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RESEARCH **Open Access**

Theory of Planned Behavior's Method on Knowledge and Preventive Behavior Toward Tuberculosis

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Abstract
Tuberculosis (TB) is an infectious disease that has become a global health concern, with Indonesia being the country with the second-highest number of pulmonary TB cases after India. The level of knowledge and preventive behavior regarding TB significantly influences both the spread and the success of TB treatment. This study aims to evaluate the impact of health education based on the Theory of Planned Behavior (TPB) on TB prevention knowledge and behavior among patients. The study design utilized a quasi-experimental approach with control and intervention groups, where the intervention was administered through face-to-face education and followed by smart chat support sessions for one month. A total of 50 respondents participated, divided into treatment and control groups. Data analysis employed the Wilcoxon Signed Ranks Test and Mann-Whitney tests. The study results show that the statistical analysis indicated a significant improvement in knowledge and preventive behavior in the intervention group post-intervention (p=0.000), while the control group showed no significant change. The finding of this this improvement suggests that TPB-based interventions, which encompass attitudes, subjective norms, and perceived behavioral control, are effective in influencing health behavior changes. The conclusion is TPB-based health education through face-to-face sessions and smart chat follow-ups can be recommended as an intervention strategy to enhance TB prevention knowledge and behavior among high-risk populations.

Keywords: Behavior, Education, Knowledge, Theory of Planned Behavior, Tuberculosis.

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1. INTRODUCTION

Tuberculosis (TB) is an infectious disease that poses a significant global health concern. Indonesia ranks as the country with the second highest incidence of pulmonary TB after India, with 1.02 million cases reported (Santoso, et al., 2023). According to the WHO (2016) Global Tuberculosis Report, Indonesia has a high TB burden, with a mortality rate of 40 per 100,000 population and 395 new cases per 100,000 population (WHO, 2016; Loya, Santoso & Paju, 2024; Santoso & Sasmito, 2020). The island of East Nusa Tenggara contributes to this burden with a recorded 20,599 TB cases and a treatment adherence rate of only 57.7% (Badan Penelitian dan Pengembangan Kesehatan, 2019; Santoso et al., 2023). In 2018, West Sumba reported 1,066 cases of smear-positive pulmonary TB (Badan Penelitian dan Pengembangan Kesehatan, 2019; Santoso et al., 2024).

A survey conducted among 20 respondents at two public health centers in West Sumba in 2023 revealed that 17 patients with smear-positive pulmonary TB had limited knowledge about the disease, which negatively impacted their preventive behaviors. Behavior encompasses all human activities, whether observable to others or not (Ramadhayanti et al., 2018). Prevention refers to actions taken to curb disease transmission and protect individuals from infection. Poor behavioral outcomes among TB patients are often attributed to insufficient knowledge about TB and its transmission (Damanik et al., 2023). Factors influencing self-care behavior include knowledge related to preventive screening, educational background, health literacy, and cohabitation with family members (Marhamah, 2019).

This study employs the Theory of Planned Behavior (TPB) as its conceptual framework. The main constructs within TPB have demonstrated a significant association with behavioral intention, allowing for the prediction of intention to engage in preventive actions (Barati et al., 2015). Effective preventive behaviors for pulmonary TB require high levels of patient commitment and a stable intention. Education aimed at enhancing compliance based on the Theory of Planned Behavior (TPB) is crucial for reinforcing patients' intent to maintain adherence.

To enhance patient adherence, a structured intervention for TB patient compliance is essential for fostering compliant behavior. According to Shmueli, (2021) in the Theory of Planned Behavior, behavior is shaped by belief-based approaches that form intentions and drive individuals to engage in specific actions. Key intention determinants include attitude, subjective norms, and perceived behavioral control. This concept is supported by a meta-analysis by Fischer & Karl, (2022), which identified significant relationships between attitude, subjective norms, and perceived behavioral control with behavioral intention. Similarly, Hagger et al., (2022) indicated that the TPB structure effectively fosters compliance intentions. This study focuses on the application of Health Education based on the Theory of Planned Behavior using a Face-to-Face and Smart Chart Method to enhance knowledge and preventive behaviors in pulmonary TB patients. This study aims to evaluate the impact of health education based on the Theory of Planned Behavior (TPB) on TB prevention knowledge and behavior among patients.

