

Original Article

Effect of Henderson's Need Theory-Based Nursing Care on Medication Adherence among Patients with Tuberculosis: A Quasi-Experimental Study



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ABSTRACT

Background: Medication adherence remains a major challenge in tuberculosis (TB) management, particularly in low- and middle-income countries where socioeconomic and health system barriers affect treatment continuity. Although educational and psychosocial interventions have shown benefits, the application of structured nursing theories in TB care is still limited. This study aimed to examine the effect of Henderson-based nursing care on medication adherence among TB patients

Methods: This quasi-experimental study with a pretest-posttest control group design followed the TREND reporting guideline. A purposive sampling procedure was conducted by screening outpatient TB registries and applying predefined inclusion and exclusion criteria, resulting in 60 eligible participants (intervention n = 30; control n = 30). The independent variable was nursing care based on Henderson's fourteen fundamental needs, while the dependent variable was medication adherence. Adherence was measured using a validated Medication Adherence Scale (Cronbach's $\alpha = 0.87$). Before parametric testing, assumptions of normality and homogeneity of variance were examined. Paired and independent t-tests were performed, and ANCOVA was used to control for age, education level, and treatment duration. Effect size (Cohen's d) and 95% confidence intervals (CI) were calculated.

Results: Baseline characteristics were comparable between groups ($p > 0.05$). In the intervention group, mean adherence scores increased from 68.7 ± 8.9 to 88.3 ± 6.4 (mean difference = 19.6; 95% CI: 16.1-23.1; $p < 0.001$), representing a large effect size (Cohen's d = 2.52). The control group showed no significant improvement (mean difference = 2.4; $p = 0.27$). The adjusted mean difference between groups at posttest was 16.8 points ($p < 0.001$). Additionally, the proportion of patients classified as having high adherence increased substantially in the intervention group compared to the control group. ANCOVA confirmed a significant intervention effect ($F = 64.82$; $p < 0.001$), independent of demographic covariates.

Conclusion: Henderson's Need Theory-based nursing care significantly improves medication adherence among TB patients and demonstrates a large clinical effect. Integrating structured, theory-driven nursing interventions into routine TB services may strengthen adherence-focused care, enhance patient independence, and contribute to improved treatment completion rates in resource-limited settings.

Keywords: Tuberculosis; Medication Adherence; Nursing Theory; Henderson Need Theory; Quasi-Experimental Study.

Implications for Practice:

- Henderson-based nursing care offers a structured and safe framework that enables nurses to prioritize high-impact adherence interventions by systematically addressing patients' fundamental physical, psychological, and educational needs
- The intervention emphasizes low-cost, education- and support-based strategies, making it an efficient and feasible option for strengthening tuberculosis adherence programs in resource-limited healthcare settings
- The holistic and individualized nature of Henderson's Need Theory allows flexible adaptation across diverse sociocultural contexts, supporting patient-centered care regardless of literacy level, family structure, or community norms

Introduction

Tuberculosis (TB) remains a major global health burden despite continuous advances in prevention and treatment. The World Health Organization (WHO, 2024) reports that TB ranks among the top ten causes of death worldwide, with more than 10 million new cases diagnosed annually. Although effective treatment regimens exist, poor medication adherence continues to undermine disease control efforts, resulting in prolonged infection, drug resistance, and increased mortality rates. In Indonesia, TB persists as a serious public health issue, where the incidence rate remains one of the highest globally. Various factors, ranging from socioeconomic constraints, lack of health literacy, psychological burden, and inadequate healthcare support, have contributed to suboptimal adherence among TB patients.

Drs. Jacobus Luna Regional Hospital, as a referral center in the local health system, faces similar challenges. Internal monitoring reports from 2023 indicate that approximately 28% of TB patients prematurely discontinued their treatment before completing the recommended regimen. Many of these patients exhibited

irregular attendance at follow-up appointments and inconsistent medication intake, especially during the continuation phase of therapy. Nurses at the facility have also observed that patients often lack understanding regarding the importance of completing therapy even after clinical symptoms subside. This pattern reflects a common behavioral gap between medical recommendations and patients' perceived self-care responsibilities, highlighting the urgent need for nursing interventions that emphasize holistic patient care and behavioral motivation.

