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Short Communication

A Randomized-Controlled Trial Study of Telecare-Based Interprofessional Collaboration: A New Strategy in Tuberculosis Treatment

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ABSTRACT

To provide optimal treatment for tuberculosis (TB), an interprofessional team is required, but most hospitals cannot provide such standards. A potential alternative method for better medication adherence is telecare. This study aims to develop a telecare service based on interprofessional collaboration to elevate medication adherence and enhance therapy outcomes for individuals with tuberculosis. The research was a single-blind randomized control trial. Data collection was carried out at three points: baseline, one month, and three months post-intervention. The primary outcome measured was the bacterial conversion, while secondary outcomes included medication adherence and the quality of TB patients' lives. Using an individually randomized sample, 100 patients (50 patients per group) were selected. The instruments used included the medication adherence rating scale-5, knowledge questionnaire, and St. George's Respiratory Questionnaire. Data were analyzed with Mann-Whitney test. A significant difference was observed in the knowledge scores between the control and experimental groups, indicated by a p-value of 0.007 ($p < 0.05$). The experimental group showed a higher median score (76.92) compared to the control group (61.54). Significant differences were also observed in the medication ($p = 0.008$, $p < 0.05$). In the experimental group, 50 patients demonstrated higher medication adherence (median score 25.00). Regarding patients' quality of life, a significant difference was observed between the two groups. The control experimental group had better quality of life. Overall, the study concluded that telecare-based interprofessional collaboration had a positive impact on improving knowledge, medication adherence, quality of life in TB patients and bacterial conversion.

Keywords: Adherence, Interprofessional Collaboration, Quality Of Life, Tuberculosis, Telecare

Introduction

The Indonesian TB information system recorded that 821,200 TB cases (77% of the target) had been notified, and the number of TB cases treated was only 86% out of 90%. However, patients who have started taking drug-sensitive TB medication are 88% out of 100%, and those who have started taking drug-resistant TB medication are 73% out of 90%. In other words, a number of people with confirmed TB have not started treatment, thus potentially infecting others. Many factors can influence the success of TB treatment indicated by the level of treatment success rate (TSR). These include patients not complying with taking anti-tuberculosis medication (ATT); moving healthcare facilities; being resistant to ATT; the absence of monitoring by medication supervisor; the absence of PMO with a lack of monitoring and drug factors; the disrupted supply of ATT; treatment delay or discontinued medication, and the decreased quality of ATT because of unstandardized storage.[1] Most studies on TSR have measured the major predictors of not achieving TSR. The factors identified comprise HIV positivity, older age, and considerable travel distance from home to healthcare facilities. [2 3]

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Inadequate treatment adherence among TB sufferers may result in high treatment failure rates, ultimately increasing morbidity and mortality and facilitating the emergence of resistant strains. [4 5]Relatively long TB treatment may cause a decline in the patient's health status, in terms of both physical and psychological conditions, which can affect the quality of TB sufferers' lives [6]. The low quality of life caused by the infection may affect the physical body, causing fatigue, disability to carry out activities, and lack of rest time at night because of continuous coughing. TB sufferers also often experience rejection and isolation by the surrounding community, causing depression and low motivation to undergo treatment. [7 8]

A long-distance m-health solution, such as digital communication media with synchronous and asynchronous video observation, which is currently under research, aims to pursue the effectiveness of monitoring medication and provide effective, efficient, and quality services to TB patients rather than directly observed treatment (DOT) in monitoring the daily dose of ATT. [9 10] However, such telehealth interventions in the form of messages, applications, and videos, one-way (non-interactive) treatments, cannot ascertain the patient's compliance. In short, telehealth interventions should be designed with communicative (interactive) electronic media to shorten the distance between patients and pharmacists for better care.[11]

Most hospitals do not have a multidisciplinary team to manage TB treatment.[12] However, collaborative practice is a fundamental aspect of TB patient therapy and interprofessional collaboration (IPC) between pharmacists, pulmonary specialists, and nurses strengthens treatment compliance and the quality of a patient's life.[13 14 15] The IPC may reduce depression and improve self-management of chronic diseases among patients including TB. [16 17 18]

The current research provides a new approach, telecare-based interprofessional collaboration, improving knowledge, treatment

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adherence, and quality of the patient's life. It combines interprofessional collaboration initiated by McLaney et al. (2022) with telecare methods, which have not previously been applied. This study aimed to develop a telecare service through interprofessional collaboration to enhance medication adherence and therapy outcomes among TB patients.

