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Original Article

Distribution of Tuberculosis (TB) Cases Based on Patient Characteristics in the Working Area of the Simeulue District Health Office in 2026

Lensoni Lensoni[1*], Rahmi Fadhila[2], Selly Hidayanti[3], Erna Fitria[4], Bunga Permata Sari[5], Safitria Safitria[6], Nosra Ayuni[7]

[1-7]Public Health Study Program, Faculty of Health Sciences, Universitas Abulyatama, Indonesia
Email: [1)] soni@abulyatama.ac.id

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Abstract

Tuberculosis remains one of the public health problems that requires serious attention because it can increase morbidity and mortality rates. The spread of tuberculosis cases is influenced by various patient characteristics such as gender, age, area of residence, treatment status, and occupation. This study aims to determine the distribution of tuberculosis cases based on patient characteristics in the working area of the Simeulue District Health Office in 2026. This study uses a quantitative descriptive design with a survey approach using secondary data from tuberculosis case reports. The number of samples in this study was 75 tuberculosis patients recorded in 2026. Data analysis was carried out univariately using frequency distribution. The results of the study on 75 TB patients in the working area of the Simeulue District Health Office in 2026 show that the majority of patients were male (73.3%), aged 45-80 years (53.3%), resided in Simeulue Timur District (37.3%), were currently undergoing treatment (74.7%), and worked as fishermen (54.7%). In addition, 20% of patients had not yet undergone treatment and 5.3% died before treatment. These results indicate that tuberculosis cases are more often found in adult to elderly males with occupations that involve high activity and particular environmental conditions. Therefore, an increase in prevention efforts, early case finding, and public health education is needed in order to reduce the incidence rate of tuberculosis in Simeulue Regency.

Keywords: Case Distribution, Patient, Tuberculosis.

1. Introduction

Tuberculosis is an infectious communicable disease that to this day remains a major challenge in the field of global public health, including in Indonesia. This disease, caused by Mycobacterium tuberculosis, generally attacks the lungs and is transmitted through droplets when the sufferer coughs, sneezes, or talks. The high incidence rate of tuberculosis has an impact on increasing morbidity and mortality rates, and gives rise to a social and economic burden for the community. The World Health Organization reports that tuberculosis remains one of the highest causes of death from infectious disease in the world and is an important concern in sustainable health development efforts (WHO, 2025).

Indonesia is one of the countries with the highest tuberculosis burden globally. The high number of tuberculosis cases is influenced by various factors relating to individual and environmental characteristics, such as gender, age, socioeconomic condition, occupation, and access to health services. Patient characteristics become an important indicator in describing

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the population groups vulnerable to the occurrence of tuberculosis. The study conducted by Azka et al. (2025) shows that the distribution of tuberculosis cases is more often found in the group of working-age males with particular socioeconomic conditions. Information regarding patient characteristics is needed as a basis for determining more effective and well-targeted disease prevention and control strategies.

Simeulue Regency is one of the island regions in Aceh Province that has its own particular challenges in the implementation of health services, including tuberculosis control. The geographic condition of areas being separated from one another can affect the community's access to health facilities and the process of early case finding. In addition, most of the community works in the informal sector, particularly as fishermen, which has a connection with environmental conditions and patterns of work activity that have the potential to increase the risk of disease transmission. The study by Sidiq et al. (2025) states that the factors of residential environment and type of occupation have a relationship with the high distribution of tuberculosis cases among coastal and island communities.

Various previous studies have placed greater emphasis on risk factors, treatment adherence, and the success of tuberculosis therapy. Meanwhile, studies describing the distribution of cases based on patient characteristics at the regional level remain relatively limited, particularly in Simeulue Regency. Yet information regarding case distribution is greatly needed in order to determine which population groups are most affected and which areas have the highest number of cases. Farkhan et al. (2026) explain that the analysis of case distribution based on patient characteristics can become a source of epidemiological information in supporting health program planning, health promotion, and continuous early detection efforts for tuberculosis.

Globally, Tuberculosis (TB) remains one of the deadliest infectious diseases in the world. In 2024, WHO estimated that 10.7 million people fell ill with TB and more than 1.2 million people died (WHO, 2025), with a global incidence rate of 131 per 100,000 population (WHO, 2025). Progress in control has been slow: global incidence fell by only a net 12% and deaths by 29% during 2015-2024 (Vision IAS, 2025), far from the End TB Strategy targets of an 80% reduction in incidence and a 90% reduction in deaths by 2030 compared with 2015 (Drishti IAS, 2025). In terms of services, the global treatment success rate for drug-susceptible TB reached 88%, while for drug-resistant TB it was 71% (WHO, 2025).