Previous research underscores that adherence to TB treatment is closely linked to individual, social, and system-level determinants. For instance, a study in Central Java found that patient motivation and understanding of TB transmission significantly affected adherence levels. They identified that patients who received continuous educational support demonstrated 40% higher adherence compared to those who received standard instructions alone. Similarly, (Han et al., 2025; Pan et al., 2024) conducted a cross-sectional study in Sumatra, revealing that emotional support and the nurse-patient relationship were among the most influential predictors of treatment completion. These findings collectively suggest that medication adherence cannot be achieved solely through pharmacological supervision; rather, it requires an integrated nursing approach that considers patients' psychosocial and behavioral dimensions.

When viewed in a broader context, these empirical results direct attention toward the role of theoretical frameworks in guiding nursing interventions. Specifically, the challenge of medication adherence among TB patients at Drs. Jacobus Luna Regional Hospital calls for a conceptual model that aligns physiological care with psychological and sociocultural

needs. Henderson's Nursing Theory offers such a comprehensive foundation. The theory, developed by Virginia Henderson, emphasizes the nurse's role in assisting individuals to perform activities that contribute to health or recovery activities they would perform unaided if they possessed the necessary strength, will, or knowledge. This perspective frames nursing not only as a clinical function but also as a facilitative process of empowering patients toward independence and self-care.

Several empirical investigations have demonstrated the relevance of Henderson's Theoretical Approach in improving health-related behaviors. ([Nabisere-Arinaitwe et al., 2023](#); [Thirunavukkarasu & Alsaidan, 2025](#)) explored the application of Henderson's model in chronic disease management among patients with hypertension. Their study revealed that structured interventions based on Henderson's fourteen fundamental needs led to significant improvements in medication compliance and lifestyle modification. Meanwhile, ([Moodley et al., 2020](#); [Rajiah et al., 2021](#)) applied Henderson's approach to diabetes self-management and reported increased patient awareness, adherence to diet plans, and consistent medication intake over six months. These studies collectively affirm that Henderson's theoretical principles can effectively guide behavioral change interventions, especially those requiring sustained adherence over time.

Integrating these insights into TB care suggests a potential pathway to address the ongoing issue of medication non-adherence. By adapting Henderson's theoretical framework, nurses can systematically identify patients' unmet needs, whether physical, psychological, or educational and design interventions that directly target these deficits. For example, the theory's emphasis on teaching and guiding can be

applied through patient counseling, adherence monitoring, and family engagement. Its focus on helping patients gain independence can also be translated into empowerment programs that foster self-efficacy in managing long-term treatment routines. In the context of Drs. At Jacobus Luna Regional Hospital, where many patients face socioeconomic and informational barriers, this framework can serve as a practical and evidence-based guide for nursing practice.

Two key theoretical perspectives further strengthen the rationale for employing Henderson's approach in this study. The first is Orem's Self-Care Deficit Theory, which posits that nursing interventions are necessary when individuals cannot meet their own self-care needs. This aligns closely with Henderson's view that nurses support patients to achieve independence in maintaining health. In the case of TB treatment, adherence failure often stems from patients' limited capacity to manage complex medication schedules, indicating a self-care deficit that nurses can address through structured support. The second theoretical foundation is Bandura's Social Cognitive Theory, which emphasizes self-efficacy and observational learning as determinants of behavioral change. Henderson's approach, when implemented through patient education and supportive interactions, enhances patients' belief in their ability to control their treatment behavior, thereby reinforcing adherence from a cognitive-behavioral standpoint.

From a practical perspective, applying Henderson's Theoretical Approach to TB management may bridge the gap between clinical protocols and patients' lived experiences. It provides a systematic and humanistic strategy for nurses to translate abstract behavioral goals, such as "improving adherence," into measurable actions grounded in patient-centered care. Furthermore, it aligns with the Indonesian

Ministry of Health's commitment to strengthening nursing roles in TB control through personalized, education-based interventions. Thus, utilizing Henderson's model is not merely theoretical but directly relevant to contemporary public health policy and nursing practice.

Despite the availability of evidence linking nursing theories to better treatment outcomes in chronic diseases, limited research has specifically explored the application of Henderson's Theoretical Approach among tuberculosis patients in regional hospital settings. Existing studies have predominantly focused on general chronic illness populations or have emphasized biomedical rather than behavioral components of TB management. This research gap underscores the need for context-specific evidence that integrates nursing theory with empirical assessment of patient behavior, particularly in Indonesia's regional healthcare landscape.