Materials and Methods

Study design and setting

This experimental study employed a randomized controlled trial (RCT) design with a single-blind pre–post approach, in which the research participants were blinded. They were not told whether they received active intervention or control intervention.

Study population, sample and sampling

Individual randomization was applied to the sample, and the sample size was determined using the dependent variable (TB treatment adherence). The calculation employed the formula for comparing two population proportions, as shown below:

$$n = \frac{(Z_{1-a/2}\sqrt{2P(1-P)} + Z_{1-\beta}\sqrt{P1(1-P1) + P2(1-P2))^2}}{(P1-P2)^2}$$

Information

$Z_{1-a/2}$ = Z value or 95% confidence level of the 2-way test (1.96)

Z_{1-b} = Z value at test strength $1-\beta$ 80% (0.84)

P = Population proportion $\frac{P1+P2}{2}$ = 0.796

P1 = Proportion of compliance with the experiment (0.67) [17]

P2 = Proportion of compliance in controls (0.922) [18]

The calculated sample size ensures 80% power and a 5% significance level, with adjustments for a 1% intra-cluster correlation coefficient and a 20% coefficient of variation in cluster size. The computation is as follows:

$$n = \frac{(1.96\sqrt{2x0.796(1-0.796)} + 0.84\sqrt{0.67(1-0.67) + 0.922(1-0.922))^2}}{(0.67-0.922)^2}$$

n = 39 ~ each group added 20% and 48~50 sample per group

TB patients who met the inclusion criteria were enrolled in the study and randomized into control and intervention groups. Selected TB patients had to be aged > 18 years, with a maximum treatment period of three months, undergoing outpatient therapy, not returning to first-level health facilities, and willing to participate in the telecare-based interprofessional collaboration service program. This current study excluded patients referred to another hospital, died, lost to follow-up, and reported as having a history of mental disorders. Patient randomization was carried out using a web-based application. The first randomization was performed using simple random sampling resulting in 100 patients. Then, the second randomization was carried out using Random Allocation Software 2.0 to determine the control and intervention groups, which consisted of 50 patients in each group.

Data collection and analysis

Measurements were taken at baseline (0 month) and then at monthly intervals up to three months after telecare-based interprofessional collaboration intervention. The primary outcome measured from the intervention was the clinical outcome of TB therapy, while the secondary outcomes measured were treatment adherence, knowledge about TB, and quality of life.

This stud's research instruments consisted of an observational sheet and medication adherence (MARS-5) questionnaire with a five-point Likert comprising of five compliance behavior items: forgetting, changing doses, stopping, missing doses, and using less medication than prescribed. This questionnaire was validated with an alpha reliability coefficient of 0.658. Compliance was defined as a questionnaire score of 25; scores less than 25 were considered non-compliance. A questionnaire regarding knowledge about TB adopted from Ulandari (2024) consisted of 13 yes/no questions with five knowledge indicators, namely causes, transmission, prevention, symptoms, and treatment. Patient's knowledge was good if the score was >75%, moderate if the score was around 56-75%, and poor if the score was <55%. The instrument had been previously validated and demonstrated acceptable reliability, with a Cronbach's alpha of 0.772.[19] The quality of life was measured using the Indonesian version of the St. George's Respiratory Questionnaire (SGRQ), adopted from earlier studies.[20] The questionnaire, which showed a Cronbach's alpha exceeding 0.70, comprises 50 items across three domains: symptoms (8 items), activities (16 items), and impacts (26 items). Each item is scored on a scale of 0–100, with higher scores reflecting poorer quality of life. The data were analyzed using the Mann–Whitney test to compare the experimental and control groups, with statistical significance set at $\alpha < 0.05$. The statistical test showed $\alpha < 0.05$, thus hypothesis Ho was rejected and the research hypothesis, Ha, was accepted, indicating the increase in adherence and treatment outcomes as a result of telecare-based interprofessional collaboration practices.

