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Spatial and Epidemiological Analysis of Tuberculosis Case Distribution and Determinants of Treatment Success in the Working Area of Rowosari Community Health Center (2024-2025)

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Abstract . Tuberculosis (TB) remains a significant global public health challenge. This study aims to analyze the distribution of TB cases based on the dimensions of time, region, age, gender, and the evaluation of treatment success at Puskesmas Rowosari for the period 2024–2025. The research method uses a quantitative descriptive design with a secondary data study approach from the health center information system. The results show a decrease in case notifications from 134 (2024) to 100 (up to November 2025), with the highest concentration in Meteseh Village (43%) and the productive age group (50%). The treatment success rate reached 89%, but the 7% Lost to Follow-Up rate still poses an elimination challenge. The conclusion emphasizes the need to strengthen area-based surveillance and psychosocial interventions to achieve the TB elimination target for Semarang City by 2028.

Keywords: Tuberculosis, Distribution, Symptom, Elimination, Surveillance

INTRODUCTION

The control of tuberculosis (TB) is a top priority in the global health agenda toward the Sustainable Development Goals (SDGs) 2030. According to the Global Tuberculosis Report 2025, TB has once again become the leading cause of death from a single infectious agent globally, with an estimated 10.7 million new cases in 2024(1). Indonesia ranks second in the highest TB burden in the world with an estimated 1.09 million cases and 125,000 deaths per year, which means approximately 14 deaths every hour (2)

At the national level, the government has established an acceleration strategy thru Presidential Regulation Number 67 of 2021 and the *"GIATKAN: Gerakan Indonesia Akhiri Tuberkulosis dengan*

Komitmen dan Aksi Nyata " for the year 2025(2). The city of Semarang itself has an ambitious target to achieve TB elimination by 2028 thru the establishment of the Tuberculosis Acceleration Team (TP2TBC). Rowosari Health Center, as a primary service unit in the peri-urban area of Tembalang District, faces complex epidemiological dynamics due to population mobility and demographic transition. This report aims to analyze the distribution patterns of cases and factors influencing treatment success in the area to provide data-driven recommendations for local control programs.

METHODS

This study uses a quantitative descriptive design with a secondary data study approach. Data is sourced from the UPTD Rowosari Health Center information system and the "Semar Betul" application, which includes all recorded TB cases from January 2024 until the data collection cut-off date on November 17, 2025(3).

The research variables include temporal distribution (month and year), spatial distribution (sub-district), demographic characteristics (age and gender), and treatment outcome. The analysis was conducted univariately to identify trends and frequency patterns. The context of the discussion is strengthened by integrating the theoretical framework of the Health Belief Model (HBM) to analyze patient compliance behavior based on the latest public health literature from 2025(4).

RESULT

Distribution of Cases Based on Time and Region

The total number of TB cases in the working area of Puskesmas Rowosari was recorded as 234 cases during the observation period. There were fluctuations in case notifications between years as presented in the following table:

Table 1. Distribution of TB Cases by Time and Region

Village	case in 2024	Percentage (%)	Case in 2025	Percentage (%)
Mateseh	68	50,7 %	43	43,0 %
Rowosari	56	41,8 %	39	39,0 %
Mangunharjo	10	7,5 %	18	18,0 %
Total	134	100 %	100	100 %

Source: puskesmas data as of November 17, 2025

Meteseh Village consistently recorded the highest number of cases, while Mangunharjo Village showed a sharp increase in notification proportion from 7.5% to 18% in 2025 (3).

Demographic Characteristics of Patients

Analysis of 2025 data shows that TB affects various age groups, with a predominance in the productive age group. Based on gender, the distribution of cases was found to be relatively balanced.

Table 2. Demographic Characteristics of Patients

Characteristics	Category	Frequency	Percentage (%)
Age Group	0 – 12 years	22	22 %
	13 – 17 years	2	2 %
	18 – 59 years	50	50 %
	>= 60 years	26	26 %
Gender	Female	52	52 %
	Male	48	48 %

Source: puskesmas data as of November 17, 2025

Evaluation of Treatment Outcomes The Treatment Success Rate in 2025 was evaluated based on the final status of patients after undergoing the standard therapy regimen.