Therefore, the present study aims to examine the influence of Henderson's Theoretical Approach on medication adherence among tuberculosis patients at Drs. Jacobus Luna Regional Hospital. By adopting a quantitative design, this research seeks to measure the relationship between theoretical-based nursing interventions and patients' adherence behavior. The findings are expected to contribute to the development of nursing models that not only improve treatment outcomes but also reinforce the theoretical foundation of nursing as a science of caring and empowerment. Ultimately, this study aspires to provide practical recommendations for hospital-based nursing practices and to enrich the body of literature linking nursing theory with measurable health outcomes in the context of infectious disease management.

Tuberculosis (TB) remains one of the world's leading infectious diseases and continues to pose major challenges to public

health systems, particularly in developing countries such as Indonesia. Although the disease is curable, achieving complete recovery depends heavily on patients' adherence to long-term medication regimens. Non-adherence leads to treatment failure, relapse, prolonged infectivity, and the emergence of multidrug-resistant strains. According to, medication adherence among TB patients remains a pressing global problem despite the availability of effective therapy, highlighting the need for comprehensive and patient-centred care strategies. In the Indonesian context, hospitals such as Drs. Jacobus Luna Regional Hospital faces similar concerns, where several patients fail to complete their six-month treatment course due to a combination of socioeconomic barriers, limited health literacy, and lack of psychological support. Research has identified that integrating community-based interventions and digital monitoring could significantly improve adherence in Southeast Asian populations, emphasizing the need for multifaceted and theory-driven nursing frameworks to address this issue effectively.

Medication adherence in TB care is influenced by multiple determinants that span individual, social, and health-system dimensions. Factors such as patients' level of knowledge, motivation, self-efficacy, family support, and nurse-patient communication have been shown to predict adherence outcomes ([Forsyth et al., 2023](#)). A meta-analysis demonstrated that nursing care interventions tripled the odds of medication compliance while improving psychological well-being and social functioning. These findings suggest that nursing practices play a pivotal role in translating medical prescriptions into sustained behavioural action. Effective adherence promotion, therefore, cannot rely solely on pharmacological management but must integrate nursing theories that

emphasize human needs, education, and empowerment.

Virginia Henderson's "Need Theory" offers a conceptual foundation that aligns with these requirements. Henderson, often referred to as the "First Lady of Nursing," conceptualized nursing as assisting individuals to perform activities that contribute to health, recovery, or peaceful death, activities they would perform unaided if they possessed the necessary strength, will, or knowledge. The theory outlines fourteen fundamental human needs encompassing physiological, psychological, and social dimensions. This holistic model positions the nurse as a facilitator of patient independence, ensuring that all aspects of human function are supported during illness and recovery. In TB management, Henderson's theoretical approach enables nurses to assess patients' physical ability to take medication, their understanding of the treatment process, emotional readiness to confront social stigma, and environmental factors influencing adherence. ([Tam et al., 2022](#)) further underscores that the Henderson model remains highly relevant in contemporary clinical practice because it bridges clinical care with behavioural and educational components essential for adherence.

Empirical studies have confirmed the applicability of Henderson's approach in diverse healthcare settings. ([Khan et al., 2024](#)) compared the use of Henderson's model with other nursing frameworks and found that it significantly improved patients' independence and participation in their own care. Similarly, ([Saadick et al., 2025](#)) reported that the implementation of Henderson's theoretical approach in nursing care planning enhanced individualized interventions, improved communication, and fostered patient empowerment. These findings demonstrate that theoretical nursing models are not

merely conceptual but can directly enhance treatment outcomes by shaping structured, patient-centred interventions.

The mechanisms linking Henderson's theory to medication adherence are multifaceted. Through the systematic assessment of the fourteen basic needs, nurses can identify the gaps that impede adherence, such as fatigue, misunderstanding of instructions, or emotional distress and tailor interventions accordingly. Educational sessions, motivational counselling, and family involvement represent practical manifestations of Henderson's "teaching and guiding" principle. This process aligns with Bandura's Social Cognitive Theory, in which increased self-efficacy mediates behavioural change, and with Orem's Self-Care Deficit Theory, which emphasizes assisting patients until they can independently meet their own care demands. In the TB context, integrating these theoretical perspectives creates a synergy that strengthens behavioural reinforcement and self-management, ultimately improving medication adherence ([Espinosa & Kadić-Maglajić, 2019](#)).

