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# Utilization of Digital Mapping to Help Community Nurses Identify and Improve the Success of Tuberculosis Treatment Among School-Age Children in Central Papua, Indonesia

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## ABSTRACT:

**Background**: Tuberculosis (TB) remains a major public health challenge among school-age children in high-burden settings. Delayed case detection and incomplete contact investigation contribute to ongoing transmission. This study evaluated the effectiveness of Geographic Information System (GIS)-based digital mapping for early identification of school-age TB patients and improved tuberculosis control outcomes in Central Papua, Indonesia.

**Methods**: A retrospective comparative cohort study was conducted using routine TB programme records from Nabire Regency between January and December 2025. The study included 259 patients aged 6–15 years, comprising 66 in the digital-mapping cohort and 193 in the comparison cohort. Descriptive statistics, Fisher's exact test, and odds ratios (ORs) with 95% confidence intervals (CIs) were used for analysis.

**Results**: Contact investigation was documented significantly more frequently in the digital-mapping cohort than in the comparison cohort (24.2% vs. 11.9%; OR=2.37, 95% CI:1.16–4.82; $p=0.027$). Standard treatment exceeded 96% in both cohorts ($p=0.682$). Among patients with documented outcomes, treatment success was 87.1% in the digital-mapping cohort and 84.3% in the comparison cohort ($p=1.000$), while loss to follow-up was lower (9.7% vs. 13.5%; $p=0.757$).

**Conclusions**: GIS-based digital mapping significantly strengthened contact investigation and improved operational surveillance of school-age TB patients. Although treatment outcomes were comparable between cohorts, digital mapping demonstrated substantial value for patient localisation, case monitoring, and targeted public health interventions in geographically challenging settings, supporting its integration into routine tuberculosis control programmes.

## 1. INTRODUCTION

Tuberculosis (TB) is an infectious disease that remains a leading cause of morbidity and mortality worldwide, despite the availability of effective diagnostic methods and curative treatment (Mukubesa et al., 2026). According to the World Health Organization (WHO), an estimated 10.8 million people had tuberculosis (TB) in 2023, and approximately 1.3 million of them were under the age of 15 (Chen et al., 2025). TB in children and school-aged children continues to be a significant public health challenge because diagnosis is often delayed, the symptoms are nonspecific, and contact investigations are frequently incomplete (Gunasekera et al., 2022). Early identification of TB in children is very important because delayed diagnosis contributes to ongoing transmission within households and the community (Otoni et al., 2024), disease progression (Fariani Syahrul et al., 2025), and poorer treatment outcomes (Huynh et al., 2025).

Indonesia is among the countries with the highest TB burden globally, and geographical disparities substantially affect the implementation of TB control programmes (Paisal & Dwi, 2025). These challenges are particularly evident in Central Papua Province, where difficult terrain, dispersed settlements, limited transportation infrastructure, and uneven access to healthcare services complicate active case finding, patient monitoring, and household contact investigation (Sarimole, 2025). School-age children (6–15 years) constitute a vulnerable population because transmission commonly occurs within households or schools, yet surveillance systems often fail to identify these epidemiological links promptly (Arief Hargono, Kurnia Dwi Artanti, 2019). Consequently, strengthening surveillance strategies that improve patient localisation and facilitate rapid programme response is essential for achieving the targets of the WHO End TB Strategy (Falzon et al., 2024).

Recent advances in digital health technologies have created new opportunities to strengthen tuberculosis surveillance and programme management (Brubacher et al., 2026). Geographic Information System (GIS)-based digital mapping enables health programmes to visualise the spatial distribution of cases, identify geographical clusters, monitor patient locations, support household contact investigations, and optimise resource allocation (Montalvan & Gallardo, 2026) & (Jones, 2023). Unlike conventional paper-based surveillance systems, digital mapping provides real-time spatial information that allows programme managers to identify underserved communities and prioritise outreach activities more efficiently (Nayak et al., 2025). Previous studies have shown that digital technologies can improve surveillance quality, treatment adherence, and programme efficiency (Miladi, 2025); however, evidence regarding the effectiveness of GIS-based digital mapping specifically among school-age TB patients remains limited, particularly in geographically remote regions of low- and middle-income countries (Irmaningsih et al., 2025).

The present study addresses this knowledge gap by evaluating the implementation of GIS-based digital mapping within the routine tuberculosis programme in Nabire Regency, Central Papua. Routine programme data from January to December 2025 were analysed using a retrospective comparative cohort design to compare school-age patients included in the digital-mapping programme with those managed through conventional surveillance. The evaluation focused on programme indicators that reflect tuberculosis control performance, including documentation of contact investigation, treatment according to national standards, treatment success, and loss to follow-up.