Ethics approval

This study adhered to the Consolidated Standards of Reporting Trials (CONSORT) guidelines. Ethical approval was obtained from the Ethics Committee of Husada Prima Hospital Surabaya under approval number 045/008.06/EC/KEPK/2024.

Results and Discussion

Treatment success rate may improve compliance with treatment and quality of life by providing two-way types of communication between health workers and patients, namely education and counseling. The increasing prevalence of TB proves that telecare is an alternative to eradicate TB cases by 2035. Telecare approaches such as Video Directly Observed Therapy (VDOT), Video Observed Therapy (VOT), and SMS reminders show promise in enhancing adherence to TB treatment and improving therapeutic outcomes. Two-way telecare interventions have demonstrated consistent and positive effects on both treatment adherence and clinical outcomes among TB patients.[21] This study found that the hospital under investigation provided telemedicine services in forms of WhatsApp blast and WhatsApp business, but their use was limited to patient service satisfaction surveys. Telecare provides remote oversight of therapy and may lessen the travel burden to health facilities in contrast to traditional DOT approaches. [22] Overall, telecare is favored by TB patients, as it is perceived to be more acceptable, more affordable, and more effective than conventional DOT.[23 24]

Compliance with taking medication is a key behavioral aspect in pursuing the desired therapeutic effect. The level of medication compliance in TB patients is influenced by knowledge about TB, the treatment process, the treatment duration and the medication count [25], family support, and low social and economic support (accessibility of medicines). [26] Patients must be aware of their disease to be abreast of their health conditions, increasing the compliance with treatment and quality of life. They should be informed about how TB spreads, its symptoms, side effects of drugs, and the importance of regular treatment.

Telecare started immediately a patient returned home after a routine check-up at Husada Prima Hospital Surabaya (Figure 1). The IPC team followed up via WhatsApp, and the patient received a reminder message every hour during medication, increasing knowledge about TB every two weeks. Pharmacists evaluate patient medication compliance through telecare and plan the treatment at another time. If a problem is found, the pharmacist will convey it to another team such as doctors, nurses, or others. The IPC team routinely meets every two weeks and discusses cases found in the counseling session and evaluate the program's sustainability.

More than half of the TB patients were male (59.0%) and within the age range of 45–65 years (54.0%). Less than half had an elementary school education (43.0%) and were unemployed (46.0%). TB infection was confirmed in patients when more than half demonstrated positive bacterial conversion (77.0%), while fewer than half showed positive results on chest X-ray examination (47.0%).