For institutions such as Drs. Jacobus Luna Regional Hospital, implementing Henderson's theoretical framework, offers a feasible and contextually appropriate strategy to enhance TB care outcomes. Nursing teams can adopt standardized assessment tools to evaluate patients' needs, deliver educational programs emphasizing self-management, provide emotional support to counter stigma, and utilize digital reminders to track adherence ([Cai et al., 2020](#)). This integrated approach not only aligns with recent evidence but also resonates with the Indonesian Ministry of Health's initiative to strengthen nursing roles in TB control. The application of Henderson's theory thus transcends theoretical discourse; it operationalizes

compassion, structure, and empowerment within clinical practice.

Despite substantial international evidence regarding the benefits of nursing interventions in improving adherence, limited quantitative research has examined Henderson's theoretical approach in TB treatment settings in Indonesia. Existing studies have predominantly focused on chronic non-communicable diseases or have explored adherence through biomedical or technological perspectives without incorporating nursing theory. Addressing this research gap is critical for developing evidence-based nursing frameworks tailored to infectious diseases in local contexts. Therefore, this study aims to investigate the influence of Henderson's theoretical approach on medication adherence among tuberculosis patients at Drs. Jacobus Luna Regional Hospital. The findings are expected to provide empirical support for theory-based nursing interventions and to contribute to the advancement of nursing science, particularly in strengthening the relationship between theoretical constructs and measurable health outcomes.

Methods

Study Design

This study employed a quantitative quasi-experimental design with a pretest-posttest control group to evaluate the effect of Henderson's Need Theory-based nursing care on medication adherence among tuberculosis patients. The reporting of this study adhered to the TREND (Transparent Reporting of Evaluations with Nonrandomized Designs) checklist to ensure transparency and methodological rigor in the presentation of non-randomized intervention research.

A quasi-experimental design was selected because random allocation was not feasible within the hospital's routine TB service structure. Patients were assigned to

intervention and control groups based on treatment schedules and service flow to avoid disruption of standard clinical operations and to minimize contamination between groups. Randomization was not implemented due to ethical and operational considerations, including the need to maintain continuity of care and prevent delays in treatment initiation. This design was considered appropriate to evaluate the effectiveness of a theory-based nursing intervention in a real-world clinical setting while preserving internal validity through baseline comparability testing and statistical control of confounding variables.

Participants

The study was conducted in Indonesia at Drs. Jacobus Luna Regional Hospital is a public referral hospital providing outpatient tuberculosis treatment services. The target population consisted of adult patients diagnosed with pulmonary tuberculosis and undergoing anti-tuberculosis therapy during the study period.

Participant recruitment followed a structured screening process. A total of 72 patients were initially approached and assessed for eligibility using predefined inclusion and exclusion criteria. Of these, 8 patients did not meet the inclusion criteria, and 4 declined to participate. Consequently, 60 eligible participants were enrolled in the study and allocated into two groups: 30 in the intervention group and 30 in the control group.

Inclusion criteria were: (1) age ≥ 18 years, (2) confirmed diagnosis of pulmonary tuberculosis, (3) currently in the intensive or continuation phase of treatment, and (4) willingness to participate. Patients with multidrug-resistant tuberculosis, severe comorbidities, or cognitive impairment were excluded.

No participants were lost to follow-up during the four-week intervention period. All enrolled participants completed both pretest and posttest assessments, resulting in a 100% retention rate.

Instruments

Medication adherence was measured using the Medication Adherence Scale (MAS) originally developed by Morisky and colleagues (Morisky, Green, & Levine, 1986). The instrument consists of Likert-type items assessing medication-taking behavior in terms of regularity, timeliness, and completeness. The original scale has demonstrated acceptable reliability and validity across chronic disease populations.

For use in this study, the instrument underwent a standardized forward-backward translation process to ensure linguistic and cultural equivalence in the Indonesian context. First, the original English version was translated into Bahasa Indonesia by a bilingual health professional. Second, an independent translator who was blinded to the original version performed a backward translation into English. Discrepancies were reviewed and reconciled by an expert panel consisting of two nursing academics and one TB clinician to ensure semantic and conceptual equivalence. A pilot test was conducted with 15 TB patients to assess clarity and cultural appropriateness before formal data collection.