The programme data demonstrated that school-age patients included in the digital-mapping cohort were significantly more likely to have documented contact investigations than those receiving conventional surveillance (24.2% versus 11.9%; OR = 2.37; 95% CI: 1.16 - 4.82; p = 0.027). Treatment success was also slightly higher (87.1% versus 84.3%), while loss to follow-up was lower (9.7% versus 13.5%), although these differences did not reach statistical significance. These findings suggest that the principal contribution of digital mapping lies in strengthening operational surveillance, improving patient visibility, and facilitating contact investigation rather than directly altering treatment outcomes.

Therefore, this study aims to evaluate the effectiveness of digital mapping for the early identification of school-aged tuberculosis patients and its relationship with tuberculosis control outcomes in Central Papua, Indonesia. The findings are expected to provide evidence supporting the integration of spatial digital surveillance into routine tuberculosis programmes, particularly in geographically challenging settings where timely case identification and comprehensive contact investigation remain major barriers to TB elimination. This research and report are highly important considering that in Nabire, Central Papua, Community Nurses serve as the frontline of the TB control program in Primary Health Care Facilities, directly handling cases in schools. Community nurses are equipped with digital devices that function to identify students' presence and communicate effectively with teachers to monitor treatment progress after a TB diagnosis.

## 2. MATERIALS AND METHODS

### 2.1 Study Material

This retrospective comparative cohort study used routine tuberculosis programme records from Nabire Regency, Central Papua Province, Indonesia, covering January–December 2025. The study materials consisted of the Indonesian National Tuberculosis Programme TBC.03 SO district/city patient register, the Tuberculosis Information System (SITB), and facility-specific Geographic Information System (GIS)-based digital-mapping worksheets. The digital-mapping system was used by community nurses as a programme-level surveillance instrument to identify patient locations, support contact investigation, and monitor treatment. The extracted variables included age, sex, healthcare facility, digital-mapping status, contact-investigation status, type and anatomical classification of TB, previous treatment history, compliance with national treatment standards, treatment-start information, and final treatment outcome.

### 2.2 Sample Collection

The source population comprised all 2,164 patients registered for TB care in Nabire Regency during 2025. Total sampling was applied to select all records of school-age patients aged 6–15 years. Records outside this age range and duplicate records were excluded. Duplicate records were identified sequentially using the SITB registration number, patient registration number, and national identification number. A total of 259 eligible patients were included, consisting of 66 patients whose records were linked to facility-specific digital-mapping worksheets and 193 patients recorded in the district TB register but not represented in those worksheets.

### 2.3 Extraction Procedure

Eligible records were extracted from the district TB register and linked with the digital-mapping worksheets using unique programme identifiers. Following linkage, the data were checked for completeness, duplication, consistency, and eligibility. Variables were subsequently cleaned, coded, and standardised into categorical or binary indicators. Contact investigation was classified as documented when the register recorded "Yes." Treatment success was defined as either "cured" or "treatment completed," whereas loss to follow-up, death, transfer or not evaluated, and missing final outcomes were retained as separate categories. Patient names, residential addresses, national identification numbers, and other personally identifiable information were excluded from the analytical dataset.

### 2.4 Analytical Methods

The study compared demographic, clinical, and TB programme indicators between the digital-mapping and comparison cohorts. The principal programme indicator was documented contact investigation. Additional indicators included bacteriological confirmation, pulmonary TB classification, new treatment episode, treatment according to national standards, final-outcome documentation, treatment success, loss to follow-up, death, and transfer or not evaluated. Digital mapping was evaluated as a surveillance and case-management support instrument rather than as a diagnostic test. Treatment-success analysis was restricted to patients with documented final outcomes to prevent patients who were still undergoing treatment or whose outcomes had not yet been recorded from being automatically classified as having unsuccessful treatment.

### 2.5 Statistical Analysis

Categorical data were summarised using frequencies and percentages. Differences between the digital-mapping and comparison cohorts were examined using Fisher's exact test because several contingency-table cells had small expected frequencies. Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated to estimate the strength of association between digital-mapping status and the principal binary outcomes. A two-sided $p$-value of less than 0.05 was considered statistically significant. Data from the Microsoft Excel workbook were processed using reproducible data-cleaning and analytical procedures.

## 3. RESULTS AND DISCUSSION

### 3.1 Preliminary Analysis

The district register contained 2,164 tuberculosis records. A total of 259 patients (12.0%) were aged 6–15 years, including 130 males (50.2%) and 129 females (49.8%). Sixty-six patients (25.5%) were linked to the digital-mapping cohort, whereas 193 (74.5%) formed the comparison cohort.