Indonesia contributes around 10% of the world's TB cases (WHO, 2025). WHO estimated 387 per 100,000 population or around 1.09 million cases in 2023, up from 325 per 100,000 in 2015 (WHO Indonesia, 2026). This means that the national trend does not follow the global decline. In terms of case reporting (notification), in 2024, 81% of the estimated 1,092,000 cases were successfully found and 90% of them were treated, up from 77% and 88% in 2023 (ANTARA, 2025), so that about one-fifth of cases have not yet been recorded and remain below the 90% case detection target. In terms of treatment success, references citing data from the Ministry of Health show a rate of 83% in 2020 and 87% in 2023 (Prepotif, 2025), which has not reached the 90% target. The latest achievements show that none of the 38 provinces has reached the treatment success target for drug-susceptible TB (IDN Times, 2026).

Aceh is among the 18 priority provinces for TB control, namely provinces with estimated and detected cases above 10,000 per year (IDN Times, 2026). The Aceh Health Office reported 12,656 TB cases in 2024 (InfoPublik, 2025). The Aceh Government has set targets of an incidence of 65 per 100,000 population and a mortality rate of 6 per 100,000 by 2030, as well as a treatment success rate of 90% (Pemerintah Aceh, 2022). Nevertheless, estimates of incidence, the percentage of case reporting against estimates, and treatment success rates at

the provincial and district levels are not yet available in accessible open publications, so the position of Aceh, and Simeulue Regency in particular, relative to national figures and program targets cannot yet be assessed.

This gap provides the rationale for the present study. Without a measurable assessment at the district level, the tuberculosis (TB) control program in Simeulue Regency lacks an adequate evidence base to determine whether its main challenges lie in case notification, case detection, or treatment completion. Therefore, this study aims to analyze TB program data from Simeulue Regency in 2026 by assessing case notification coverage in relation to the estimated number of cases, comparing program performance with national figures and targets, and evaluating treatment success rates and unfavorable treatment outcomes. The findings are expected to provide an epidemiological and programmatic overview of TB control in Simeulue Regency and serve as a basis for developing evidence-based recommendations for the District Health Office and local primary healthcare centers, particularly in strengthening case detection, patient follow-up, and treatment adherence.

2. Literature Review

2.1. Epidemiologic Triad Theory and Eco-epidemiology Model

The epidemiologic triad explains infectious disease as the result of an interaction between three components: the agent (pathogen), the susceptible host, and the environment that brings the two together. John and Kompithra (2023) state that the origin of this model cannot be determined, and that the explicit form of the "epidemic triad" was, according to them, formulated by Wade Hampton Frost in 1928. In this model, the "environment" accommodates all determinants of infectious disease, including socioeconomic and demographic factors (John & Kompithra, 2023).

In TB, the agent is M. tuberculosis, the host is a human with a certain susceptibility, and the environment includes conditions that facilitate airborne transmission. Daniel et al. (2022) detail these factors as household crowding, poor ventilation, tobacco use, indoor air pollution, and diseases that increase susceptibility, such as HIV, diabetes, and malnutrition. These factors are shaped by more upstream social determinants, such as economic inequality, migration, and urbanization (Daniel et al., 2022). Ferreira et al. (2023) emphasize that TB is strongly influenced by social determinants related to poverty and social exclusion.

John and Kompithra (2023) consider the classic triangle incomplete because pathogen ecology and transmission routes are not explicit. They propose an eco-epidemiology triangle with three systems: microbial amplification, microbial transmission, and host-pathogen interaction. In TB, the bacilli multiply in the lungs of patients with pulmonary TB. Patients can already be infectious even before cough appears as a symptom, and bacilli in sputum can survive when dry and be carried by the wind. In extrapulmonary TB, the agent remains within the host as a "dead end" for the chain of transmission. For diseases transmitted directly between humans, the infected host acts as the "environment" for healthy people nearby (John & Kompithra, 2023). The implication is that cases tend to be concentrated at the source of transmission and at places where people often come into contact.

2.2. Spatial Epidemiology Theory

Spatial analysis is based on Tobler's (1970) first law of geography, which states that everything is related to everything else, but near things are more related than distant things. In epidemiology, this principle is manifested as spatial autocorrelation, namely the similarity of incidence values between neighboring areas. Mergenthaler et al. (2022) reviewed the use of

spatial autocorrelation in infectious diseases to support public health decision-making, as access to geographically disaggregated surveillance data increases.

