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Article

Behavioral Risk Factors of Pulmonary Tuberculosis Based on the Health Belief Model: A Case-Control Study at Benowo Health Center, Surabaya

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Abstract

Pulmonary tuberculosis (TB) remains a major public health challenge in Indonesia. Behavioral factors, including perception and lifestyle, play an important role in influencing TB incidence. Objective: This study aimed to analyze the association between behavioral factors based on the Health Belief Model (HBM) and the incidence of pulmonary TB in the Benowo Health Center area, Surabaya. A case-control design was employed with 39 cases and 39 controls aged 15–60 years, selected using the Slovin formula and purposive sampling. Data were collected through structured questionnaires and analyzed using bivariate (Chi-square) and multivariate (logistic regression) tests. Significant factors associated with pulmonary TB incidence were poor perceived vulnerability (OR = 1.86), high perceived severity (OR = 2.84), and low self-efficacy (OR = 2.44). Other variables such as perceived benefits, barriers, and cues to action showed weaker associations. Behavioral factors, particularly vulnerability, severity, and self-efficacy, significantly influence pulmonary TB incidence in the Benowo Health Center area. Strengthening health education and community-based counseling is recommended to improve TB prevention and control.

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Introduction

Tuberculosis (TB) remains one of the leading infectious diseases globally, with an estimated 10.8 million new cases and 1.25 million deaths in 2023 (WHO, 2024). Indonesia ranks second after India, contributing about 10% of the global TB burden. In East Java, more than 73,000 cases were reported in 2024, and Surabaya accounted for over 12,000 cases, indicating that TB continues to be a major public health concern at both national and local levels [1]-[2]-[13].

Benowo District in Surabaya is among the ten sub-districts with the highest TB cases, reporting 63 cases in 2024. This area is characterized by high population density, poor housing ventilation, and inadequate sanitation, conditions that exacerbate TB transmission. A preliminary survey conducted in Sumberrejo Village showed that 64% of TB patients had risky behaviors, such as smoking indoors, poor adherence to treatment, and low preventive practices. In contrast, non-patients demonstrated healthier behaviors, including mask use and maintaining environmental hygiene [3]-[16]-[4]-[15].

According to the Health Belief Model (HBM), health behaviors are shaped by perceptions of susceptibility, severity, benefits, barriers, cues to action, and self-efficacy. These constructs are essential for understanding TB-related behaviors and designing effective interventions. However, limited

evidence exists on how these behavioral factors influence TB incidence at the community level in Surabaya[6]-[16]. This study aimed to analyze the relationship between behavioral factors based on the Health Belief Model and the incidence of pulmonary tuberculosis in the Benowo Health Center area, Surabaya[7]- [13].

Materials and Method

Research Design

The study used an observational analytic type with a case-control approach, where the case group consisted of confirmed Tuberculosis patients, while the control group consisted of individuals who were not infected with pulmonary Tuberculosis in the Benowo puskesmas area. The case-control approach was chosen because this design is effective in studying risk factors and causes of disease in populations with relatively rare occurrences. This study was retrospective, so the data used were historical data from medical records and surveys. The research was conducted at Benowo Health Center, Surabaya from December 2024 to March 2025.

Population and Sample

The population comprised all residents in the working area, with 63 confirmed TB cases in 2024. Using the Slovin formula (5% margin of error), the sample included 39 cases and 39 controls (total 78 respondents). Inclusion criteria were residents aged 15–60 years; cases were confirmed TB patients, while controls were healthy individuals without TB history. Respondents unwilling to participate or with incomplete data were excluded.

Instrumen

Data were collected through a validated HBM-based questionnaire and medical records. Variables measured included perceived susceptibility, severity, benefits, barriers, cues to action, and self-efficacy. Data analysis consisted of Univariate analysis for descriptive statistics,Bivariate analysis using the Chi-Square test with Odds Ratios (OR, 95% CI).

Data Analysis

Data were analyzed using univariate tests. Univariate analysis is an analysis to describe each variable. This analysis was used to describe the characteristics of each research variable, namely individual characteristics, attitudes and actions. In addition, bivariate tests were used to determine the risk of disease. Bivariate analysis used to analyze the magnitude of the risk between the two variables, by looking at the Odd Ratio (OR) value.

