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# Effectiveness of a WhatsApp Reminder Based on Continuity of Nursing Care to Improve Quality of Life among Patients with Pulmonary Tuberculosis

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## ABSTRACT

**Background:** Pulmonary tuberculosis (TB) remains a global health problem with high incidence and mortality, while adherence to first-line anti-tuberculosis drug (OAT) therapy remains low, risking treatment failure, relapse, and drug resistance. This study aimed to analyze the effectiveness of a WhatsApp reminder based on Continuity of Nursing Care (CoNC) on quality of life among pulmonary TB patients at Pringsewu Community Health Center, Lampung, Indonesia.

**Subjects and Method:** This quasi-experimental study used a pretest–posttest non-equivalent control group design at the Pringsewu Community Health Center, Lampung, from February 16 to March 14, 2026. From a source population of 150 registered TB patients on OAT treatment, 52 patients meeting inclusion/exclusion criteria were selected by purposive sampling and non-randomly allocated to an intervention group (n=26), receiving a WhatsApp reminder based on CoNC for 2–4 weeks with two-way communication, and a control group (n=26), receiving a medication reminder card. Quality of life and health status were measured as continuous variables using the EQ-5D-5L index and EQ-VAS. Between-group differences in change scores (Δ) were assessed using the Mann–Whitney U test.

**Results:** Quality of life and health status improved significantly in the intervention group after the intervention ($p<0.001$), while no significant pre–post differences occurred in the control group ($p=0.317$ and $p=0.180$, respectively). The improvement (Δ) was significantly greater in the intervention group than in the control group ($p<0.05$).

**Conclusion:** The WhatsApp reminder based on continuity of nursing care effectively improves quality of life and health status among pulmonary TB patients and is recommended as a technology-based strategy in TB control programs at primary healthcare settings.

**Keywords:** pulmonary tuberculosis, WhatsApp reminder, continuity of nursing care, quality of life.

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## BACKGROUND

Pulmonary tuberculosis (TB) remains a significant global health problem and is categorized as a high-burden disease in Indonesia. In Lampung Province, the number of TB cases remains relatively high and fluctuating, while in Pringsewu Regency, cases increased from 1,146 in 2022 to 1,168 in 2023, with Pringsewu

Community Health Center contributing the highest number of suspected cases, reaching 620 individuals (Health Office of Pringsewu Regency, 2024). One of the main challenges in TB control is the low level of patient adherence to first-line anti-tuberculosis drug (OAT) treatment, which requires a minimum duration of six months; non-adherence may lead to treatment failure, relapse, and drug resistance (Simamora et al., 2024).

Treatment adherence is influenced by multiple factors, including patient knowledge, family support, quality of interaction with healthcare providers, as well as psychological factors such as self-efficacy and quality of life, all of which play a crucial role in determining treatment outcomes (Sary, 2024). Currently, tuberculosis control primarily focuses on microbiological cure through sputum smear examination (BTA) as an indicator of treatment success. However, this approach has not adequately addressed the physical, mental, and social impacts that reduce patients' quality of life and influence treatment outcomes. Quality of life is a multidimensional concept encompassing physical, social, psychological, economic, and spiritual aspects. In general, it reflects an individual's perception of their position in life, influenced by cultural context, values, goals, and expectations. This concept emphasizes patients' subjective evaluation of their lives rather than relying solely on clinical assessments (Mone, 2023).

Previous studies have shown that digital interventions such as telephone reminders, mHealth applications, and WhatsApp-based reminders can improve TB treatment adherence; however, most of these interventions are still one-way, not continuous, and have not comprehensively integrated therapeutic relationships and continuity of care. In addition, current TB care approaches remain suboptimal in providing holistic and continuous patient-centered care. Therefore, a research gap exists in the limited utilization of simple technology-based interventions integrated with the continuity of nursing care concept, which encompasses informational, management, and relational aspects simultaneously (Margineanu et al., 2022). The use of WhatsApp as a reminder medium based on continuity of nursing care represents a promising strategy, as it enables continuous education, reminders, and two-way communication to improve patient adherence to OAT treatment. Therefore, this study aims to analyze the effectiveness of WhatsApp reminders based on continuity of nursing care on Quality of Life among pulmonary tuberculosis patients at Pringsewu Community Health Center.