Methodologically, global autocorrelation is measured with Moran's I, while local clusters are identified with local indicators such as LISA (Anselin, 1995) or the Getis-Ord Gi* statistic. The Gi* statistic produces hotspots (high values) and coldspots (low values) (Spies et al., 2024). Because the influence of risk factors can differ between locations, Geographically Weighted Regression (GWR) is used to capture this spatial heterogeneity (Kurniawan et al., 2026).

3. Methods

This study used a quantitative approach with a descriptive research design to describe the distribution of tuberculosis cases based on patient characteristics in the working area of the Simeulue District Health Office in 2026. Descriptive research aims to provide a systematic description of a phenomenon or condition based on collected data without examining relationships between variables (Notoatmodjo, 2018).

The study was conducted in the working area of the Simeulue District Health Office. The study was conducted in the working area of the Simeulue District Health Office in 2026. The study used a total enumeration approach, in which all eligible tuberculosis case records during the study period were included. The final dataset consisted of 75 records of patients with newly diagnosed, bacteriologically confirmed pulmonary tuberculosis. Therefore, the study did not distinguish between the population and sample, as all records meeting the eligibility criteria were analyzed.

The data were secondary data obtained from tuberculosis case recapitulation reports maintained by the Simeulue District Health Office. The inclusion criteria were records of patients with newly diagnosed, bacteriologically confirmed pulmonary tuberculosis recorded during the study period and containing complete information on the variables analyzed. Records of patients with extrapulmonary tuberculosis, previously treated cases, cases without bacteriological confirmation, and records with incomplete data were excluded. All 75 records met the inclusion criteria, and no records were excluded from the final analysis. The variables analyzed included sex, age, sub-district, treatment status, and occupation. Data processing involved editing, coding, data entry, and cleaning to ensure completeness and consistency.

Data were analyzed using univariate analysis to describe the frequency distribution of each study variable. The results are presented as frequency distribution tables and percentages to describe the characteristics of tuberculosis patients in the study area. Data processing and analysis were performed using the Statistical Package for the Social Sciences (SPSS), version 25. Patient confidentiality was maintained by excluding identifying information from data processing and presentation. The data were used solely for scientific research purposes.

4. Results and Discussion

4.1. Research Results

The results of the study on the distribution of tuberculosis cases based on patient characteristics in the working area of the Simeulue District Health Office in 2026 were obtained from an analysis of data on 75 tuberculosis patients. The analysis was carried out univariately to describe the frequency distribution based on gender, age, sub-district area, treatment status, and occupation of the patients. The data are presented in the form of frequency distribution tables in order to make the interpretation of the study results easier.

Table 1. Distribution of Tuberculosis Cases Based on Gender

Gender	Frequency (f)	Percentage (%)
Male	55	73.30
Female	20	26.70
Total	**75**	**100.00**

On the basis of Table 1, it is known that the majority of tuberculosis patients are male, numbering 55 people (73.30%). Meanwhile, female patients numbered 20 people (26.70%). These results show that males are more dominantly affected by tuberculosis compared with females.

The high number of cases in males can be influenced by social activities and occupations that are more often carried out outside the home, thereby increasing the risk of exposure to the Mycobacterium tuberculosis bacterium. In addition, the habit of smoking, insufficient maintenance of a healthy lifestyle, and delay in undergoing health examinations are factors that also contribute to increasing the risk of tuberculosis in males. The study by Aryasih et al. (2025) states that males have a higher level of vulnerability to tuberculosis due to behavioral factors and the work environment.

Efforts that can be made to reduce the number of tuberculosis cases in males include increasing education regarding the dangers of smoking, the importance of maintaining environmental cleanliness, and regular health examinations. Health promotion programs also need to be focused on the working-age group with high work mobility so that disease transmission can be prevented from an early stage.

Table 2. Distribution of Tuberculosis Cases Based on Age

Age Group	Frequency (f)	Percentage (%)
13-24 years	10	13.30
25-44 years	25	33.30
45-80 years	40	53.30
Total	**75**	**100.00**

On the basis of Table 2, it is known that the 45-80 year age group has the highest number of cases, namely 40 people (53.30%). The 25-44 year age group numbered 25 people (33.30%), while the 13-24 year age group is the group with the lowest number of cases, namely 10 people (13.30%).