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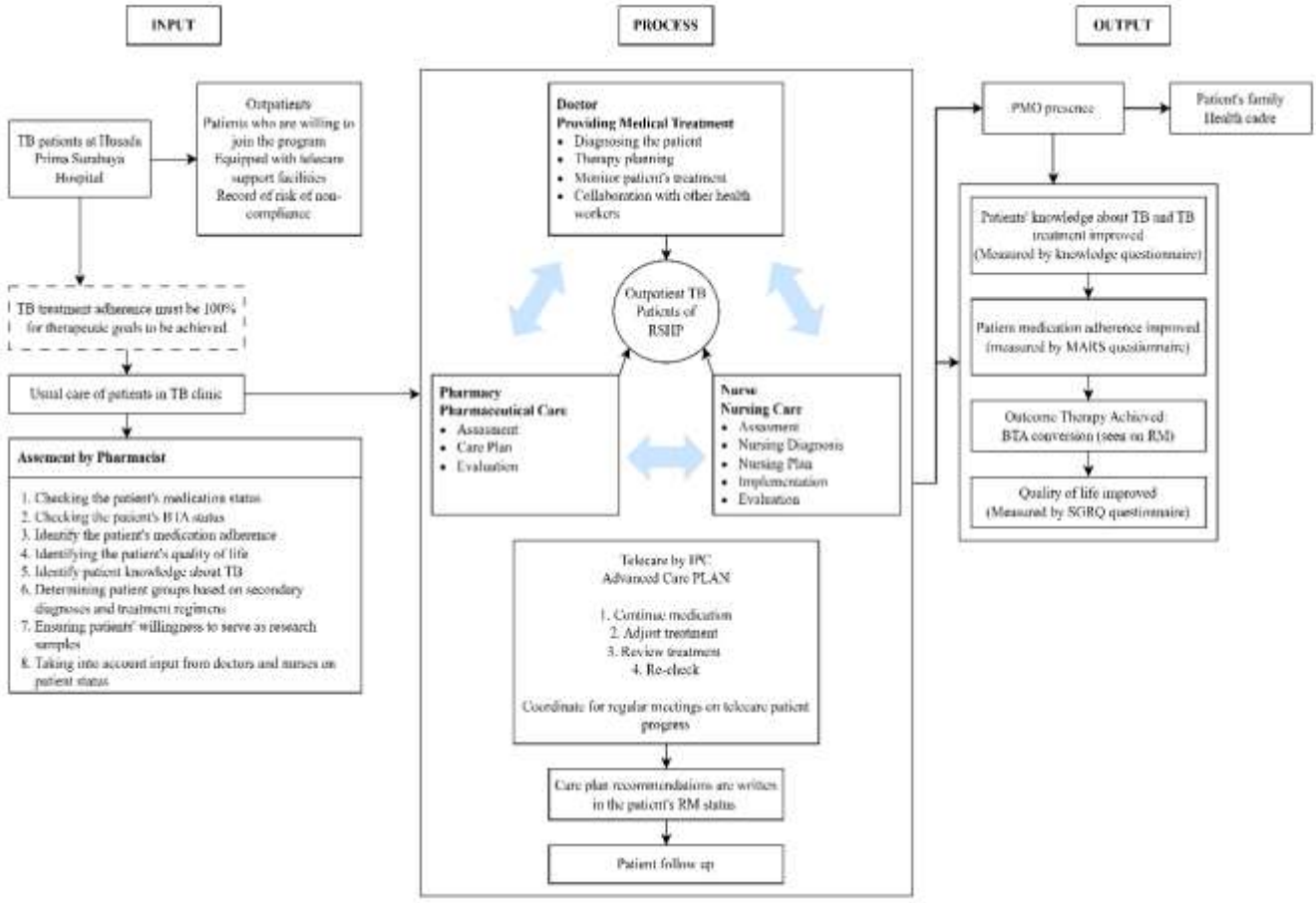

Figure 1: Implementation Flow of Interprofessional Collaboration Service Model Based on Telecare (developed by the authors)

Table 1: Patient Characteristics Data (n = 100)

Characteristics	Category	Total n (%)	Control Group n (%)	Experimental Group n (%)	p-value
Gender	Male	59 (59.0)	29 (58.0)	30 (60)	1.000[b]
	Female	41 (41.0)	21 (42.0)	20 (40)	
Age	13-25	12 (11.0)	4 (8.0)	7 (14.0)	
	26-45	25 (25.0)	12 (24.0)	13 (26.0)	0.574[a]
	45-65	54 (54.0)	30 (60.0)	24 (48.0)	
	>65	10 (10.0)	4 (8.0)	6 (12.0)	
Education	Not go to school	3 (3.0)	2 (4.0)	1 (2.0)	
	Elementary School	43 (43.0)	25 (50.0)	18 (36.0)	
	Junior High School	12 (12.0)	4 (8.0)	8 (16.0)	0.215[a]
	High School	36 (36.0)	16 (32.0)	20 (40.0)	
	Diploma/Bachelor's Degree	5 (5.0)	2 (4.0)	3 (6.0)	
	Post Graduate	1 (1.0)	1 (2.0)	0	
Occupation	Not Working	46 (46.0)	23 (46.0)	23 (46.0)	
	Self-Employed	21 (21.0)	9 (18.0)	9 (18.0)	
	Student	3 (3.0)	2 (4.0)	2 (4.0)	
	Civil Servants/Military/Police	1 (1.0)	0	1 (2.0)	0.836[b]
	Private Employees	3 (3.0)	1 (2.0)	2 (4.0)	
	Others	26 (26.0)	13 (26.0)	13 (26.0)	
Distance to Hospital (km)	0-5	60 (60.0)	31 (62.0)	29 (58.0)	
	5.1-10	21 (21.0)	10 (20.0)	11 (22.0)	
	10.1-15	2 (2.0)	1 (2.0)	1 (1.82)	0.712[a]
	15.1-20	1 (1.0)	0	0	
	>20	16 (16.0)	8 (16.0)	8 (16.0)	
Bacterial Conversion	Positive	77 (77.0)	39 (78.0)	38 (76.0)	1.000[b]
	Negative	23 (23.0)	11 (22.0)	12 (24.0)	
X-ray	Positive	47 (47.0)	25 (50.0)	28 (56.0)	0.689[a]
	Negative	53 (53.0)	25 (40.0)	22 (44.4)	
Knowledge	Mean ± SD		66.12±19.8	63.5±19.08	0.359[a]