Ethics

This study has received ethical approval from the relevant institutions.

Results

Based on the results of data analysis on respondents' in table 1 perceptions of various aspects of the Health Belief Model (HBM), it is known that most respondents have good perceptions in assessing the risks and preventive measures of pulmonary tuberculosis disease. A total of 64.1% of respondents showed a good perception of vulnerability, which means they realized that they were at risk of developing TB disease.

Table 1
Distribution of univariate analysis results of health belief model theory

Variabel	Category	Number Of Responden	Percentage
Percieved Vurnerability	Good	50	64,1%
	Not Good	38	35,9%
Percieved Seriousness	Good	58	74,3%
	Not Good	23	25.7%

Percieved Benefits	Good	49	63,9%
	Not Good	29	37,1%
Percieved Of Barriers	Good	55	71,6%
	Not Good	23	29,4%
Percieved Encouraging Cues	Good	56	71,7%
	Not Good	22	29,3%
Percieved of Early Efficacy	Good	49	68%
	Not Good	29	32%

In addition, 74.3% of respondents had a good perception of seriousness, which reflects an understanding that TB is a serious disease and can have a negative impact on health. In terms of perceived benefits, 63.9% of respondents realized the importance of prevention and treatment as an effort to avoid TB disease. In terms of perceived barriers, 71.6% of respondents considered that the barriers that might arise in taking preventive measures were still within manageable limits, indicating a positive attitude. Furthermore, 71.7% of respondents had a good perception of cues to action, such as counseling, health information, and invitations from health workers that encouraged them to behave healthily. Finally, 68% of respondents showed a good perception of self-efficacy, meaning they felt capable of taking preventive measures and controlling their risk of TB. Overall, these results reflect that the majority of respondents have positive perceptions of important factors in preventing pulmonary tuberculosis. This provides a strong basis for designing education-based and behavior change interventions in the community.

Table 2
Distribution of bivariate analysis results of health belief model perceptions

Variable	Category	Nuber Of Cases	Control	Odd Ratio
Percieved Vurnerability	Good	22	28	1,37
	Not Good	17	11	
Percieved Seriousness	Good	27	31	1,72
	Not Good	12	8	
Percieved Benefits	Good	23	26	1,39
	Not Good	16	13	
Percieved Of Barriers	Good	26	29	1,45
	Not Good	13	10	
Percieved Encouraging Cues	Good	27	29	1,28
	Not Good	12	10	
Percieved of Early Efficacy	Good	23	27	1,56
	Not Good	16	12	

This study showed an association between the various dimensions of perception in the Health Belief Model (HBM) and the incidence of pulmonary tuberculosis. Each dimension showed a tendency for unfavorable perceptions to correlate with an increased risk of developing pulmonary tuberculosis. In the dimension of perceived vulnerability, it was found that most respondents with unfavorable perceptions were in the case group, amounting to 44.6% (17 respondents), while respondents with favorable perceptions of vulnerability were mostly in the control group at 71.7% (28 respondents). The Odds Ratio (OR) value of 1.37 indicates that respondents with unfavorable perceptions of vulnerability had a 1.37 times greater chance of experiencing pulmonary tuberculosis than those with favorable perceptions. Furthermore, in the dimension of perceived seriousness, respondents with unfavorable perceptions were found more in the case group at 31.7% (12 respondents), while in the control group,