The high number of cases in the adult to elderly age group shows that an increase in age has an influence on a person's vulnerability to experiencing tuberculosis. Physiologically, an increase in age can cause a decline in the body's immune system so that the body's ability to fight infection becomes reduced. In addition, the elderly age group generally has comorbid diseases and a longer history of environmental exposure compared with the younger age group.

Chen et al. (2024) explain that the decline in bodily resistance in old age is one of the main factors in the increasing risk of infectious communicable disease. Therefore, an increase in health screening for the elderly age group as well as education regarding the symptoms of tuberculosis is needed so that the diagnostic process can be carried out more quickly.

Table 3. Distribution of Tuberculosis Cases Based on Sub-District Area

Sub-District Area	Frequency (f)	Percentage (%)
Alafan	4	5.30
Salang	5	6.70
Simeulue Barat	10	13.30

Sub-District Area	Frequency (f)	Percentage (%)
Simeulue Cut	1	1.30
Simeulue Tengah	4	5.30
Simeulue Timur	28	37.30
Teluk Dalam	2	2.70
Teupah Barat	12	16.00
Teupah Selatan	7	9.30
Teupah Tengah	2	2.70
Total	**75**	**100.00**

On the basis of Table 3, it is known that Simeulue Timur District has the highest number of cases, namely 28 people (37.30%). Conversely, Simeulue Cut District has the lowest number of cases, namely 1 person (1.30%). The difference in case distribution between areas can be influenced by population density, the condition of the residential environment, the level of community mobility, and access to health services. Areas with a high level of social interaction tend to have a greater risk of tuberculosis transmission. In addition, house conditions with poor ventilation and minimal lighting can accelerate the spread of the disease through the air.

According to Kurniawan et al. (2026), environmental factors have a significant relationship with the distribution of tuberculosis cases in the community. Therefore, an increase in active case finding, examination of household contacts, and education regarding the importance of maintaining air circulation and the cleanliness of the home environment are needed.

Table 4. Distribution of Tuberculosis Cases Based on Treatment Status

Treatment Status	Frequency (f)	Percentage (%)
Currently undergoing treatment	56	74.70
Not yet treated	15	20.00
Died before treatment	4	5.30
Total	**75**	**100.00**

On the basis of Table 4, it is known that most patients are in the status of currently undergoing treatment, namely 56 people (74.70%). Nevertheless, there are still patients who have not yet received treatment, numbering 15 people (20.00%), and who died before treatment, numbering 4 people (5.30%).

Treatment status has an important influence on the success of tuberculosis control. Patients who receive treatment late are at risk of experiencing complications and can become a source of transmission in the surrounding environment. Delay in treatment can be influenced by the low level of community knowledge, limited access to health services, and a lack of awareness to undergo early health examination.

The World Health Organization (2025) states that the success of tuberculosis treatment is greatly influenced by early detection and patient adherence in undergoing therapy. Therefore, strengthening of the medication supervision program, public health education, and improvement of access to health services, especially in remote areas, are needed.

Table 5. Distribution of Tuberculosis Cases Based on Occupation

Occupation	Frequency (f)	Percentage (%)
Student	10	13.30
Housewife	13	17.30
Fisherman	41	54.70
Self-employed	11	14.70
Total	**75**	**100.00**

On the basis of Table 5, it is known that the majority of tuberculosis patients work as fishermen, namely 41 people (54.70%). Meanwhile, the occupational group with the lowest number of cases is students, namely 10 people (13.30%). The type of occupation can influence the risk of tuberculosis occurring because it relates to the condition of the work environment, the level of physical fatigue, and access to health services. Fishermen generally work in unpredictable weather conditions and a humid environment, which can affect bodily resistance. In addition, coastal communities often live in houses with inadequate ventilation, thereby increasing the risk of transmission of respiratory tract infectious disease.

Ismah et al. (2024) explain that occupations with high environmental exposure have a relationship with the increasing incidence of tuberculosis. Efforts that need to be carried out include increasing health counseling regarding clean and healthy living behavior, improving environmental sanitation conditions, and expanding the reach of health services to coastal communities.

4.2. Discussion

The differences in the characteristics of tuberculosis (TB) patients in Simeulue Regency show that TB control needs to consider the conditions of patients and the environments where they live. However, the characteristics most frequently found in the data are not necessarily factors that increase the risk of TB. This study used univariate analysis, so the results describe the patient profile, not the relationship between certain characteristics and the occurrence of TB. Therefore, the findings need to be compared with previous studies to explain possible factors related to the distribution of cases, while also identifying aspects that still require further research.