2. RESEARCH METHOD

This study design is a quasi-experimental research with a one-group pre- and post-test with control group design, wherein the intervention group received Health Education based on the Theory of Planned Behavior, using Face-to-Face and Smart Chart methods, while the control group received standard treatment procedure explanations from the nurse. The sample size calculation was performed using the PS-Power Sample Size Calculation software. Sample selection was conducted through convenience sampling from February to August 2024 across three health centers in West Sumba, which report the highest number of pulmonary TB cases. A total of 50 patients were included, divided into an intervention group and a control group with 25 patients each. Inclusion criteria required patients to be over 21 years old, receiving TB

treatment without severe complications, able to comprehend instructions, and possessing adequate hearing. Exclusion criteria encompassed MDR-TB patients, those with hearing impairments, or patients with comorbidities. Patients who passed away before the post-test were classified as drop-outs.

The research steps involved initially assigning respondents to either the intervention or control group, followed by a pre-test survey assessing knowledge, attitudes, and practices (KAP) among TB clients. Each pre-test required 15-20 minutes to complete. The control group only received standard information about tuberculosis treatment procedures from nurses in the two health centers in West Sumba, East Nusa Tenggara, Indonesia. The intervention group received educational sessions based on the Theory of Planned Behavior via Face-to-Face and Smart Chart methods. The face-to-face educational activity was conducted once, followed by twice-weekly smart chat messages over a one-month period. Subsequently, a post-test KAP survey was administered to TB clients after the intervention.

The research instruments utilized were standardized and had been validated for reliability. Knowledge, attitudes, and practices were assessed using the KAP survey (Zakaria et al., 2023). In addition, we noted lower reliability (Raykov's rho = 0.557). For reliability, Cronbach's alpha (for IRT and EFA) and Raykov's rho (for CFA) were used, with the value ≥ 0.65 (Cronbach's alpha) and ≥ 0.7 (Raykov's rho) considered acceptable.

The questionnaire employed to measure knowledge about pulmonary TB prevention consisted of 10 closed-ended questions using the Guttman scale, where correct answers were scored as 1 and incorrect answers as 0. To measure preventive behaviors for pulmonary TB, a 10-item questionnaire was used with positive statements on a Likert scale, with scores ranging from "always=4," "often=3," "sometimes=2," "seldom=1," to "never=0" (Tuharea et al., 2024).

Data analysis was performed using t-tests. Within-group differences were analyzed with Wilcoxon and Mann-Whitney tests and using statistical software. This study received ethical approval from the Research Ethics Committee of STIKes Bahrul Ulum Jombang, with ethics number 137/EC/KEPK-BU/I/2023, issued on January 27, 2024.

3. RESULTS AND DISCUSSION

Table 1. Demographic Characteristic Data of Respondents.

Characteristic		Treatment Group		Control Group		Total		*p*-value
		n	%	n	%	n	%	
Gender	Men	16	64	15	60	31	62	0.565
	Female	9	36	10	40	19	38	
Age	<40 years	11	44	12	48	16	26.7	0.782
	>41 years	14	56	13	52	44	73.3	

Table 1 presents a total of 50 respondents with tuberculosis, divided into two groups: 25 respondents in the intervention group and 25 in the control group. An equivalence test result indicated $p > 0.05$, suggesting no significant differences in gender, age, education level, occupation, or duration of TB between the intervention and control groups, indicating homogeneity across these characteristics. The data also reveals that the majority of respondents were men. In the intervention group, 16 respondents were men (64%) and 9 were female (36%), while in the control group, 15 were men (60%) and 10 were female (40%). Most respondents were over 41 years old compared to those under 40. In the intervention group, 14 respondents were over 41 (56%) and 11 were under 40 (44%). In the control group, 13 respondents were over 41 (52%) and 12 were under 40 (48%).

