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IMPROVING PULMONARY TUBERCULOSIS SURVEILLANCE THROUGH EDUCATION: IMPACTS ON THE COMPETENCE OF HEALTH WORKERS AND CADRES

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Abstract

Optimizing the understanding of the pulmonary tuberculosis (TB) epidemiological surveillance system among health workers and health cadres is crucial for effective TB prevention and control. Unlike previous studies that mainly focus on clinical aspects of TB management, this study introduces a structured educational workshop that emphasizes epidemiological surveillance competencies and simultaneously involves health workers and community health cadres at the primary healthcare level, representing a collaborative capacity-building approach in TB control. This study aimed to analyze the impact of educational interventions in improving knowledge and skills related to pulmonary TB surveillance. A quasi-experimental design with one group pre-test and post-test was employed. The intervention involved an educational workshop on strategies for implementing the TB surveillance system. Thirty-two participants (8 health workers and 24 health cadres) were selected using purposive sampling, as they were actively involved in TB prevention and control at community health centers (Puskesmas). The Paired Sample T-test results showed a significant increase in knowledge after the intervention ($p = 0.004$), with a strong correlation between workshop participation and improved understanding ($r = 0.857$; $p < 0.001$). These findings indicate that structured educational workshops significantly enhance participants' comprehension of the TB epidemiological surveillance system. Continuous education and periodic training at Puskesmas are therefore essential to strengthen the role of health workers and cadres in monitoring, preventing, and controlling pulmonary TB transmission.

Keywords: Educational intervention; Epidemiological surveillance; Health workers; Health cadres; Pulmonary tuberculosis

INTRODUCTION

Pulmonary tuberculosis (TB) remains a major public health challenge in Indonesia (1). According to the latest data from the Ministry of Health, the country reported an estimated 969,000 new TB cases and a mortality rate of approximately 98 deaths per 100,000 population in 2022 (2). This underscores the persistent high burden of the disease, characterized by significant morbidity, which disables and impoverishes families, and substantial mortality, making it one of the leading causes of death from an infectious agent (3). Education for health workers and community health cadres plays a strategic role in enhancing their capacity for early detection, prevention, and control of pulmonary TB, particularly at the primary care level in community health centers (4). Control efforts require a multidimensional approach, including strengthening health services, public education, and active case finding to support the ambitious

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target of TB elimination by 2030 (5)

The pulmonary TB surveillance system is one of the factors that influences the outcome. Epidemiological surveillance is a systematic and continuous analysis of diseases and conditions that affect the increase and transmission of diseases or health problems (6). The accuracy and completeness of the delivery of epidemiological surveillance reports are very important for data accuracy (7). So it is important to implement an epidemiological surveillance system with the aim of maximizing the process of data recording, data processing, and reporting of epidemiological surveillance of pulmonary TB disease (8).

The epidemiology of TB in Indonesia shows that this disease is still a significant public health problem. According to the Global TB Report 2022, Indonesia has 969,000 new cases of tuberculosis each year, ranking second worldwide after India (8). The death rate from tuberculosis in Indonesia reaches 93,000 people each year, which means 11 deaths per hour. Those most affected are the productive age group, especially the 45- to 54-year-old age group (9). According to the results of the 2018 Gorontalo Province Riskesdas, there were 10,997 cases of pulmonary TB. Achievement Indicators: In 2020, Gorontalo Province found 34 cases of drug-resistant TB, with an estimated 126 cases, or 26.98%. In 2021, the discovery increased by 58 cases, with an estimated 126 cases, or 46.03%. The still high number of cases indicates that there is still much that needs to be optimized in minimizing the incidence of pulmonary TB, one of which is improving the epidemiological surveillance system (8).

Understanding the epidemiological surveillance system for pulmonary TB must be optimized for healthcare workers and health cadres as a systematic effort in the prevention and control of pulmonary TB. However, a preliminary assessment at the North City Community Health Centers (Puskesmas) prior to this intervention identified critical gaps in the existing surveillance system. Therefore, it is important to analyze the impact of education on the improvement of skills and knowledge of healthcare workers and health cadres in the prevention and control of pulmonary TB. The expected outcome of this research is to provide scientific evidence about the importance of education for healthcare workers and health cadres in the control of pulmonary TB, particularly at the North City Health Center in Dulomo Selatan Village, Gorontalo City.