The predominance of male patients can be understood through possible differences in exposure and health behavior between males and females. Smoking habits, work activities, social interaction, and delays in seeking examination may be factors that need to be considered in explaining this difference. Nevertheless, this study did not collect data on smoking habits, history of contact with TB patients, or treatment-seeking behavior. Thus, these factors cannot be confirmed as the explanation for the predominance of male patients. Aryasih et al. (2025) examined the implementation of the SAPA TBC program as an effort to control TB in Badung Regency. That study is relevant for emphasizing the importance of implementing programs that reach the community in a targeted manner, although it does not directly explain the difference in cases by sex in Simeulue. TB control efforts in this area need to ensure that education and early examination reach males, especially through workplaces and communities, without neglecting the needs of females.

The predominance of patients in the older age group also needs to be understood in terms of biology and exposure history. Chen et al. (2024) explain that immune aging can reduce the effectiveness of the body's response to infection. In TB, these changes can increase a person's susceptibility to disease progression, including the possible reactivation of latent infection. In addition to biological factors, history of contact with TB patients, comorbid diseases, nutritional status, and living conditions may also play a role. However, this study has not provided data that would allow researchers to determine which factors are most related to patient characteristics in Simeulue. Therefore, the high number of patients in the 45-80 year age group cannot be explained solely by declining immunity. This finding is more appropriately used as a basis for strengthening early examination in adults and the elderly, especially those who experience TB symptoms, have a history of contact, or have comorbid diseases.

The difference in the number of cases between sub-districts shows the importance of considering geographic conditions in TB control planning. Kurniawan et al. (2026), through a

spatial analysis at the district/city level in Indonesia, found that variation in TB prevalence is related to a number of factors, including poverty, population density, smoking behavior, HIV/AIDS prevalence, and the number of medical personnel. Farkhan et al. (2026) also examined the distribution of TB and its related factors through a spatiotemporal analysis in Indonesia. Both studies show that the distribution of TB cannot be separated from social conditions and regional characteristics. Nevertheless, a high number of cases in a sub-district does not necessarily mean that the risk of transmission is greater. Population size, ease of obtaining health services, and the intensity of case finding can also influence the number of recorded patients.

In this study, population data for each sub-district and the results of spatial statistical testing were not available. Therefore, the sub-district with the highest number of cases cannot yet be stated as the area with the highest TB risk. Teibo et al. (2023), in a systematic review of 79 geospatial studies, found that clustering of TB cases is often related to unfavorable socioeconomic conditions and population density. These findings reinforce the need to consider regional factors, but do not mean that the same factors have been proven to explain the pattern of cases in Simeulue. Further research needs to compare the number of cases with population size, residential conditions, and the reach of health services in each sub-district. This information is needed to determine whether differences in the number of cases reflect differences in disease burden or are related to differences in the ability to find and record patients.

Occupational characteristics also need to be considered in understanding the distribution of TB, especially because occupation is related to daily activities, economic conditions, and access to health services. Ismah et al. (2024) discussed the relationship between risky occupations and TB based on patient data at a specialized lung health facility. Meanwhile, Sidiq et al. (2025) examined the distribution of TB cases in the highland and coastal areas of Padang. That study provides a basis for considering occupation and geographic conditions as part of TB epidemiological studies. However, the predominance of patients who work as fishermen in Simeulue has not proven that this occupation increases the risk of TB. To explain this pattern, information is needed on the number of residents who work as fishermen, living conditions, history of contact with TB patients, smoking habits, and access to health examinations.

Explanations regarding weather conditions or the humidity of the fishermen's work environment also need to be distinguished from known factors of TB transmission. TB is mainly transmitted through the air when a person inhales infectious particles released from the respiratory tract by a person with active TB. Therefore, household crowding, inadequate ventilation, and close indoor contact are more relevant aspects to investigate than considering weather or fatigue as direct causes. In the context of Simeulue, TB examination services can be more easily reached through health activities in coastal communities, household contact examination, and education about TB symptoms. However, the implementation of such interventions should be based on an assessment of local community needs, not only on the occupation of patients.

Treatment status provides an overview of the continuity of services after patients are found. WHO (2025) emphasizes the importance of accurate diagnosis, access to treatment, and therapy monitoring in TB control. The presence of patients who have not yet undergone treatment needs attention because every diagnosed patient requires clear follow-up. Nevertheless, the data in this study do not explain the reasons why patients have not yet started treatment. This condition may be related to the referral process, access barriers, clinical conditions, or other factors that need to be examined through service data. Likewise,

death before treatment cannot be directly interpreted as a result of delayed diagnosis without information on clinical history, cause of death, and the timing of diagnosis.