Table 2. Results of the Mann-Whitney U Test and Wilcoxon Signed Ranks Test for Knowledge and Behavior Scores in the Intervention and Control Groups.

Variable	Group	n	Pre-test		Post-test		p-value
			Mean	SD	Mean	SD	wilcoxon
Knowledge	Treatment	25	6.52	1.046	8.48	0.653	0.000
	Control	25	6.28	0.542	6.68	0.945	0.039
	Mean Difference		0.24		1.80		
	Mann-Whitney U Test		0.283		0.000		
Behavior	Treatment	25	23.28	1.458	32.16	1.405	0.000
	Control	25	21.92	1.706	22.84	2.285	0.000
	Mean Difference		1.36		9.32		
	Mann-Whitney UTest		0.234		0.000		

Table 2 indicates that the results of the Mann-Whitney U Test for the pre-test knowledge scores show a p-value of 0.283, which means there is no significant difference in knowledge between the intervention and control groups before the intervention was conducted. In contrast, the results of the Mann-Whitney U Test for the post-test knowledge scores show a p-value of 0.000, indicating a significant difference in knowledge between the intervention and control groups after the intervention. The results of the Wilcoxon Signed Ranks Test for the intervention group yield a p-value of 0.000, indicating a significant difference in knowledge before and after the intervention. The control group also shows a p-value of 0.039, indicating a difference in knowledge before and after the intervention.

Table 2 further shows the results of the Mann-Whitney U Test for the pre-test behavior scores, with a p-value of 0.234, meaning there is no significant difference in behavior between the intervention and control groups before the intervention. Conversely, the results of the Mann-Whitney U Test for the post-test behavior scores indicate a p-value of 0.000, signifying a significant difference in behavior between the intervention and control groups after the intervention. The Wilcoxon Signed Ranks Test for the intervention group also shows a p-value of 0.000, indicating a significant difference in behavior before and after the intervention. Similarly, the control group shows a p-value of 0.000, indicating a difference in behavior before and after the intervention.

DISCUSSION

Several studies indicate that demographic factors, such as age, gender, education, and occupation, play significant roles in the prevalence and treatment of TB. Males, particularly those over 40, generally have a higher risk of TB due to occupational and lifestyle factors (Bulu et al., 2023). Occupations such as farming expose individuals to dust and environmental hazards, which can worsen respiratory issues, thereby increasing susceptibility to TB (Bulu et al., 2023). Additionally, education levels often correlate with health literacy; individuals with lower educational attainment may have limited understanding of disease prevention methods and lack awareness about seeking timely medical care (WHO, 2020). Consequently, respondents with only primary education may have restricted access to TB prevention and treatment information (Irma et al., 2023). This underscores the importance of educational intervention programs, particularly for high-risk groups, to enhance the efficacy of TB prevention and control efforts (WHO, 2022).

The study findings indicate that prior to the intervention, both the control and treatment groups had a moderate level of TB-related knowledge. This suggests that while awareness exists, there is significant room for improvement in understanding TB causes, symptoms, and prevention strategies (Safaruddin & Aris, 2023). Previous research also shows that even if individuals have heard of TB, misconceptions about transmission and prevention are prevalent.

For example, many believe TB can only spread through direct contact, overlooking airborne transmission factors (Auliya et al., 2024).

Most respondents in both groups demonstrated a moderate level of preventive behavior before the intervention. This aligns with other studies Safaruddin & Aris, (2023) that show individuals, although familiar with basic preventive strategies such as covering their mouths when coughing or taking medications, often fail to adopt comprehensive preventive measures, like enhancing home ventilation or consistently wearing masks in public (Aja et al., 2022). Furthermore, individuals with mid-level education from rural backgrounds, as in this study, may have limited access to resources needed for optimal preventive practices. Rural communities and farmers often face healthcare access challenges, exacerbating the issue of inadequate TB prevention practices (Kementerian Kesehatan Republik Indonesia, 2021).

