

FULL PAPER

Preventing tuberculosis transmission in Madura, Indonesia: A health belief model-based approach

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Pulmonary Tuberculosis (TB) is one of the top 10 causes of death in the world. Various efforts have been made to prevent the transmission of pulmonary TB, but it has not yet had a positive impact, and the success is still low. The health belief model (HBM) is a theory related to health as a form of orientation for health behavior interventions. This study aimed to determine the Lung TB transmission prevention model with the health belief model theory in Sumenep District, Madura, Indonesia. The study design was cross-sectional and implemented in Sumenep District from August to September, 2021. The study population was 152 patients with pulmonary TB, and the authors used a simple random sampling technique of 110 patients. The influence between variables was analyzed using Structural Equation Modeling (SEM) with SmartPLS. Cues to action, perceived susceptibility, perceived barriers, and self-efficacy factors affect the prevention of transmission. Personal factors indirectly affect the transmission prevention through perceived susceptibility, perceived barriers, and self-efficacy. Personal factors have a direct effect on self-efficacy and an indirect effect on self-efficacy through perceived susceptibility. The perceived susceptibility factor indirectly affects the prevention of transmission through self-efficacy. The cues to action factor has an indirect effect on self-efficacy through perceived benefits. The prevention of pulmonary TB transmission model based on the health belief model is vital in supporting the increased effectiveness of preventing pulmonary TB transmission.

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KEYWORDS

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Introduction

Pulmonary Tuberculosis (TB) is one of the top 10 causes of death in the world [1]. It has received worldwide attention due to the various efforts to prevent transmission [2]. Pulmonary TB has been infecting one-third of the world's population [3]. It leads to deteriorating health in millions of people each

year and is the second leading cause of death from infectious diseases in the world [4].

According to the World Health Organization (WHO), by 2022, an estimated 10.6 million people will suffer from pulmonary TB, and 1.4 million will die. Indonesia is the second largest contributor of pulmonary TB cases worldwide after India,

with an estimated 969,000 cases [5]. East Java Province is in the top three with the number of Lung TB cases out of 34 provinces in Indonesia, and Sumenep Regency 2021 is the district with the highest number of Lung TB in East Java [6]. Based on data from the Sumenep District Health Office in 2023, several health center areas have a high incidence of pulmonary TB, namely Puskesmas Bluto, Puskesmas Pamolokan, and Puskesmas Gapura.

Pulmonary TB is hazardous because of its rapid transmission through airborne droplets when coughing and sneezing [7]. The transmission of lung TB germs is due to the lack of awareness of sufferers, families, and the environment to prevent transmission of Lung TB [8]. Various efforts to overcome the transmission of lung TB have been optimized in various countries since 1995 [9]. However, Pulmonary TB still causes health problems in the community that cause sickness, disability, and a very high mortality rate [10].

The World Health Organization (WHO) developed a strategy to end the global pulmonary TB epidemic by 2035 by reducing the incidence and mortality rates by 90% and 95%, respectively [11]. DOTS strategy recommendations (Directly Observed Treatment Shortcourse) from WHO as an effort to control Lung TB have not had a positive impact, and its success is still low [12]. especially the transmission of Lung TB in the Sumenep community is still very high [13].

Therefore, a model is needed to prevent the transmission of Lung TB in the Sumenep district so that the incidence rate decreases each year [14]. The health belief model (HBM) is proven potentially effective because this theory is used from a behavioral science perspective to prevent disease transmission [15]. The health belief model theory has been used since the early 1950s to maintain health-related behavior as a health behavior intervention orientation [16]. Based on the background above, the researcher needs to use the theory in this study on the prevention

model of Pulmonary TB transmission with the health belief model. This study aims to determine the prevention model of pulmonary TB transmission based on the health belief model in Madura, Indonesia.