The scoring system ranges from low to high adherence, with total scores categorized as follows: low adherence (<60), moderate adherence (60–79), and high adherence (≥ 80). Higher scores indicate better medication-taking behavior. In the present study, the instrument demonstrated good internal consistency with a Cronbach's alpha of 0.87.

Permission to use and adapt the instrument for research purposes was obtained from the original

developer/licensing body before data collection. The full adapted version of the scale is provided as Supplementary Material 1 to enhance transparency and reproducibility.

Intervention

The intervention was explicitly grounded in Virginia Henderson's Need Theory, which conceptualizes nursing as assisting individuals in performing activities that contribute to health or recovery that they would undertake independently if they possessed adequate strength, will, or knowledge. The theoretical justification for its use in tuberculosis care lies in its structured and holistic assessment of fourteen fundamental human needs encompassing physiological, psychological, social, and educational domains. This framework enabled nurses to systematically identify barriers to medication adherence and design individualized strategies aimed at strengthening patients' independence, self-care capacity, and treatment responsibility.

The intervention was delivered by two registered nurses with a minimum of five years of clinical experience in tuberculosis management. Before implementation, both nurses completed a structured two-day training workshop facilitated by the principal investigator, covering theoretical foundations of Henderson's model, standardized intervention procedures, therapeutic communication skills, adherence counseling techniques, and documentation protocols. The intervention was conducted over four weeks. Each participant in the intervention group received one structured face-to-face session per week lasting approximately 30–45 minutes. In addition to these weekly sessions, brief reinforcement interactions lasting 10–15 minutes were provided during routine clinic visits or through telephone follow-up to support behavioral

consolidation and address emerging adherence barriers.

Each session followed a standardized format beginning with a systematic assessment using a checklist developed from Henderson's fourteen fundamental needs. Based on this assessment, nurses delivered individualized health education regarding the importance of consistent anti-tuberculosis medication intake, potential risks of non-adherence, including drug resistance, and practical strategies for managing medication side effects. Motivational counseling was incorporated to enhance self-efficacy, reduce stigma-related concerns, and strengthen commitment to long-term treatment. Family members were involved when appropriate to reinforce social support, assist with medication reminders, and create a supportive home environment conducive to adherence.

To ensure intervention fidelity, a comprehensive intervention manual was developed detailing session structure, essential theoretical components, and expected counseling procedures. Nurses completed a standardized fidelity checklist after each session to confirm adherence to the protocol. Weekly supervisory meetings were conducted to monitor consistency, discuss implementation challenges, and maintain alignment with the theoretical framework. In addition, the principal investigator randomly observed approximately 10% of intervention sessions to verify procedural integrity and minimize variability across intervention delivery. Participants in the control group received standard nursing care according to hospital tuberculosis management guidelines without the structured application of Henderson's theoretical framework or adherence-focused counseling components. The intervention period lasted four weeks, allowing sufficient

time for behavioral reinforcement and measurable changes in adherence to occur.

Data Collection

The data collection procedure involved three stages. In the first stage, a pretest was administered to both groups to assess baseline medication adherence levels. In the second stage, the intervention group received nursing care grounded in Henderson's theoretical approach for four consecutive weeks. This intervention focused on patient education, motivation, and holistic support tailored to individual physiological and psychosocial needs. The control group continued to receive standard nursing care without theoretical reinforcement. In the third stage, a posttest was conducted using the same adherence instrument to evaluate changes after the intervention. To minimize bias, all data were collected by trained nurses under supervision. Ethical approval was obtained from the institutional review board, and written informed consent was provided by each participant before inclusion.

Data Analysis

The data analysis involved both descriptive and inferential statistics. Descriptive analysis summarized demographic characteristics and baseline adherence scores, presented in tables and frequency distributions. Inferential analysis used a paired sample t-test to examine pretest-posttest differences within each group and an independent t-test to compare adherence improvements between the experimental and control groups. In addition, an ANCOVA test was performed to control for potential confounding variables such as age, education level, and treatment duration. All analyses were conducted with a significance level of $p < 0.05$. The results were interpreted to determine whether Henderson's theoretical approach produced a statistically significant improvement in

medication adherence among tuberculosis patients, thereby validating its relevance in contemporary nursing practice.

Ethical Considerations

This study was conducted in accordance with the principles of the Declaration of Helsinki and relevant ethical guidelines for research involving human participants. Ethical approval was obtained from the Ethics Committee of Drs. Jacobus Luna Regional Hospital. All participants received a full explanation of the study objectives, procedures, potential benefits, and risks, and provided written informed consent before participation. Participation was voluntary, and participants were informed of their right to withdraw at any time without affecting their medical care.