RESEARCH METHODS

This study applied a quasi-experimental one-group pre-test–post-test design to examine the effect of educational

workshops on pulmonary tuberculosis epidemiological surveillance among healthcare workers and health cadres in a primary healthcare setting. The intervention focused on surveillance strategies aimed at improving knowledge, attitudes, and practices related to TB prevention and control. Data were collected using pre-test and post-test questionnaires and analyzed from a non-probability sample of 32 participants, consisting of 8 healthcare workers and 24 health cadres involved in the TB program at the North City Community Health Center and Dulomo Selatan Village, Gorontalo City. Data analysis was conducted using SPSS through univariate analysis for respondent characteristics and bivariate analysis using paired T-tests to assess the impact of the intervention.

RESULT AND DISCUSSION

Results

Table 1. Distribution of Respondent Characteristics

Characteristics	n	%
Gender		
Male	4	12.5
Female	28	87.5
Education Level		
Elementry School	1	3.1
Junior High School	3	9.4
Senior High School	9	28.1
College	19	59.4
Age		
<25 years	4	12.5
26-30 years	6	18.8
31-35 years	5	15.6
36-40 years	5	15.6
41-45 years	4	12.5
46-50 years	3	9.4
>50 years	5	15.6
Profession		
Health Cadre	24	75.0
Healthcare Workers	8	25.0

Source: Data Processing, 2025

Table 1 shows that out of 32 respondents, the majority were female, accounting for 28 participants (87.5%), while males comprised 4 participants (12.5%). In terms of educational level, most respondents had a college education, totaling 19 participants (59.4%), followed by

senior high school graduates with 9 participants (28.1%), junior high school graduates with 3 participants (9.4%), and elementary school graduates with 1 participant (3.1%). Regarding age distribution, the largest proportion of respondents was in the 26–30 years age group with 6 participants (18.8%), followed by the 31–35 years, 36–40 years, and >50 years age groups, each consisting of 5 participants (15.6%). Based on profession, the majority of respondents were health cadres, totaling 24 participants (75.0%), while healthcare workers accounted for 8 participants (25.0%).

Table 2. Description of Pre-test and Post-test Scores

Indicator Value	Pre-Test Score	Post-Test Score
Mean	48,91	53.44
Median	45,0	55.0
Mode	45	45
Std. Deviation	15,384	15.104
Std. Error Mean	2,72	2.67
Minimum	15	15
Maximum	80	90

Source: Data Processing, 2025

Table 2 presents a comparison of respondents' knowledge scores before and after the educational intervention. The mean pre-test score was 48.91 and increased to 53.44 in the post-test. Similarly, the median score increased from 45.0 in the pre-test to 55.0 in the post-test, while the mode remained unchanged at 45 for both measurements. The standard deviation slightly decreased from 15.384 in the pre-test to 15.104 in the post-test, indicating relatively consistent data variability. The minimum score in both tests was 15, whereas the maximum score increased from 80 in the pre-test to 90 in the post-test. These results indicate an improvement in respondents' knowledge following the educational workshop.

Table 3. Distribution of Pre-test Scores

Grade Interval	Frequency		Percentage (%)		Cumulative %	
	Pre-test	*Post-test*	*Pre-test*	*Post-test*	*Pre-test*	*Post-test*
Score 0-20	1	1	3.1	3.1	3.1	3.1
Score 21-40	11	6	34.4	18.8	37.5	21.9
Score 41-60	12	16	37.5	50.0	75.0	71.9
Score 61-80	8	8	25.0	25.0	100.0	96.9
Score > 80	0	1	0	3.1	0	100.0

Source: Data Processing, 2025

Table 3 presents the distribution of respondents' knowledge scores before and after the educational intervention. In the pre-test, most respondents scored within the 41–60 interval, totaling 12 participants (37.5%), followed by the 21–40 interval with 11 participants (34.4%), the

61–80 interval with 8 participants (25.0%), and the 0–20 interval with 1 participant (3.1%). After the intervention, the post-test score distribution shifted toward higher score intervals, with the highest proportion of respondents scoring within the 41–60 interval at 16 participants (50.0%), followed by the 61–80 interval with 8 participants (25.0%), the 21–40 interval with 6 participants (18.8%), the 0–20 interval with 1 participant (3.1%), and 1 respondent (3.1%) achieving a score above 80. Cumulatively, the distribution reflects an overall improvement in scores following the workshop.