Experimental

The design in this study was cross-sectional. This study was conducted at three health centers in the Sumenep district, namely Puskesmas Bluto, Puskesmas Gapura, and Puskesmas Pamolokan, and was conducted from August to September, 2024. The population in this study were all patients with pulmonary TB in three health centers in the Sumenep district, namely Puskesmas Bluto, Puskesmas Gapura, and Puskesmas Pamolokan, with as many as 152 patients. This study used a simple random sampling technique with a sample size of 110 pulmonary TB patients. At this stage, preliminary studies, research permits, and research instruments with questionnaires about demographic and respondent characteristic data were collected and analyzed. The authors collected the data by administering questionnaires tested for validity and reliability. Questionnaire measurements on the perceived susceptibility construct are categorized into low-risk, moderate-risk, and high-risk. The severity, perceived benefit, and self-efficacy are categorized into high, moderate, and low. The perceived barriers are categorized into low, moderate, and high. The classification of cues to action with indicators of health worker support, family support, and media information construct is categorized into high, moderate, and low. The classification of prevention of transmission of pulmonary tuberculosis (prevention of transmission) is categorized into good, sufficient, and deficient. Personal constructs with indicators of age, gender, education, occupation, income, and length of illness-data analysis using Structural Equation Modeling (SEM) Smart PLS.

Results and discussion

Almost half of the respondents were aged ≥ 58 (31.8%). Gender was mostly (55.5%) male. Education almost half (40.0%) graduated

from high school. Almost half (47.3%) were self-employed. Economic status was mostly (57.3%) \geq UMR. Length of illness was (61.8%) 1-2 years (Tables 1-3).

TABLE 1 Distribution of personal factors for patients with pulmonary TB in Sumenep District, Madura, Indonesia, in 2024

Indicator	F	Percentage (%)	
Age (years old)			Min: 13
≤ 15-25	17	15.5	Max: 83
26-36	22	20.0	Mean: 46.67
37-47	13	11.8	SD: 17.444
48-57	23	20.9	
≥ 58	135	31.8	
Total	110	100	
Sex			
Male	61	55.5	
Female	49	44.5	
Total	110	100	
Education			
Uneducated	12	10.9	
Elementary graduates	33	30.0	
Junior high school graduates	21	19.1	
Senior high school graduates	44	40.0	
Total	110	100	
Occupation			
Unemployed	12	10.9	
Farmers/fishers	32	29.1	
Self-employed	52	47.3	
Employee	14	12.7	
Total	110	100	
Income			
< minimum wage	47	42.7	
≥ minimum wage	63	57.3	
Total	110	100	
Illness duration			Min: 0.16
<1 year	27	24.5	Max: 9
1-2 years	68	61.8	Mean: 1.6670
> 2 years	15	13.6	SD: 1.67422
Total	110	100	

TABLE 2 Distribution of perceived susceptibility of lung TB in Sumenep District, Madura Indonesia, in 2024

No.	Category	Frequency	Percentage (%)
1	Low risk	28	25.5
2	Moderate risk	55	50.0
3	High risk	27	24.5
Total		110	100

TABLE 3 Distribution of perceived severity of lung TB in Sumenep District Madura, Indonesia, in 2024

No.	Category	Frequency	Percentage(%)
1	High	49	44.5
2	Moderate	47	42.7
3	Low	14	12.7
Total		110	100

TABLE 4 Distribution of perceived benefit of lung TB in Sumenep District Madura, Indonesia, in 2024

No.	Category	Frequency	Percentage (%)
1	High	19	17.3
2	Moderate	67	60.9
3	Low	24	21.8
Total		110	100

Table 4 reveals that most patients with pulmonary TB (60.9%) have moderate perceived benefits. Patients with Lung TB have perceived barriers almost entirely (78.2%) moderate barriers (Table 5).