[a] Significance test using Mann Whitney, [b] Significance test using chi square

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The comparison test between the two groups produced a p-value greater than 0.05, indicating no significant differences between the control and experimental groups at baseline. Normality testing using the Kolmogorov–Smirnov test yielded a p-value of 0.00 (<0.05), suggesting that the data were not normally distributed. Consequently, the Mann–Whitney test was applied to assess the effect of the intervention on the control and experimental groups. A significant increase was observed in the experimental group between the pre-test and post-test (p = 0.024), suggesting a beneficial impact of the intervention. Using digital communication media, telecare services could be delivered in the form of e-consultation, e-prescription services mobile health, and VOT. [27] The current investigation found WhatsApp as the most accessible telecare medium among TB patients observed. The patients received regular reminder messages to take medication, posters about knowledge of TB disease, TB treatment, and tips for healthy lifestyles. In addition, direct online counseling sessions were available for patients at Husada Prima Hospital Surabaya. [28] [29] Knowledge of the experimental group significantly increased after interprofessional-collaboration telecare was used, providing accurate and integrated information. Given a p-value of 0.007, interprofessional collaboration telecare plays a role in increasing patients' awareness of TB disease, treatment procedures, and the significance of adhering to therapy.

The Mann–Whitney test (Table 2) showed that the Asymp. Sig. (2-tailed) values for the knowledge, treatment compliance, and quality-of-life variables were <0.05, indicating significant differences between the control and experimental groups. Based on the minimum, maximum, and median values, the experimental group demonstrated better outcomes following the intervention than the control group. The bacterial conversion variable in the experimental group was also significant, showing superior results compared to the control group.

Table 2: Test Results of the Effect of Telecare-Based Interprofessional Collaboration on TB Patients

Criteria	Group	n	Median	Minimum	Maximum	Asymp. Sig (2-tailed)
Knowledge	Control	50	61.54	8	100	0.007*
	Experiment	50	76.92	46	100	
Adherence to Medication	Control	50	25.00	16	25.00	0.010*
	Experiment	50	25.00	19	25.00	
Quality of Life	Control	50	35.67	9	68	0.002*
	Experiment	50	25.45	3	80	
				Negative (%)	Positive (%)	
Bacterial conversion	Control	50	-	90.4	9.6	0.025*
	Experiment	50	-	100	0	

* Significant with p-value < 0.05 tested with Mann Whitney

Patient compliance with medication in the experimental group showed statistically significant findings, reflected by a p-value of 0.008. Although both experimental and control groups showed a relatively high level of compliance (median = 25.00), their compliance was higher with interprofessional-collaboration telecare. Patients sought for a sense of security and emotional support through routine monitoring and motivational support through telecare. The median value of quality of life in the experimental group was lower (25.45) demonstrating statistical significance (p = 0.001), meaning that the QoL in the experimental group was better than in the control group. The interprofessional-collaboration telecare had a positive impact on the quality of life in the long term by implementing routine health monitoring, remote consultation with the multidisciplinary team, and effective communication.

The comparison of bacterial conversion between the control and experimental groups yielded a significant result (p = 0.025), indicating a direct effect on the results of diagnostic tests (bacterial conversion) for detecting *mycobacterium* TB in the patient's body.