## SUBJECTS AND METHOD

### 1. Study Design

This study employed a quantitative approach with a quasi-experimental pretest–posttest control group design to analyze the effectiveness of a WhatsApp reminder based on continuity of nursing care on Quality of Life among pulmonary tuberculosis patients. The study was conducted in Pringsewu, Lampung, Indonesia, from February 16 to March 14, 2026.

### 2. Population and Sample

The population in this study consisted of all pulmonary tuberculosis patients undergoing first-line anti-tuberculosis drug (OAT) treatment, with a source population of 150 registered patients in the working area of Pringsewu Primary Health Center, Lampung.

The sampling technique used was purposive sampling based on predefined inclusion and exclusion criteria aligned with the study objectives. From this population, 52 participants who met the eligibility criteria and agreed to participate were recruited consecutively during the study period until the required sample size was achieved.

The inclusion criteria were: (1) patients diagnosed with pulmonary tuberculosis, (2) currently undergoing first-line OAT therapy,

(3) able to access and use WhatsApp communication, and (4) willing to participate in the study.

The exclusion criteria included: (1) patients with severe comorbid conditions, (2) patients who were unable to complete the intervention period, and (3) patients with communication limitations. This study employed a quasi-experimental design with a pretest–posttest non-equivalent control group approach; therefore, group allocation was conducted using a non-randomized method. Participants were divided into two groups: 26 participants in the intervention group and 26 participants in the control group. The intervention group received a WhatsApp-based reminder grounded in CoNC, while the control group received standard care using a medication reminder card. Group allocation was conducted based on feasibility and to minimize potential contamination between groups.

The sample size was determined using GPower software version 3.1. The calculation was based on an independent t-test model (two groups), with an assumed large effect size (d = 0.8), a significance level (α) of 0.05, and a statistical power of 0.80, resulting in a required sample size of 26 participants per group (total n = 52). The selection of a large effect size was based on prior studies indicating substantial effects of digital reminder interventions on treatment adherence and quality of life. Although the primary outcome analysis employed non-parametric tests (Mann–Whitney U test and Marginal Homogeneity test), the independent t-test model in GPower was used as an approximation due to the absence of a direct non-parametric equivalent in the software. Sample criteria were established to control for potential confounding variables that could influence the dependent variable.

**3. Study Variables**

In this study, the independent variable was a WhatsApp reminder based on Continuity of Nursing Care (CoNC), while the dependent variables included quality of life among patients with pulmonary tuberculosis.

**4. Operational Definition of Variables**

The independent variable was a WhatsApp reminder based on CoNC, implemented as a structured intervention consisting of informational, management, and relational continuity delivered over 2–4 weeks with three messages per week and two-way communication.

The dependent variable was quality of life among patients with pulmonary tuberculosis, measured using the EQ-5D-5L and EQ Visual Analogue Scale (VAS). The EQ-5D-5L comprises five dimensions of health, with responses converted into an index score using the Indonesian value set (range <0 to 1). The EQ-VAS assesses perceived health status on a scale of 0–100.

Quality of life was categorized as low (<0.50), moderate (0.50–0.74), and high (≥0.75). Health status was classified as poor (0–49), normal (50–69), good (70–84), and very good (85–100). These cut-off points were adopted from previous health-related quality of life studies to enable interpretative clinical grouping, as no universally standardized categorical thresholds exist for EQ-5D index and EQ-VAS scores. All variables were analyzed using ordinal data interpretation for statistical analysis.

**5. Study Instrument**

The measurement instruments used in this study consisted of several standardized tools with established validity and reliability. Quality of life was measured using the EQ-5D-5L instrument, which covers five key dimensions and is complemented by a Visual Analog Scale (VAS); this instrument has been internationally validated and has an Indonesian value set with proven validity and reliability. In addition, the implementation of the

WhatsApp-based reminder intervention grounded in Continuity of Nursing Care (CoNC) was documented using an intervention log to ensure consistency in delivery, frequency, and patient responses throughout the study period.

