; 19: 907.
 27. Samuel B, Volkmann T, Cornelius S, Mukhopadhy S, MejoJose, Mitra K, et al. Relationship between nutritional support and tuberculosis treatment outcomes in West Bengal, India. *J Tuberc Res*. 2016; 4 (4): 213–9.
 28. Deshmukh RD, Dhande DJ, Sachdeva KS, Sreenivas AN, Kumar AMV, Parmar M. Social support a key factor for adherence to multi-drug-resistant tuberculosis treatment. *Indian J Tuberc*. 2018; 65 (1): 41–7.
 29. Sanusi GN, Satus AS, Karso I. Hubungan tingkat ekonomi dengan kepatuhan minum obat penderita TB paru BTA positif di wilayah kerja Puskesmas Cukir Kabupaten Jombang. *JIKep*. 2017; 3 (1).
 30. Iksan RR, Muhaimin T, Anwar S. Fungsi-fungsi keluarga dengan hasil pengobatan tuberculosis program DOTS. *J Keperawatan Silampari*. 2020; 3 (2): 638–47.
 31. Septia A, Rahmalia S, Sabrian F. Hubungan dukungan keluarga dengan kepatuhan minum obat pada penderita TB paru. *JOMPSIK*. 2014; 1 (2).
 32. Gugssa Boru C, Shimels T, Bilal AI. Factors contributing to non-adherence with treatment among TB patients in Sodo Woreda, Gurage Zone, Southern Ethiopia: a qualitative study. *J Infect Public Health*. 2017; 10 (5): 527–33.