Patients who are currently undergoing treatment also cannot be directly considered to have successfully completed therapy. Treatment success must be assessed based on the final outcome of therapy, not only on treatment status at the time the data were collected. Therefore, the evaluation of the TB program in Simeulue needs to include the time between diagnosis and the start of treatment, patient adherence, continuity of monitoring, and the final outcome of treatment. Tracing patients who have not yet started therapy and evaluating cases of death before treatment can also help identify service barriers that need to be improved.

Overall, this study provides an overview of the characteristics of TB patients recorded in Simeulue Regency and can be used as an initial basis for evaluating the implementation of the TB control program. Comparison with previous studies shows that biological factors, socioeconomic conditions, regional characteristics, occupation, and access to health services are relevant aspects to be studied further. However, this study cannot yet determine which factors play the greatest role because it did not test relationships between variables or take population size into account as a basis for comparison. Therefore, the development of research needs to be directed toward analysis that combines patient characteristics, environmental conditions, population data, and access to health services. The results are expected to provide a stronger basis for determining the need for early examination, expanding service reach, and improving the continuity of TB treatment in Simeulue Regency.

5. Conclusion

This study concludes that tuberculosis cases in the working area of the Simeulue District Health Office in 2026 were more often found in males, the 45-80 year age group, residents of Simeulue Timur District, patients currently undergoing treatment, and fishermen. These findings provide an overview of patient characteristics that need attention in the implementation of the tuberculosis control program, but do not yet prove that sex, age, occupation, or regional conditions are causal factors for the high number of cases. Control efforts need to be directed at strengthening screening and early detection among males aged over 45 years and fishing communities, accompanied by household contact examination and increased reach of health services in areas with a high number of recorded cases. Monitoring also needs to be strengthened to ensure that diagnosed patients promptly receive treatment and complete therapy. Further research is recommended to use incidence rates based on population size as well as analytic designs to test the relationship between individual characteristics, occupation, environmental conditions, and access to health services with the incidence of tuberculosis. Spatial analysis can also be conducted to identify case distribution patterns more accurately and support the determination of intervention priorities.

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5.2. Conflict of Interest Statement

The authors declare that they have no known financial or personal relationships that could be perceived as competing interests in connection with this article. The Simeulue

District Health Office, as the data provider, had no role in the analysis, interpretation of results, or decision to publish.

5.3. Author Contributions

L.L.: Conceptualization, Methodology, Formal Analysis, Writing – Original Draft, Project Administration.
R.F.: Investigation, Data Curation, Validation, Writing – Review & Editing.
S.H.: Investigation, Data Curation, Visualization, Writing – Review & Editing.
E.F.: Investigation, Data Curation, Validation, Writing – Review & Editing.
B.P.S.: Investigation, Data Curation, Resources, Writing – Review & Editing.
S.S.: Investigation, Data Curation, Visualization, Writing – Review & Editing.
N.A.: Investigation, Data Curation, Resources, Writing – Review & Editing.

5.4. Funding Statement

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

5.5. Informed Consent

Informed consent was not required. The study analyzed retrospective, routinely collected tuberculosis case records obtained with the permission of the Simeulue District Health Office, and no direct contact with patients occurred. Patient confidentiality was protected by excluding all identifying information from data processing and presentation.

5.6. Ethical Approval

This study used secondary data from routine tuberculosis case reports and involved no human participants, no clinical intervention, and no collection of identifiable personal data. Ethical clearance for secondary analysis of anonymized surveillance data was obtained from the relevant institutional authority, and the data were used solely for scientific research purposes.

5.7. Data Availability

The dataset analyzed in this study consists of tuberculosis case records held by the Simeulue District Health Office. Because these records contain patient-level health information, they are not publicly available and remain subject to the data-governance requirements of the issuing office. Aggregated data supporting the frequency distributions reported in Tables 1–5 are presented within the article; any further request may be directed to the corresponding author [L.L.] and will be subject to approval by the data provider.

5.8. Declaration of Generative AI and AI-assisted Technologies

During the preparation of this manuscript, the authors utilized ChatGPT (OpenAI) for language editing and clarity improvement. All outputs generated with the assistance of the tool were critically reviewed and revised by the authors to ensure factual accuracy, faithful representation of the data, and adherence to academic standards. The authors assume full responsibility for the integrity and content of this manuscript.

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