TABLE 5 Distribution of perceived barrier of lung TB in Sumenep District Madura, Indonesia, in 2024

No.	Category	Frequency	Percentage(%)
1	Low barrier	8	7.3
2	Moderate barrier	86	78.2
3	High barrier	16	14.5
Total		110	100

TABLE 6 Distribution of lung TB cues to action in Sumenep District Madura, Indonesia, in 2024

Indicator	Category						Total	
	High		Moderate		Low		Σ	(%)
	F	(%)	F	(%)	F	(%)		
Health worker support	20	18.2	66	60.0	24	21.8	110	100
Family support	64	58.2	45	40.9	1	0.9	110	100
Media information	8	7.3	34	30.9	68	61.8	110	100

Table 6 indicates that patients with Lung TB have cues to action with indicators of health worker support mostly (60.0%) moderate, indicators of family support mostly (58.2%) high, and indicators of media information mostly (61.8%) low.

TABLE 7 Distribution of lung TB self-efficacy in Sumenep District Madura, Indonesia, in 2024

No.	Category	Frequency	Percentage (%)
1	High	36	32.7
2	Moderate	58	52.7
3	Low	16	14.5
Total		110	100

Table 7 shows that most patients with pulmonary TB have moderate self-efficacy (52.7%). Patients with pulmonary TB have

behavior to prevent the transmission of pulmonary TB. Most of them (58.2%) are sufficient (Table 8).

TABLE 8 Distribution of prevention of lung TB transmission in Sumenep District Madura, Indonesia, in 2024

No.	Category	Frequency	Percentage (%)
1	Good	17	15.5
2	Sufficient	64	58.2
3	Deficient	29	26.4
Total		110	100

This study uses SEM analysis to determine the prevention model of pulmonary TB transmission based on the health belief model in Madura, Indonesia. Based on the results of the convergent validity test output, six indicators have a factor loading value below 0.5, namely indicators of age, gender, education, and occupation on personal constructs, as well as indicators of family support and media information on cues to

action constructs removed from the model (Figure 1). The results of the Average

Variance Extracted (AVE) test obtained the value of all constructs > 0.5, indicating that the indicators can explain their factors, and the reliability test of all constructs obtained a composite reliability value > 0.6, which means that the described constructs are reliable (Table 9).

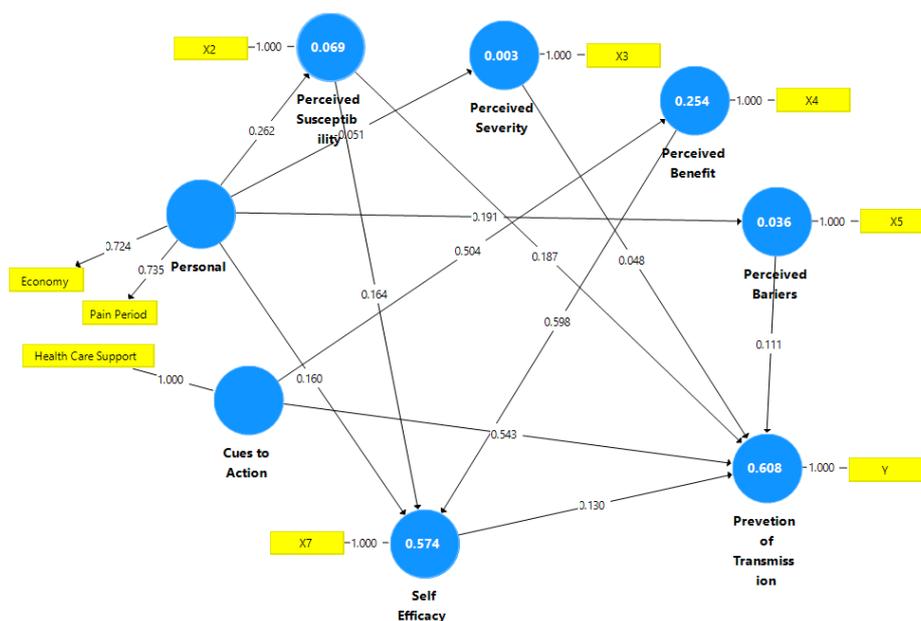


FIGURE 1 Factor loading model fit analysis

TABLE 9 Average Variants Extracted (AVE) and composite reliability values

	Composite Reliability	AVE
Cues to Action	1.0000	1.0000
Perceived Barriers	1.0000	1.0000
Perceived Benefit	1.0000	1.0000
Perceived Severity	1.0000	1.0000
Perceived Susceptibility	1.0000	1.0000
Personal	0.6949	0.5324
Prevention of Transmission	1.0000	1.0000
Self-Efficacy	1.0000	1.0000