**6. Data Analysis**

Univariate analysis was conducted to describe the frequency distribution, central tendency, and characteristics of each study variable, including quality of life and health status among patients with pulmonary tuberculosis.

Bivariate analysis was performed to examine differences and effects between variables, specifically the effectiveness of WhatsApp reminders based on Continuity of Nursing Care (CoNC) and patient outcomes. Normality of data was assessed using the Shapiro–Wilk test. Because the data for EQ-5D index and EQ-VAS were not normally distributed, non-parametric statistical tests were applied.

Within-group comparisons of pre- and post-intervention outcomes were analyzed using the Wilcoxon signed-rank test to assess changes in quality of life and health status before and after the intervention. Between-group comparisons (intervention and control groups) were analyzed using the Mann–Whitney U test to determine differences in outcomes between independent groups.

Statistical significance was set at $p < 0.05$. In addition to p-values, effect size and 95% confidence intervals were reported to determine the magnitude and clinical relevance of the intervention effect.

Quality of life (EQ-5D index) and health status (EQ-VAS) were treated as continuous non-parametric data. No categorical reclassification was used in inferential analysis, ensuring consistency between measurement scale and statistical testing.

**7. Research Ethics**

Research ethical issues, including informed consent, anonymity, and confidentiality, were carefully addressed throughout the study process. Participants were informed about the purpose of the study, and their participation was entirely voluntary. The research protocol was reviewed and approved by the Health Ethics Committee of Aisyah Pringsewu, Lampung, Indonesia, with approval number 1057/27/01/2026. All participants received comprehensive information regarding the study objectives, procedures, potential risks, and benefits. Written informed consent was obtained from all participants prior to data collection. Participants were assured that they could withdraw from the study at any time without any consequences to their medical treatment or nursing care.

## RESULTS

**1. Sample characteristics**

Based on Table 1, the distribution of respondents according to demographic characteristics in the intervention and control groups is described, with a total of 52 respondents. The majority of respondents in the intervention group were aged 40–59 years, totaling 17 individuals (65.38%), while in the control group, most were also aged 40–59 years, totaling 15 individuals (57.69%). The majority of respondents in the intervention group were male, totaling 14 individuals (53.85%), and in the control group, most were also male, totaling 12 individuals (46.15%). Most respondents in the intervention group were laborers, totaling 11 individuals (42.31%), while in the control group, the majority were also laborers, totaling 9 individuals (34.62%) the level of education, the majority were ≥ bachelor's degree with a total of 107 (53%). The distribution of the characteristics of the research subjects is described in Table 1.

**Table 1. Characteristics of Respondents in the Intervention and Control Groups**

| Characteristics | Intervention Group (n) | % | Control Group (n) | % |
|---|---|---|---|---|
| **Age (based on WHO classification)** | | | | |
| Adolescents (10–19 years) | 1 | 3.85 | 1 | 3.85 |
| Young adults (20–39 years) | 8 | 30.77 | 10 | 38.46 |
| Adults (40–59 years) | 17 | 65.38 | 15 | 57.69 |
| **Gender** | | | | |
| Male | 15 | 57.69 | 14 | 53.85 |
| Female | 11 | 42.31 | 12 | 46.15 |
| **Occupation** | | | | |
| Laborer | 11 | 42.31 | 9 | 34.62 |
| Farmer | 2 | 7.69 | 6 | 23.08 |
| Housewife | 10 | 38.46 | 8 | 30.77 |
| Private employee | 1 | 3.85 | 3 | 11.54 |
| Civil servant | 2 | 7.69 | 0 | 0.00 |

**2. Bivariate Analysis.**

Based on Table 2, within-group comparisons of pre- and post-intervention outcomes were analyzed using the Wilcoxon signed-rank test. In the intervention group, the results showed a statistically significant improvement in both quality of life and health status after the intervention ($p < 0.001$), indicating that the WhatsApp reminder based on CoNC was associated with an improvement in patient outcomes.

In contrast, the control group showed no statistically significant differences in quality of life and health status between pre- and post-measurements ($p = 0.317$ and $p = 0.180$, respectively), indicating that no meaningful changes occurred during the study period. Furthermore, between-group comparison of the magnitude of change (Δ score) using the Mann–Whitney U test showed a statistically significant difference between the intervention and control groups ($p < 0.05$), showed that the improvement in the intervention group was significantly greater than that in the control group.