Educational interventions based on the Theory of Planned Behavior (TPB) are effective in enhancing adherence to preventive practices (Putra & Sari, 2020). TPB is founded on belief-driven approaches that shape intention, motivating individuals to adopt specific behaviors (Nisson & Earl, 2020). In this intervention, TPB-based face-to-face education guided patients to interact with their environment, learn about TB prevention, and understand the importance of a healthy environment to reduce transmission. As intentions and understanding of prevention are established, Smart Chat reminders are sent regularly to reinforce consistent preventive behaviors (Dewanti & Masfuri, 2023). This approach enables patients to implement TB prevention not only in the hospital setting but also at home and in social interactions.

In this intervention, respondents received guidance on proper coughing and sneezing techniques, sputum disposal, the use of personal eating and drinking utensils, and how to maintain a healthy home environment to prevent transmission (Dauletbayev, & Abdullayev, 2022). Face-to-face education sessions were conducted once, followed by twice-weekly Smart Chat reminders over a month. Face-to-face sessions allowed for direct information transfer and clarification of misconceptions surrounding TB transmission, symptoms, and prevention. This approach facilitated personal interaction where educators could address individual concerns and offer tailored advice (Santoso et al., 2024). Following up with Smart Chat sessions reinforced the knowledge provided during face-to-face meetings. Continued engagement through Smart Chat is critical, as TB Tumuhimbise & Musiimenta, (2021) is a disease requiring long-term treatment, and patients often need ongoing motivation and support to adhere to treatment regimens and preventive measures (Endriani et al., 2019).

After the educational intervention, both the control and treatment groups showed increased knowledge and behavior, with the treatment group exhibiting a more significant improvement. This indicates that structured health education programs based on the Theory of Planned Behavior, particularly when paired with continued engagement, are effective in enhancing TB-related knowledge and behavior (Putra & Sari, 2020). Similar findings have been reported in studies using health education to improve understanding and prevention behaviors for other infectious diseases, such as malaria and HIV/AIDS.

The findings of this study align with previous research emphasizing the importance of structured education programs in improving health outcomes. A similar study by Putra & Sari, (2020) demonstrated that TB education based on the Theory of Planned Behavior significantly increased knowledge and improved preventive behaviors among high-risk groups. Collectively, these studies suggest that targeted educational interventions, especially those based on established behavioral theories, are effective in enhancing health literacy and behavior.

The study presents several limitations that should be acknowledged. Firstly, the relatively small sample size comprising only 50 participants divided into two groups limits the generalizability of the findings to broader populations. Such a restricted sample may not adequately capture the heterogeneity of experiences and behaviors across different demographic or geographic contexts. Secondly, the one month duration of the intervention may

have been insufficient to capture sustained or long-term behavioral changes, thereby restricting the scope of outcome assessment. Furthermore, the quasi-experimental design employed in this study inherently lacks full control over extraneous variables, potentially introducing bias and limiting the ability to infer causality regarding the intervention's effects.

4. CONCLUSION

This study demonstrates the significant impact of health education based on the Theory of Planned Behavior in enhancing TB prevention knowledge and behavior. Face-to-face education, combined with ongoing Smart Chat sessions, proved to be an effective strategy for reinforcing learning and promoting sustained behavior change. Looking forward, these findings may inform public health strategies aimed at TB prevention, particularly in rural and underserved populations. By tailoring health education to the specific needs of various demographic groups and implementing continuous engagement techniques, substantial progress can be made in the fight against TB.

To address these limitations, future research is encouraged to utilize larger and more diverse samples across multiple regions, thereby enhancing the external validity and generalizability of the findings. Prolonging the duration of the intervention would also allow for a more robust assessment of its long-term efficacy in improving tuberculosis-related knowledge and preventive behavior. Moreover, adopting more rigorous methodological approaches such as randomized controlled trials (RCTs) could strengthen internal validity by minimizing potential biases and enhancing causal inference. Finally, future investigations should consider incorporating additional variables, such as social support mechanisms and accessibility of healthcare services, to provide a more holistic understanding of the determinants influencing tuberculosis prevention efforts.

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