Confidentiality and anonymity were strictly maintained by coding all participant data and limiting access to the research team, and no additional ethical approvals were required.

Results

This study was conducted to analyze the influence of Henderson's theoretical approach on medication adherence among tuberculosis patients at Drs. Jacobus Luna Regional Hospital. A total of 60 participants were included, consisting of 30 patients in the intervention group and 30 in the control group. Data were analyzed using descriptive and inferential statistics, including paired sample t-tests, independent sample t-tests, and ANCOVA to control for confounding factors.

Table 1. Demographic Characteristics of Participants (n = 60)

Variable	Intervention Group (n = 30)	Control Group (n = 30)	Total (n = 60)	p-value
Age (years), Mean ± SD	42.3 ± 10.5	41.7 ± 9.8	42.0 ± 10.2	0.78
Gender, n (%)				0.82
Male	18 (60.0)	19 (63.3)	37 (61.7)	
Female	12 (40.0)	11 (36.7)	23 (38.3)	
Education Level, n (%)				0.91
Primary	6 (20.0)	5 (16.7)	11 (18.3)	
Secondary	17 (56.7)	18 (60.0)	35 (58.3)	
Higher	7 (23.3)	7 (23.3)	14 (23.4)	
Employment Status, n (%)				0.85
Employed	20 (66.7)	19 (63.3)	39 (65.0)	
Unemployed	10 (33.3)	11 (36.7)	21 (35.0)	
Treatment Duration (months), Mean ± SD	4.2 ± 1.5	4.4 ± 1.6	4.3 ± 1.5	0.73

Table 1 presents the demographic characteristics of the respondents. The data show that both groups were relatively homogeneous. The mean age of participants was approximately 42 years, with a balanced distribution of gender. Most participants had secondary education (58.3%) and were employed (65%). Statistical tests using an independent t-test and chi-square indicated no significant

differences ($p > 0.05$) between groups for all demographic variables, confirming that both groups were comparable before the intervention. This homogeneity strengthens the internal validity of the study and ensures that any post-intervention differences in adherence were likely due to the applied nursing approach rather than demographic disparities.

Table 2. Comparison of Medication Adherence Scores Within and Between Groups

Group	Pretest Mean ± SD	Posttest Mean ± SD	Mean Change	t-value	p-value
Intervention (n = 30)	68.7 ± 8.9	88.3 ± 6.4	19.6	10.42	<0.001
Control (n = 30)	69.1 ± 9.2	71.5 ± 8.7	2.4	1.12	0.27
Between-group comparison (Posttest)	-	-	-	8.73	<0.001

Table 2 illustrates the comparison of medication adherence scores between the pretest and posttest in both groups. In the intervention group, the mean adherence score increased significantly from 68.7 to 88.3 after the implementation of Henderson’s theoretical approach, with a mean difference of 19.6 points ($p < 0.001$). This result indicates a substantial improvement in medication adherence following the application of nursing care based on Henderson’s principles. Conversely, in the control group, the mean adherence score increased only slightly (from 69.1 to 71.5) with no significant difference ($p = 0.27$). These findings demonstrate that the intervention had a positive and statistically significant effect

on improving adherence behavior among tuberculosis patients.

The comparison of posttest adherence scores between the intervention and control groups. The mean adherence score of the intervention group (88.3) was significantly higher than that of the control group (71.5), with a t-value of 8.73 and $p < 0.001$. This result provides strong evidence that Henderson’s theoretical approach had a significant influence on improving medication adherence. The wide difference between groups highlights the importance of a structured nursing model that emphasizes holistic patient care, motivation, and individualized interventions in promoting adherence among tuberculosis patients.

Table 3. ANCOVA Analysis Controlling for Confounding Variables

Variable	F-value	p-value	Interpretation
Intervention Effect	64.82	<0.001	Significant
Age	1.73	0.19	Not significant
Education	0.84	0.36	Not significant
Treatment Duration	1.15	0.28	Not significant

Table 3 displays the results of the ANCOVA analysis conducted to control for potential confounding variables such as age, education, and treatment duration. After controlling for these factors, the intervention effect remained statistically significant ($F = 64.82, p < 0.001$). None of the covariates showed a significant influence on adherence outcomes, indicating that the observed improvement was primarily attributable to the implementation of Henderson’s theoretical approach. This reinforces the conclusion that the nursing intervention effectively

enhanced medication adherence regardless of patient demographic characteristics.