Overall, interprofessional collaboration telecare was more effective in improving the knowledge, medication adherence, and quality of life among TB patients compared to information and counseling session during routine treatment checks. Using digital media is a solution to monitor the compliance with medication in TB patients, which is more effective than DOTs. [27] Other studies also state that remote health services using WhatsApp visual media telecommunications are more effective because patients have sufficient opportunity and time to ask questions and bacterial conversion information about TB treatment, prevention, and transmission to family members. [30] [31] Meanwhile, the control group experienced a slight change in compliance with treatment and quality of life after being given information and counseling sessions during routine treatment checks. Most patients in the control group asserted that the messages conveyed by the health workers were not understandable and too much within a short period of meeting session.[32] Instead of direct counselling as is normally performed, interprofessional-collaboration telecare is a gateway to provide more effective health promotion.

Telecare lets patients explore a lot of unknown information and connect with an IPC team to get feedback. The availability of information may influence decision-making on health services and this may be sourced from electronic media, print media, or direct information such as counseling.[33] Low understanding of the disease will result in non-adherence to the medication whereas well-equipped knowledge about TB and motivation to undergo the treatment process may exist when patients have sufficient understanding of TB.[34] [35]

One of the promotional media to improve patient's awareness is posters having an attractive physical appearance and conveying useful messages in a more interactive way.[36] Previous research revealed that android-based health education can improve a person's knowledge.[37] Knowledge can improve the quality of life by using smartphones. Health promotion will be easier and more effective by using leaflets and WhatsApp to invite and make people aware of their health. WhatsApp feature has significant features to increase learners' interest to learn new information.[38] [39] Evidence has shown that sending educational pictures and text messages on social media may increase knowledge.

Conclusion

A telecare-based interprofessional collaboration model can be implemented to improve adherence to and primary and secondary therapy outcomes of TB treatment. Interprofessional collaboration-based telecare is more effective and significant in improving the knowledge, medication adherence, and quality of life among TB patients compared to information and counseling session during routine treatment checks.

Conflict of Interest

The authors declare no conflict of interest.

Authors' Declaration

The authors hereby declare that the work presented in this article is original and that any liability for claims relating to the content of this article will be borne by them.

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References

1. Ministry of Health of the Republic of Indonesia. National guidelines for tuberculosis control. Jakarta: Ministry of Health; 2014.
2. Izudi J, Okello G, Bajunirwe F. Low treatment success rate among previously treated persons with drug-susceptible pulmonary