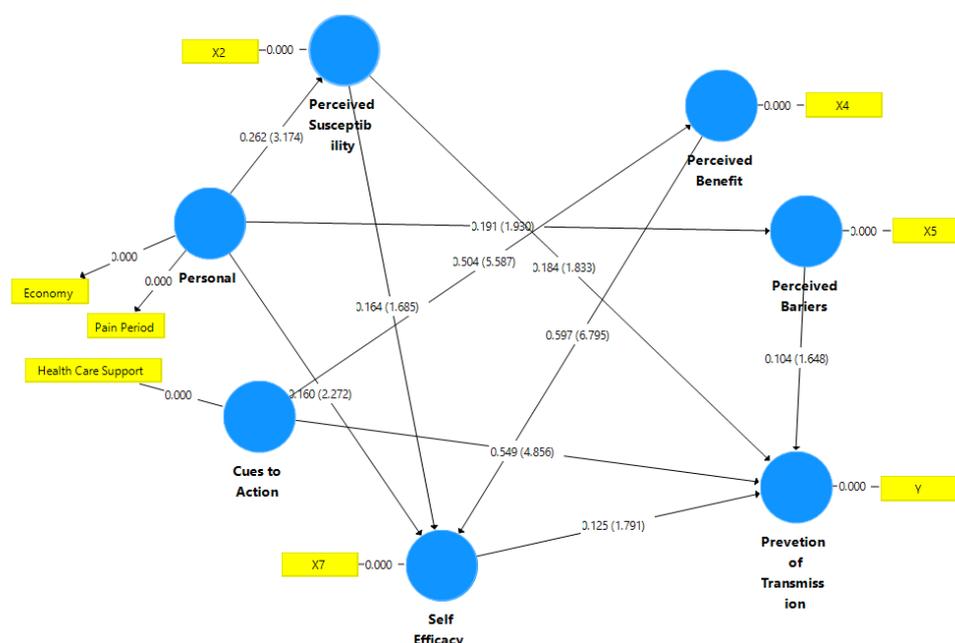


FIGURE 2 P-value model fit analysis

Figure 2 demonstrates that personal Lung TB on perceived susceptibility has a p-value of 0.262 (>0.05), so personal lung TB affects perceived susceptibility. Personal Lung TB on perceived barriers has a p-value of 3.191. The analysis for personal Lung TB on perceived barriers showed P-value = 0.191, which is significant ($P < 0.05$), so personal lung TB affects perceived barriers. Personal Lung TB on self-efficacy has a p-value of 3.160 (>0.05), so personal lung TB affects self-efficacy. Perceived susceptibility of lung TB to the prevention of transmission has a p-value of 3.184 (>0.05), so that perceived susceptibility of Lung TB affects the prevention of transmission. Perceived susceptibility of lung

TB to self-efficacy has a p-value of 3.164 (>0.05), so perceived susceptibility of Lung TB affects self-efficacy. Lung TB cues to action on perceived benefit has a p-value of 3.504 (>0.05), so lung TB cues to action affect perceived benefit. Lung TB cues to action on the prevention of transmission have a p-value of 0.549 (>0.05), so lung TB cues to action affect the prevention of transmission. Lung TB self-efficacy in the prevention of transmission has a p-value of 3.125 (>0.05), so lung TB self-efficacy affects the prevention of transmission. Perceived benefits of lung TB on self-efficacy has a p-value of 0.597 (>0.05), so the perceived benefits of lung TB affect self-efficacy. Perceived barriers of Lung TB to the

prevention of transmission have a p-value of 0.104 (>0.05), so perceived barriers to lung TB affect the prevention of transmission. Two pathways are not significant, namely personal lung TB to perceived severity and perceived severity to the prevention of transmission, because they have a p-value <0.05 , so they are removed from the pathway.