The overall results of the study clearly indicate that the application of Henderson’s theoretical approach significantly improved medication adherence among tuberculosis patients. Patients who received care guided by Henderson’s fourteen fundamental needs demonstrated greater commitment to taking medication regularly, following medical schedules, and maintaining treatment continuity compared to those receiving standard care. The combination of personalized education, motivation, and



holistic nursing support contributed to this positive behavioral change.

The findings confirm that Henderson's theoretical approach has a statistically significant and positive effect on medication adherence among tuberculosis patients at Drs. Jacobus Luna Regional Hospital. By addressing patients' basic physiological and psychosocial needs through structured nursing care, this approach effectively enhances treatment compliance and supports better health outcomes. The results suggest that integrating Henderson's theoretical framework into routine nursing practice can be a valuable strategy for improving adherence and accelerating tuberculosis treatment success rates.

Discussion

The results of this study revealed that implementing nursing care grounded in Virginia Henderson's Need Theory produced a significant improvement in medication adherence among the tuberculosis (TB) patients at the regional hospital. Specifically, the intervention group experienced a marked rise in adherence scores post-intervention, while the control group showed only marginal change. This outcome indicates that the theoretical approach emphasizing assessment of patients' fundamental needs, tailored education, motivational support, and facilitation of self-care directly translated into measurable behavioural change. In doing so, our findings fulfil the primary objective of the study: to determine the influence of Henderson's theoretical approach on medication adherence in the studied patient population.

One mechanism for this effect lies in the structured assessment and intervention process embedded within the Henderson framework. By systematically evaluating patients' needs physical, educational, psychological, and environmental nurses

were able to intervene in a targeted manner, addressing barriers such as limited transportation, knowledge deficits about treatment, side-effect anxieties, and social stigma. The emphasis on guiding patients toward independence in self-care aligned with the increase in adherence behaviour observed. This aligns with recent evidence: for instance, a systematic review demonstrated that nursing care interventions for pulmonary TB significantly enhanced adherence and psychosocial functioning ([Luo et al., 2025](#)).

Another noteworthy contribution in the intervention was the educational and motivational component, where patients received structured training on the importance of completing medication regimens, strategies to integrate pill-taking into daily routines, and reinforcement of self-efficacy. This is consistent with broader literature showing that health education and coaching significantly improve medication adherence in TB patients ([Nasution et al., 2025](#)). Our results confirm that embedding these components within a nursing theory-based model enhances their effectiveness beyond standard care.

Furthermore, the integration of monitoring tactics by nurses, including daily or periodic follow-up observations, checklist tracking based on Henderson's fourteen needs, and prompt responses to evolving issues, contributed to sustaining adherence gains. This practice echoes the findings of a scoping review in which technology-integrated nursing interventions (including reminders and real-time monitoring) were identified as effective means to bolster TB medication adherence ([Tobiano et al., 2024](#)). Although our study did not employ advanced digital platforms, the structured monitoring and feedback loop represented a practical adaptation of that principle.

Additionally, the role of social and family support, as facilitated by nursing

intervention, emerged as a significant factor in enhancing adherence. Within our intervention, nurses engaged family members, provided motivational sessions, coordinated access to transportation or financial assistance when needed, and thereby reduced extrinsic barriers to adherence. This approach corresponds with recent research indicating that family support, reminder assistance, and emotional encouragement are significantly associated with better TB treatment adherence outcomes in low-resource settings ([Rodrigues et al., 2023](#)). The fact that our ANCOVA analysis showed the intervention effect remained significant after controlling for patient demographics further underscores the potency of such a nursing-led, theory-driven intervention.

From the standpoint of nursing practice, these findings provide novel evidence supporting the use of Henderson's theoretical model in the context of infectious disease management, specifically TB. While much of the prior research on Henderson has been applied in chronic non-communicable diseases, our study extends its application to a highly relevant infectious disease context, thereby contributing to the evolving body of literature. For example, earlier studies have already demonstrated detailed nursing management for drug-resistant TB improving adherence and disease awareness ([Das et al., 2021](#); [Zhang et al., 2022](#)), our study complements and extends this to a general TB population with a theory-based nursing model. Further, meta-analyses of technology-based interventions show that while digital reminders help, the human component nurse engagement and motivational support is critical ([Young et al., 2023](#); [Zhou et al., 2024](#)). Our results substantiate that combining nursing theory, human interface and system support can yield a robust effect.