tuberculosis in Kampala, Uganda. J Clin Tuberc other Mycobact Dis. 2023;32:100375. doi:10.1016/j.jctube.2023.100375.
3. Schoenbaechler V, Guilavogui Y, Onivogui S, Hébélamou J, Mugglin C, Furrer H, Hensen Corina, Bavogui EB, Kolie C, Zoumanigui P, Béavogui I, Leuenberger D, Staehelin C. Rate of treatment success and associated factors in the program for drug-susceptible tuberculosis in the Forest Region, Republic of Guinea, 2010-2017: A real-world retrospective observational cohort study. Int J Infect Dis. 2021;110:6–14.
4. Pameswari P, Halim A, Yustika L. Level of compliance of tuberculosis patients at Mayjen H.A. Thalib Kerinci Hospital. J Clin Pharm Sci. 2016;2(2):116–121.
5. Rahem A, Priyandani Y, Djunaedi M. The correlation between belief and adherence to therapeutic regimens in pharmaceutical care for tuberculosis patients in primary healthcare centres in Surabaya, Indonesia. Trop J Nat Prod Res. 2020;4(8):355-359. doi:10.26538/tjnpr/v4i8.6.
6. Azalla CR, Maidar, Ismail N. Quality of life and treatment adherence among pulmonary tuberculosis patients in Pidie Jaya District. J Aceh Med. 2020;4(2):122–136.
7. Atif M, Syed SS, Shafie A, Asif M, Sarfraz M, Low H, Babar Z. Impact of tuberculosis treatment on health-related quality of life of pulmonary tuberculosis patients: a follow-up study. Health Qual Life Outcomes. 2014;12(1):19.
8. Endria V, Yona S. Depression and tuberculosis-related stigma associated with quality of life in patients with pulmonary tuberculosis. Natl Health Res J. 2019;3(1):21–8.
9. Arjuna A, Sukihananto S. Mobile health as an effort to improve treatment success in tuberculosis patients: a literature review. Citra Delima J Ilm STIKES Citra Delima. 2019;2(2):89–94.
10. Octavia DR, Hermansyah A, Nita Y, Priyandani Y, Pristianty L, Ming LC, Alsaleh NA, Alsharif AA, Meilianti S. The adherence–quality of life paradox in tuberculosis care after COVID-19: a cross-sectional study in Indonesia. Discov Public Health. 2025;22(1):704. doi:10.1186/s12982-025-01111-6.
11. Gashu KD, Gelaye KA, Mekonnen ZA, Lester R, Tilahun B. Does phone messaging improves tuberculosis treatment success? A systematic review and meta-analysis. BMC Infect Dis. 2020;20(1):1-13. doi:10.1186/s12879-020-4765-x
12. Iskandar D, Pradipta IS, Anggriani A, Postma MJ, van Boven JFM. Multidisciplinary tuberculosis care: leveraging the role of hospital pharmacists. BMJ Open Respir Res. 2023;10(1):1-11. doi:10.1136/bmjresp-2023-001887.
13. Pradipta IS, Yanuar EO, Nurhijriah CY, Maharani NP, Subra L, Destiani DP, Diantini A. Practical models of pharmaceutical care for improving tuberculosis patient detection and treatment outcomes: a systematic scoping review. Trop Med Infect Dis. 2023;8(5).
14. Bosch B, Mansell H. Interprofessional collaboration in health care: Lessons to be learned from competitive sports. Can Pharm J. 2015;148(4):176-179. doi:10.1177/1715163515588106.
15. Bosch B, Mansell H. Interprofessional collaboration in health care: Lessons to be learned from competitive sports. *Can Pharm J*. 2015;148(4):176-179. doi:10.1177/1715163515588106
16. Wetherell JL, Petkus AJ, Thorp SR, Stein MB, Chavira DA, Campbell-Sills L, Craske MG, Sherbourne C, Bystritsky A, Sullivan G, Byrne PR. Age differences in treatment response to a collaborative care intervention for anxiety disorders. Br J Psychiatry. 2013;203(1):65–72.
17. Bachina P, Lippincott CK, Perry A, Munk E, Maltas G, Bohr R, Rock RB, Shah M. Programmatic adoption and implementation of video-observed therapy in Minnesota: prospective observational cohort study. JMIR Form Res. 2022;6(8):e38247.
18. Park S, Sentissi I, Gil SJ, Park WS, Oh BK, Son AR, Kong YJ, Park S, Paek E, Park YJ, Lee SH. Medication event monitoring system for infectious tuberculosis treatment in Morocco: A retrospective cohort study. Int J Environ Res Public Health. 2019;16(3).
19. Ulandari S, Rahem A, Priyandani Y. An evaluation of the validity and reliability of the tuberculosis patient knowledge questionnaire. Pharm Educ. 2024;24(3):173-177. doi:10.46542/pe.2024.243.173177
20. Adnan A, Perwitasari DA, Mulyani UA. Reliability and validity of the St George's Respiratory Questionnaire (SGRQ) Indonesian version. Int J Public Health Sci. 2014;3(3):179–186. doi:10.11591/ijphs.v3i3.4691