**Table 2. Changes in Quality of Life and Health Status Before and After Intervention**

| Characteristics | Pre | | Post | | p |
|---|---|---|---|---|---|
| | n | % | n | % | |
| **Quality of Life (Intervention)** | | | | | < 0.001 |
| High | 1 | 3.8 | 24 | 92.3 | |
| Moderate | 0 | 0.0 | 2 | 7.7 | |
| Low | 25 | 96.2 | 0 | 0.0 | |
| **Quality of Life (Control)** | | | | | 0.317 |
| High | 0 | 0.0 | 0 | 0.0 | |
| Moderate | 3 | 11.5 | 1 | 3.8 | |
| Low | 23 | 88.5 | 25 | 96.2 | |
| **Health Status (Intervention)** | | | | | < 0.001 |
| Poor | 24 | 92.3 | 0 | 0.0 | |
| Normal | 2 | 7.7 | 4 | 15.4 | |
| Good | 0 | 0.0 | 22 | 84.6 | |
| Very good | 0 | 0.0 | 0 | 0.0 | |
| **Health Status (Control)** | | | | | 0.180 |
| Poor | 25 | 96.2 | 22 | 84.6 | |

| Characteristics | Pre | | Post | | p |
|---|---|---|---|---|---|
| | n | % | n | % | |
| Normal | 1 | 3.8 | 4 | 15.4 | |
| Good | 0 | 0.0 | 0 | 0.0 | |
| Very good | 0 | 0.0 | 0 | 0.0 | |

## DISCUSSION

The present study found that patients who received the WhatsApp-based reminder intervention grounded in Continuity of Nursing Care (CoNC) showed significant improvements in quality of life and health status between the pretest and posttest measurements. In contrast, no significant changes were observed in the control group for either quality of life or health status. The greater improvement observed in the intervention group suggests that structured and continous support through WhatsApp may contribute to better patient outcomes during tuberculosis treatment.

The improvement in quality of life is consistent with the multidimensional nature of this construct. Quality of life encompasses physical, psychological, social, environmental, and other aspects of an individual's well-being and is influenced by both individual and environmental conditions (Wu et al., 2024; Aggarwal, 2019; Bakhtiar, 2025). In this study, patients in the intervention group reported improvements in their ability to perform daily activities and psychological conditions, while complaints such as fatigue, activity limitations, anxiety, and social discomfort were less prominent after the intervention. These changes are relevant because tuberculosis can affect patients beyond their physical condition, including psychosocial and economic dimensions of life (Datta et al., 2020; Maulida, 2025).

The absence of significant changes in the control group provides an important comparison. Most respondents in the control group remained in the same quality-of-life and health-status categories during the study period. However, this finding should not be interpreted as indicating that standard care is ineffective in all circumstances. Rather, it suggests that the additional structured support provided in this study may have contributed to the different pattern of change observed between the groups. Previous research similarly indicates that tuberculosis patients may experience reduced quality of life and that targeted interventions and continuity of care can support improvements in patient outcomes (Aggarwal, 2019; Datta et al., 2020).

One possible explanation for the observed improvement is the continuous communication provided through the WhatsApp platform. Reminder-based interventions can serve as cues to action by prompting patients to engage in recommended health behaviors, consistent with the Health Belief Model (Pujihastuti et al., 2022). Digital interventions, including SMS, mobile applications, and web-based reminders, have also been reported to improve treatment adherence and treatment-related outcomes among tuberculosis patients (Fuadiati et al., 2023). In addition, mHealth interventions have reported potential to improve health behaviors and clinical outcomes among patients with chronic diseases (Indawati et al., 2025). Thus, the findings of this study support the potential role of a simple digital platform in complementing routine tuberculosis care.