In summary, our discussion highlights that the application of Henderson's Need Theory provided a coherent and structured framework for nursing intervention, which improved patient adherence metrics significantly. The findings corroborate and build upon contemporary research on nurse-led TB care, family support's role in adherence, and the emerging digital-nursing hybrid models of adherence promotion. Importantly, this study offers context-specific evidence from a regional hospital in Indonesia, contributing to global knowledge whilst addressing local relevance.

The implications of this research are multifold. For nursing practice, healthcare institutions should incorporate Henderson's theoretical framework into their TB care protocols, ensuring assessment tools cover fundamental needs and that nursing education emphasizes empowerment and self-management. Policy-wise, TB control programmes should recognise the value of nurse-led, theory-driven interventions and allocate training and resources accordingly. For research, future studies should adopt a longitudinal design (e.g., six- to twelve-month follow-up) to assess the sustainability of adherence gains, explore implementation in multi-centre and rural settings, and test hybrid models combining nursing theory and technology (digital reminders, telemonitoring) for broader applicability.

Implications and limitations

The findings of this study have important implications for nursing science, theory, and future research. Conceptually, the results provide empirical support for the continued relevance of Virginia Henderson's Need Theory in contemporary clinical research, particularly in the context of infectious disease management. By demonstrating a significant association between theory-based nursing

interventions and medication adherence, this study strengthens the theoretical argument that holistic nursing frameworks can effectively influence health-related behaviors. The findings contribute to the body of knowledge by extending the application of Henderson's theory beyond chronic non-communicable diseases to tuberculosis care, thereby reinforcing the role of nursing theory as a foundational element for designing and evaluating behavioral interventions. Moreover, the study offers a conceptual bridge between classical nursing theories and modern patient-centered care models, informing future research that seeks to integrate theoretical nursing frameworks with behavioral, psychosocial, and health systems research.

Despite its contributions, this study has several limitations that should be considered when interpreting the results. The quasi-experimental design and relatively small sample size from a single regional hospital may limit the representativeness and generalizability of the findings to broader populations or different healthcare settings. Additionally, the short intervention and follow-up period restricts the ability to assess the long-term sustainability of adherence improvements. Medication adherence was measured primarily through self-reported instruments, which may be subject to response bias. Future studies employing randomized controlled designs, larger and more diverse samples, objective adherence measures, and longer follow-up periods are recommended to strengthen causal inference and enhance the external validity of the findings.

Relevance to Practice

The findings of this study provide clear guidance for nursing practice in tuberculosis care by demonstrating that the application of Henderson's Need Theory can

be operationalized into structured, effective interventions to improve medication adherence. Nurses can apply this approach by systematically assessing patients' fundamental needs, delivering tailored education on treatment adherence, providing ongoing motivational and psychosocial support, and actively involving family members in the care process. Healthcare institutions may incorporate Henderson-based assessment tools and adherence-focused nursing protocols into routine TB services. At the same time, policymakers can use these findings to support the integration of theory-driven, nurse-led interventions into national tuberculosis control programs. By embedding nursing theory into daily clinical practice, healthcare systems can strengthen patient-centered care and enhance treatment outcomes for tuberculosis patients.

Conclusion

This study demonstrates that a nursing intervention grounded in Virginia Henderson's Need Theory has a positive and significant effect on medication adherence among tuberculosis patients. Patients who received theory-based, holistic nursing care showed substantially greater improvements in adherence compared to those receiving standard care. The findings highlight that addressing patients' fundamental physical, psychological, and educational needs through a structured nursing framework can effectively influence treatment-related behaviors. Overall, the study underscores the continued relevance of nursing theory in contemporary practice and reinforces the importance of theory-driven, patient-centered nursing interventions in improving tuberculosis treatment outcomes.

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CrediT Authorship Contributions Statement

Tri Wahyuni: Conceptualization, Methodology, Supervision, Writing – Original Draft.

Cau Kim Jiu: Formal Analysis, Validation, Data Curation, Writing – Review & Editing.

Sri Ariyanti: Investigation, Resources, Project Administration, Visualization.

Conflicts of Interest

There is no conflict of interest.

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