Table 3. Treatment Outcomes of Patients

Final Threatment	Status Number	Percentage
Recovered	50	50,0 %
Threatmnet Completed	39	39,0 %
Lost to Follow Up (LTE)	7	7,0 %
Deaths	4	4,0 %
Total	100	100 %

Source: puskesmas data as of November 17, 2025

DISCUSSION

Spatial Analysis and Peri-Urban Environmental Factors

The concentration of cases in the Meteseh Village is closely related to the population density, which reaches 12,093 people, the highest in the working area of the Rowosari Health Center (3) Spatially, peri-urban areas such as Rowosari and Meteseh have a high transmission risk due to intensive social interactions and the physical conditions of the residential environment. Recent studies show that environmental factors such as poor ventilation increase the transmission risk by up to 9 times (5,6). Case clustering in this densely populated area requires intervention in the form of an "Agile Health Risk Map" for early identification at the Citizens Association level(7). This clustering of cases in densely populated areas indicates an active local transmission pattern, necessitating an area-based intervention approach. The "Agile Health Risk Map" intervention for early identification at the Civil Assocoation level can be strengthened by utilizing Geographic Information Systems (GIS) to map TB hotspots in real time, which has proven effective in improving intervention targeting accuracy and resource efficiency(8).

Case Burden in the Productive Age and Children

The finding that 50% of cases are of productive age (18–59 years) aligns with national data (Ministry of Health, 2025). This age group is highly mobile, both in terms of work and social activities, thus acting as a key transmitter in the spread of TB in the community(9). Furthermore, TB in productive age groups has a significant economic impact, including lost work productivity and increased household healthcare costs(10).

Meanwhile, the 22% number of pediatric cases indicates active transmission within households, given that children are generally infected from close adult contacts(3). The WHO states that TB cases in children often reflect failures in the detection and control of adult cases in their surrounding environment(11). This highlights the importance of a household contact investigation strategy as part of active case finding.

The urgency of providing TB Preventive Therapy (TPT) to household contacts is growing, given that this intervention has been shown to reduce the risk of latent infection progressing to active TB by 60–90% (12). The national coverage target of 72% by 2025(13) needs to be supported by increased contact screening, family education, and integration of TPT services into primary care.

Perspective of the Health Belief Model (HBM) on Compliance

The Lost to Follow Up (LTF) rate of 7% indicates obstacles in completing treatment, which could potentially increase the risk of drug resistance and ongoing transmission. Analysis using the Health Belief Model (HBM) reveals that a high perceived susceptibility makes patients 7 times more compliant, while perceived barriers such as distance to facilities or indirect costs can significantly reduce compliance (14). Additionally, other dimensions in the HBM, such as cues to action (support from healthcare workers and community health volunteers) and self-efficacy (patients' confidence in undergoing therapy), also play a crucial role in the success of TB treatment(15). In Semarang, family social support factors were found to be the main determinants in preventing LTF, where low support can increase the risk of treatment interruption by up to 14 times(16). Community-based approaches such as treatment supporters, directly observed therapy (DOT), and the use of digital technology (e.g., app-based medication reminders) have proven effective in improving TB treatment adherence(17). Therefore, behavioral interventions must be an integral part of TB control programs.

Delay in Diagnosis and Access to Services

Although notifications among women are slightly higher (52%), a study in Semarang recorded a median diagnostic delay of 19 days, primarily influenced by educational factors and the belief that TB is a hereditary disease(18). Delayed diagnosis is one of the main factors that prolongs the infectious period of patients, thereby increasing the risk of transmission in the community(19). Other factors contributing to the delay in diagnosis include social stigma, low health literacy, and a preference for alternative treatments before accessing formal services(20). This highlights the importance of an effective risk communication approach to raise public awareness about symptoms and the importance of early screening. The innovation of using the Molecular Rapid Test (TCM), which now has a global coverage of 54%, is expected to accelerate early detection at the community health center level(21). TCM has a higher sensitivity compared to conventional microscopic examinations and is capable of quickly detecting rifampicin resistance, thereby contributing to the improvement of TB diagnosis and treatment quality(22).

CONCLUSION

The distribution of TB cases at Puskesmas Rowosari during 2024–2025 shows a significant burden on the productive age group and residents in densely populated areas such as Kelurahan Meteseh. This pattern reflects the complex interaction between environmental, social, and behavioral factors in determining the dynamics of TB transmission in peri-urban areas.

Although the treatment success rate (89%) is close to the national target of 90%, the presence of LTF cases and deaths remains a serious challenge for achieving TB elimination in Semarang City by 2028. Therefore, it is necessary to strengthen area-based strategies, enhance early detection thru diagnostic

innovations, and implement behavioral interventions that focus on improving treatment adherence and social support. A data and community-based integrated approach is key to accelerating the sustainable elimination of TB.

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