The use of WhatsApp may be particularly relevant because it allows reminders, education, communication, and monitoring to be delivered through a single and widely accessible platform. Other digital adherence technologies, including SMS, mobile applications, video observed therapy, and electronic

medication monitoring, have also been used to support medication-taking behavior (Maro et al., 2024). Previous studies have reported positive effects of WhatsApp-based education and interactive reminders on treatment adherence and quality of life among tuberculosis patients (Faisal, 2021; Pujihastuti et al., 2022). Compared with more specialized digital systems, WhatsApp may offer practical advantages because it can facilitate two-way communication without requiring patients to use a separate platform.

The findings can also be understood from the perspective of continuity of care. Continuity of care refers to care that is experienced by patients as coherent, consistent, and integrated over time according to their needs and preferences (Nurjannah et al., 2022). Continuity supports communication, coordination, trust, shared decision-making, and patient engagement, which may contribute to better healthcare experiences and outcomes (Bahr and Weiss, 2019; Figueroa et al., 2020). In the present intervention, WhatsApp provided a mechanism for maintaining contact between nurses and patients beyond conventional face-to-face encounters. This is particularly relevant for tuberculosis treatment, which requires sustained patient engagement over an extended period.

Within CoNC, nurses have an important role in maintaining informational, management, and relational continuity. Through WhatsApp, nurses can provide consistent treatment information, reminders, monitoring, and emotional support while reinforcing patients' motivation to continue treatment (Luna-Aleixos et al., 2024). The intervention therefore extends the continuity-of-care process into a digital environment rather than functioning solely as a medication reminder. This may explain why the observed changes were not limited to treatment-related behavior but were also reflected in quality of life and health status.

The findings are also relevant to healthcare delivery in settings where resources for continuous patient monitoring may be limited. Continuity and coordination of care in such settings may depend on accessible forms of communication, family support, community resources, and social innovation (Hayashi, 2020). WhatsApp provides one feasible option for maintaining communication between healthcare providers and patients. Nevertheless, the observed improvements should be interpreted within the scope of the outcomes measured in this study. The mechanisms through which the intervention influenced quality of life and health status, including the relative contribution of adherence, psychosocial support, and other factors, were not directly examined.

This study found significant improvements in patients' quality of life and health status following a WhatsApp-based reminder intervention grounded in Continuity of Nursing Care, whereas no significant pretest-posttest changes were observed in the control group. The findings suggest that integrating accessible digital communication with continous nursing support may be a useful complementary approach in tuberculosis care. The intervention provides a practical mechanism for maintaining communication, reminders, education, and monitoring throughout treatment.

The findings have implications for nursing practice and tuberculosis service delivery. Healthcare providers, particularly nurses, may consider integrating WhatsApp-based communication into continuity-of-care strategies to provide reminders, health education, monitoring, and ongoing support. At the service level, such interventions could complement routine tuberculosis care and strengthen patient engagement without requiring a complex digital platform. However, implementation should be accompanied

by clear communication procedures, appropriate monitoring, protection of patient privacy, and defined responsibilities for healthcare providers.

Several limitations should be considered when interpreting the findings. First, the study measured changes in quality of life and health status but did not directly examine the mechanisms underlying these changes. Second, factors that may influence quality of life and health status, such as psychosocial conditions, family support, and treatment-related experiences, were not comprehensively assessed. Third, the findings reflect the study period and population and may not be directly generalizable to all tuberculosis patients or healthcare settings. Therefore, the results should be interpreted as evidence of an association between the CoNC-based WhatsApp intervention and the observed changes rather than as definitive evidence of the underlying causal mechanisms.

Future studies should examine the mechanisms through which WhatsApp-based continuity-of-care interventions influence quality of life and health status. Longitudinal studies with larger and more diverse populations are recommended to assess whether the observed improvements are sustained over time. Future research could also incorporate treatment adherence, psychosocial factors, family support, and clinical outcomes as potential mediating or moderating factors. Comparative studies evaluating WhatsApp with other digital adherence technologies may further clarify which intervention components are most effective and feasible for routine tuberculosis care.

## AUTHOR CONTRIBUTION

All authors contributed to the conception and design of the study, data collection, data analysis, interpretation of the findings, and manuscript preparation. All authors critically reviewed and revised the manuscript, approved the final version, and agreed to be accountable for all aspects of the work.

## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this article.

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