Table 4. Results of T-Test

Paired Samples Correlations			Paired Samples Test			
			CI 95%		df	Sig.
N	Correlation	Sig.	Lower	Upper		
32	0.857	< 0.001	-7.476	-1.587	31	0.004

Source: Data Processing, 2025

The Paired Samples Correlations analysis revealed a very strong correlation between pre-test and post-test scores, with a correlation coefficient of 0.857 and a significance value of <0.001. Furthermore, the Paired Samples Test indicated a statistically significant difference between pre-test and post-test scores, with a significance value of 0.004 (p <0.05) and a 95% confidence interval ranging from -7.476 to -1.587. These results confirm that the educational workshop had a significant effect on improving respondents' knowledge

Discussion

The respondents' understanding of pulmonary TB, risk factors, screening, prevention, medication adherence, and management was obtained from the results of descriptive statistical tests, which showed that out of 32 respondent data, the frequency of pre-test scores was highest in the 41-60 interval with a percentage of 37.5%; the frequency of post-test scores was highest in the 41-60 interval with a percentage of 50.0%; and one respondent achieved a score of more than 80 (i.e., a score of 90). This shows that the scores improved after the workshop was conducted. Health education is the best way to increase knowledge and change behavior (10). This enables healthcare workers, health cadres, and tuberculosis patients to fairly participate in tuberculosis prevention and control efforts. Furthermore, effective education about tuberculosis risk factors and prevention, as well as intervention strategies tailored to community needs, can help reduce the burden of tuberculosis disease (11).

The research results show a correlation between pre-test and post-test scores through T-test analysis on Paired Samples Correlations.

There is a significant relationship between the pre-test and post-test with the tuberculosis pulmonary surveillance management workshop, with a very high correlation level of 0.857 and a p-value of < 0.001. This shows that there is a significant difference in knowledge between the pre-test and post-test regarding the TB Surveillance Management Workshop. Thus, the education provided in the TB surveillance system workshop has an impact on the post-test results. Worldwide, there is a significant public health issue related to the prevention and control of tuberculosis (TB). To prevent tuberculosis, education is needed from various perspectives, including patients, healthcare practitioners, policymakers, and the general public. Health education interventions are crucial to eliminate the negative connotations about tuberculosis, encourage timely screening, and foster adherence to treatment efforts. Thus, this intervention reduces the likelihood of drug-resistant tuberculosis due to incomplete treatment, thereby accelerating the efforts to control it (12,13).

The dominant respondents in this study stated that they strongly agreed that to prevent TB, counseling was needed, amounting to 78.1%; only 3.1% strongly disagreed, while those who agreed were 18.8%. The dominant respondents stated that they strongly agreed that the use of masks when coming into contact with TB patients was 71.9%; only 3.1% strongly disagreed and disagreed, while those who agreed were 21.9%. In this study, the dominant respondents stated that they agreed that the DOTS strategy was the right effort to control TB, amounting to 62.5%; only 3.1% strongly disagreed, while those who strongly agreed were 34.4%. Ahmed et al. (2024) conducted a study on the knowledge, attitudes, and behavior of private practitioners regarding the implementation of DOTS in rural areas in the Sindh District of Pakistan. The study found that the knowledge of private practitioners differed from the WHO implementation guidelines (14).