Discussion

The health belief model theory explains that perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy influence the prevention of transmission [17].

Cues to action is a cue for someone to take action or behave in the form of behavior [17]. Cues can be in the form of external and internal factors, such as support from health workers, messages from the mass media, and advice or recommendations from friends or other family members. Cues to action on indicators of health worker support have a direct effect on the prevention of transmission behavior (prevention of transmission) of pulmonary tuberculosis and have an indirect effect by increasing health knowledge and skills through health system support that makes one aware of the benefits of an action taken by a person so that it forms a person's belief to continue to behave healthily and ultimately make a proper prevention of transmission behavior [18].

Self-efficacy is a belief in one's ability to organize and carry out the expected actions to achieve goals [19]. Self-efficacy can influence his decisions about actions to achieve his goals, including his evaluation of various events encountered [20]. Self-efficacy affects one's personal goals in action. The higher a person's level of self-efficacy, the better the prevention of transmission behavior of pulmonary tuberculosis [21]. Personal factors such as economic level affect the formation of good self-efficacy. Personal factors in the form of a good economy are in line with high

knowledge. Therefore, it is easy to have confidence in behavior in preventing pulmonary TB [22]. Besides personal economic factors, the length of illness affects the self-efficacy of patients and families with pulmonary TB. The length of illness a person suffers will make them try to find treatment information and carry out all kinds of treatment to recover and prevent transmission [23].

Perceived susceptibility is a person's subjective perception of the risk of their health condition, including acceptance of diagnostic results and personal estimates [19]. Perceived susceptibility affects a person's behavior. The higher the perceived susceptibility of a person, the better the prevention of transmission behavior (prevention of transmission) of Lung TB [24]. Personal factors in the form of a good economy align with high knowledge to understand low feelings of vulnerability and obedient behavior in preventing good Pulmonary TB [25]. Besides personal economic factors, the length of illness affects the feelings of vulnerability of people with pulmonary TB. The length of illness a person suffers will make them feel highly vulnerable to infecting others [26].

Perceived barriers or perceived barriers to change, if individuals face obstacles found in carrying out a health behavior such as uncertainty, perceived side effects, nervousness, and something that might act as an obstacle for someone to behave healthily [17]. Perceived barriers affect a person's healthy behavior. The lower a person's perceived barriers, the better the prevention of transmission behavior of Pulmonary TB [27]. Personal factors in the form of economics affect feelings of barriers to healthy behavior, such as difficulty getting to health services, low health knowledge, and excessive worry [28]. Besides personal economic factors, the length of illness affects feelings of obstacles for patients and families with pulmonary TB. The length of illness

someone suffers will make sufferers saturated with trying to find treatment information and carry out all kinds of treatment [29].

Conclusion

Cues to action, perceived susceptibility, perceived barriers, and self-efficacy factors affect the prevention of transmission. Personal factors indirectly affect the prevention of transmission through perceived susceptibility, perceived barriers, and self-efficacy. Personal factors have a direct effect on self-efficacy and an indirect effect on self-efficacy through perceived susceptibility. The perceived susceptibility factor indirectly affects the prevention of transmission through self-efficacy. The cues to action factor indirectly affects self-efficacy through perceived benefits. The model of prevention of pulmonary TB transmission based on the health belief model has a vital role in supporting the increase in the effectiveness of preventing pulmonary TB transmission.

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Authors' Contributions

Mujib Hannan: substantial contribution to the conception and design, analysis and interpretation of data.

Emdat Suprayitno: Creating research discussion, conducting data analysis, assisting

in collecting research data, assisting in publication.

Yudhiakuari Sincihu: Drafting the concept of module material, coordination and Focus group discussion with a team of health experts, drafting research instruments, validity and reliability tests.

Cory Nelia Damayanti: data collection process, drafting the final report, drafting the KI submission, conducting the RAB report, coordinating with health experts

Ristrini: Drafting the Concept of the TB Transmission Prevention Model, Data Analysis and Assisting in Publication.

Conflict of Interest

The authors declare no conflict of interest.

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