21. Ridho A, Alfian SD, Van BJFM, Levita J, Yalcin EA, Le L, Alffenaar JW, Hak E, Abdulah R, Pradipta IS. Digital health technologies to improve medication adherence and treatment outcomes in patients with tuberculosis: Systematic review of randomized controlled trials. J Med Internet Res. 2022;24(2):e33062.
22. Lam CK, Pilote KMG, Haque A, Burzynski J, Chuck C, Macaraig M. Using video technology to increase treatment completion for patients with latent tuberculosis infection on 3-month isoniazid and rifapentine: An implementation study. J Med Internet Res. 2018;20(11). doi:10.2196/jmir.9825
23. Holzman SB, Zenilman A, Shah M. Advancing patient-centered care in tuberculosis management: a mixed-methods appraisal of video directly observed therapy. Open Forum Infect Dis. 2018 Apr;5(4):ofy046.
24. Guo P, Qiao W, Sun Y, Liu F, Wang C. Telemedicine technologies and tuberculosis management: A randomized controlled trial. Telemed e-Health. 2020;26(9):1150-1156. doi:10.1089/tmj.2019.0190.
25. Abubakar A, Asih BO, Cabu R. Patient adherence to tuberculosis treatment at the Maba City Health Center, East Halmahera. Leleani J Nurs Public Health. 2022;2(1):27–34.
26. Tukayo IJH, Hardyanti S, Madeso MS. Factors influencing adherence to anti-tuberculosis medication among pulmonary tuberculosis patients at Waena Primary Health Center. J Trop Papua Nurs. 2020;3(1):145–150.
27. Garfein RS, Doshi RP. Synchronous and asynchronous video observed therapy (VOT) for tuberculosis treatment adherence monitoring and support. J Clin Tuberc Other Mycobact Dis. 2019;17:100098. doi:10.1016/j.jctube.2019.100098.
28. Yunitasari R, Akbar IB, Nurmeliani R. Correlation between the performance of directly observed treatment supervisors and medication adherence among pulmonary tuberculosis patients. Bandung Conf Ser Med Sci. 2023;3(1):19–24. doi:10.29313/bcsms.v3i1.5478.
29. Octavia DR, Hermansyah A, Nita Y. The readiness and acceptance of patients with tuberculosis to use telecare. Pharm Educ. 2024;24(3):251-255. doi:10.46542/pe.2024.243.251255.
30. Octavia DR, Hermansyah A, Nita Y, Zairina E. Enhancing tuberculosis patient safety: The impact of interprofessional collaboration based telecare on drug-related problems in a randomized control trial. Indian J Tuberc. 2025;(April). doi:10.1016/j.ijtb.2025.04.010.
31. Pujihastuti N, Priyo P, Priyanto S. Whatsapp reminder and educational video to improve pulmonary tuberculosis patient control compliance during the pandemic. Media Keperawatan Indones. 2022;5(4):280-287.
32. Mulyani ES. Effect of video-based education on knowledge, attitude, and treatment adherence among pulmonary tuberculosis patients at the Klaten Regional Public Health Center. Gastron Ecuatoriana Tur Local. 2019;1(69):5–24.
33. Rachma W, Makhfudli, Wahyuni S. Effect of health education on knowledge and attitudes of pulmonary tuberculosis patients. Muhammadiyah Nurs J. 2021;6(3):137–149.
34. Sriwijaya RA, Kumala S, Keban SA. The effect of pharmacist education on therapeutic outcomes of pulmonary TB patients in the intensive phase at Persahabatan hospital, March–July 2015. Journal of Science Research. 2018;20(September):86–91.
35. Suarnianti, Selan C, Sumi S. Evaluation of peer group support and family support on treatment adherence among pulmonary tuberculosis patients: literature review. Health Sci Rev J. 2021;11(3):9–11.
36. Nataprawira H, Tirtosudiro A, Primaturia C, Hasbrima S. Effect of poster and leaflet media intervention on knowledge, attitudes, and behavior of Islamic boarding school students in Karawang

ISSN 2616-0684 (Print)
ISSN 2616-0692 (Electronic)

District regarding tuberculosis. Indones Public Health J. 2018;5(2):123–9.
37. Mutasar A, Irawan A, Kabuhung IE. Effect of android-based electronic media on improving tuberculosis patient knowledge: a literature review. Proc Sari Mulia Univ Nurs Natl Semin. 2020;2(4):25–37.
38. Aliva M, Rahayu H, Margowati S. Effect of health promotion through leaflet and WhatsApp media on adherence to iron tablet consumption among pregnant women. Indones J Midwifery. 2021;5(2):45–49.
39. Kamel Boulos MN, Giustini DM, Wheeler S. Instagram and WhatsApp in health and healthcare: An overview. Futur Internet. 2016;8(3):1-14. doi:10.3390/fi8030037.