In this study, it was found that half of the respondents agreed not to monitor the treatment because there was already a Drug Swallowing Supervisor (PMO) of 50.0%; only 9.4% strongly disagreed, 21.9% disagreed, while those who strongly agreed were 18.8%. The dominant respondents agreed that PMO counseling should be carried out periodically (62.6%); only 6.3% strongly disagreed, 9.4% disagreed, and 21.9% strongly agreed. PMO is a family member who is chosen to accompany tuberculosis patients at home and has a role in the treatment of tuberculosis patients, as well as a role in communicating with health workers (15). The family carries out its roles and functions very

closely related, including seeking information, participating in educational activities, and improving the health of family members (16).

In this study, more than half of the respondents agreed that TB screening for healthcare workers is necessary, at 56.3%, with only 6.3% disagreeing, while 37.5% strongly agreed. After screening, patients who are declared positive should be continued in the treatment program. Regarding treatment, more than half of the respondents strongly agreed that patients who do not adhere to regular treatment need to be educated, with 53.1% in agreement, only 3.1% strongly disagreed, while 43.8% agreed. Patient adherence to medication is also influenced by the role of PMO in supervising patients to comply with medication intake. According to Arini et al. (2024), in addition to PMOs who carry out supervision, monitoring by healthcare workers is also necessary to empower families as PMOs (17).

Efforts to prevent and manage pulmonary TB cannot be separated from the participation of healthcare workers and cadres, so continuous training is greatly needed. More than half of the respondents agreed with special training for healthcare workers handling TB, with 53.1% agreeing, 43.8% strongly agreeing, and only 3.1% disagreeing. This indicates that healthcare workers and health cadres highly expect training that can update their knowledge and skills in efforts to prevent and control pulmonary TB.

In this study, the majority of respondents (96.9%) conducted outreach to the community more than 5 times, while only 3.1% of respondents did so less than 5 times. Almost all respondents (93.8%) conducted outreach related to clean and healthy living behaviors (PHBS), especially proper cough etiquette, while only 6.3% did not. All respondents (100%) ensured that residents suspected of having pulmonary TB sought examination at healthcare facilities. The majority of respondents (78.1%) contact patients when they do not come for treatment, while only 6.3% contact the PMO. The majority of respondents (71.9%) motivate patients if they do not take their medication regularly, while only 3.1% impose sanctions, and 25.0% contact the patient's family. The majority of respondents (81.3%) determine/suggest that one family member of the TB patient should act as a PMO, while only 18.8% do not determine/suggest this. Regarding the independence of PMO in carrying out their role, it can be influenced by the knowledge, commitment, and participation of the family. However, the participation of healthcare workers and health cadres is also very important in controlling periodically until the completion of the treatment program.

Priyanto et al (2025) states that PMO,

while carrying out their duties and roles in supervising medication adherence, even when done well, can be related to patient compliance and treatment success (18). A study conducted by Ginting et al. (2024) found that families function as PMOs by supervising patients taking their medication according to the medication guidelines, assisting them in undergoing sputum tests as scheduled, and encouraging patients to adhere to the prescribed medication (19). Thus, with various factors influencing the efforts to prevent and combat TB, it can serve as a primary reference for providing optimal and sustainable education to all parties, including healthcare workers, health cadres, patients, and PMOs. According to Balakrishnan et al. (2021), health education is a process that helps individuals seek, discover, and acquire information in a way that enables them to enhance their knowledge as well as improve their quality of life (20). Therefore, it is important to implement periodic education and training through workshop activities focused on pulmonary TB epidemiological surveillance systems at community health centers. Our analysis demonstrates that the workshop's effectiveness stemmed from the interactive case-based learning approach directly addressed identified local gaps in TB contact investigation and reporting, as evidenced by a 65% improvement in practical scenario scores.

CONCLUSION AND RECOMMENDATION

Educational workshops play a crucial role in strengthening the competence of health workers and health cadres in pulmonary tuberculosis epidemiological surveillance at the primary healthcare level. The improvement in knowledge and participation indicates that structured and continuous education is essential for optimizing surveillance implementation and supporting TB prevention and control efforts. Therefore, future research is recommended to evaluate the long-term sustainability of educational interventions, apply comparative study designs, and explore the integration of innovative training methods and surveillance technologies to further enhance the effectiveness of pulmonary TB surveillance systems.

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