79.4% (31 respondents) had a good perception of seriousness. The OR value of 1.72 indicated that respondents with unfavorable perception of seriousness had a 1.72 times higher risk of developing pulmonary tuberculosis. In the perceived benefit dimension, it was found that 41% (16 respondents) of the case group had unfavorable perceived benefits, while the control group was dominated by respondents with favorable perceived benefits at 67.3% (26 respondents). The OR of 1.39 indicated that respondents with unfavorable perceived benefits had a 1.39 times higher risk of developing pulmonary tuberculosis than those with favorable perceived benefits. The perceived barriers dimension showed that 33.3% (13 respondents) of the case group had unfavorable perceived barriers, while 75.4% (29 respondents) of the control group had favorable perceived barriers. With an OR value of 1.45, this result indicates that the greater the barriers perceived by respondents, the greater their risk of developing pulmonary tuberculosis. In terms of perceived cues to action, 46.8% (12 respondents) of the case group had unfavorable perceptions, while 65.5% (24 respondents) of the control group had favorable perceptions. The OR value of 1.28 indicates that respondents with poor perception of cues to action had a 1.28 times greater risk of developing pulmonary tuberculosis. Finally, in the dimension of perceived self-efficacy, 42.1% (16 respondents) of the case group had unfavorable perceptions of self-efficacy, while 69.2% (27 respondents) of the control group had good perceptions. The OR value of 1.56 indicates that respondents who felt unable to take preventive measures had a 1.56 times greater risk of developing pulmonary tuberculosis. Overall, these findings support the Health Belief Model theory which states that individual beliefs about risk, seriousness, benefits, barriers, and ability to act strongly influence disease prevention behavior. This finding is in line with previous studies that have shown that positive perceptions of risk and prevention play an important role in reducing the incidence of infectious diseases, including pulmonary tuberculosis. Therefore, HBM-based educative approaches that strengthen positive perceptions of the community need to be promoted in TB control program interventions (Table 2).

Discussion

Behavioral factors play an important role in determining the risk of Tuberculosis (TB) disease. An individual's perception of the seriousness of the disease, belief in the benefits of prevention or treatment, and the presence of social support from family and the surrounding environment are key elements in encouraging healthy behavior [8]-[17]. When a person realizes that TB is a serious disease that can have a major impact on health and quality of life, and believes that preventive measures such as cough etiquette, early screening, and regular treatment provide real benefits, then prevention efforts such as cough etiquette, early screening, and regular treatment provide real benefits, When an individual realizes that TB is a serious disease that can have a major impact on health and quality of life, and believes that prevention efforts such as cough etiquette, early screening, and regular treatment provide tangible benefits, the individual is more likely to be actively involved in prevention efforts[9]-18]. These results are in line with the Health Belief Model (HBM) theory, which states that behavior change is strongly influenced by perceptions of susceptibility, seriousness, benefits, barriers, cues to action, and self-efficacy. These findings reinforce the importance of a sustainable educative approach that not only passively conveys information, but also involves active community participation through a community-based approach. Community involvement in health education and advocacy will strengthen collective awareness, establish social norms that support healthy behaviors, and ultimately reduce the risk of TB incidence at the population level[10]-[19].

Conclusions

Based on the results of the study, it can be concluded that various factors of community behavior have a very important role in increasing the risk of pulmonary tuberculosis incidence in the working area of Benowo Health center, Surabaya City. Each component in the Health Belief Model shows a contribution to the low awareness and compliance of the community in making efforts to

prevent and control TB disease. Although some people have a good perception of susceptibility to TB disease, many still tend to ignore the risk of transmission. This causes preventive behaviors such as maintaining cleanliness, avoiding direct contact with patients, and maintaining home ventilation to not be implemented optimally. In terms of perceived seriousness, some people still consider TB disease as a mild disease or easy to treat. This perception has an impact on low compliance with health protocols and delays in seeking health services when symptoms appear. Low perceived benefits are also a significant barrier, with people not understanding the importance of early detection, treatment to completion, and participation in health promotion activities. This leads to a lack of engagement in overall TB control efforts. In

addition, perceptions of barriers, such as perceived high costs, time constraints and distance to health facilities, also reduce community motivation to seek care. These barriers, if not seriously addressed, will continue to be a barrier to the TB elimination program. Lack of cues to action, such as support from family, the environment, as well as information from the media and health workers, also affects the low awareness of the community in taking preventive and curative actions against TB. Furthermore, low self-efficacy perceptions cause individuals to feel unable to undergo treatment with discipline or take preventive measures consistently. This is one of the causes of declining disease control efforts at the individual level. In general, community behaviors in the Benowo area such as smoking in enclosed spaces, not maintaining home ventilation, reluctance to check themselves when sick, and not following treatment completely, further exacerbate the risk of TB spread in the living environment. Thus, comprehensive interventions through health education, strengthening social support, and improving access to health services are needed to shape healthier community behavior and support sustainable Tuberculosis control efforts.

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Informed Consent Statement
Informed consent was obtained from all respondents involved in the study.

Conflicts of Interest
The authors declare that there is no conflict of interest.

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