**Table 1.** Characteristics of school-age tuberculosis patients by cohort

| Characteristic | Digital mapping n = 66 | Comparison n = 193 | p-value |
|---|---|---|---|
| Male sex | 31 (47.0%) | 99 (51.3%) | 0.571 |
| Bacteriologically confirmed TB | 28 (42.4%) | 58 (30.1%) | 0.071 |
| Pulmonary TB | 60 (90.9%) | 165 (85.5%) | 0.299 |
| New treatment episode | 66 (100.0%) | 187 (96.9%) | 0.344 |
| Contact investigation documented | 16 (24.2%) | 23 (11.9%) | 0.027 |
| Treatment according to standard | 65 (98.5%) | 187 (96.9%) | 0.682 |
| Final outcome documented | 31 (47.0%) | 89 (46.1%) | 1.000 |

Contact investigation was documented for 16 of 66 patients (24.2%) in the digital-mapping cohort compared with 23 of 193 patients (11.9%) in the comparison cohort. The odds of documented contact investigation were 2.37 times higher in the digital-mapping cohort (OR = 2.37; 95% CI: 1.16–4.82; Fisher's exact p = 0.027). Standard treatment was recorded for 98.5% and 96.9% of patients, respectively; this difference was not statistically significant (OR = 2.09; 95% CI: 0.25–17.68; p = 0.682).

The preliminary screening of the Nabire Regency tuberculosis register identified 2,164 patients recorded between January and December 2025. Of these, 259 patients (12.0%) met the school-age eligibility criterion of 6–15 years. The sample showed an almost equal sex distribution, comprising 130 males (50.2%) and 129 females (49.8%). Sixty-six patients (25.5%) were linked to the digital-mapping programme, while 193 patients (74.5%) received conventional programme surveillance and formed the comparison cohort.Lorem ipsum dolor sit amet, consectetur adipiscing elit. Sed ut perspiciatis unde omnis iste natus error sit voluptatem accusantium doloremque laudantium.

The baseline characteristics of the two cohorts are presented in Table 1. No statistically significant differences were found in sex distribution, pulmonary TB classification, previous treatment status, standardised treatment, or availability of final treatment outcomes ($p > 0.05$). Male patients accounted for 47.0% of the digital-mapping cohort and 51.3% of the comparison cohort ($p = 0.571$). Pulmonary TB was the predominant anatomical classification in both cohorts, affecting 90.9% and 85.5% of patients, respectively ($p = 0.299$). These findings indicate that the cohorts were broadly comparable in their principal demographic and clinical characteristics.

Bacteriological confirmation was more frequent in the digital-mapping cohort than in the comparison cohort (42.4% versus 30.1%), although the difference did not reach statistical significance ($p = 0.071$). The higher proportion may indicate better linkage between community surveillance, healthcare facilities, and laboratory services. Nevertheless, it could also reflect differences in diagnostic practices or patient characteristics between participating health facilities. Childhood TB is frequently difficult to confirm bacteriologically because paediatric disease is generally paucibacillary and affected children may have difficulty producing an adequate sputum specimen.

Nearly all patients received treatment according to national TB standards, including 98.5% of the digital-mapping cohort and 96.9% of the comparison cohort ($p = 0.682$). This high level of treatment conformity indicates that standard treatment implementation was already well established throughout Nabire Regency. Consequently, the potential contribution of digital mapping was more likely to be observed in patient localisation, contact investigation, and follow-up than in the selection of the pharmacological treatment regimen.

### 3.2 Instrumental Analysis

**Table 2.** Final treatment outcomes among patients with documented outcomes

| Final outcome | Digital mapping n = 31 | Comparison n = 89 |
|---|---|---|
| Treatment success | 27 (87.1%) | 75 (84.3%) |
| Cured | 8 (25.8%) | 3 (3.4%) |
| Treatment completed | 19 (61.3%) | 72 (80.9%) |
| Loss to follow-up | 3 (9.7%) | 12 (13.5%) |
| Died | 1 (3.2%) | 1 (1.1%) |
| Not evaluated/transferred | 0 | 1 (1.1%) |

Among patients with a documented final outcome, treatment success was 87.1% in the digital-mapping cohort and 84.3% in the comparison cohort. The difference was not statistically significant (OR = 1.26; Fisher's exact $p = 1.000$). Loss to follow-up was numerically lower in the digital-mapping cohort (9.7% versus 13.5%), although the difference was not significant ($p = 0.757$). Because 139 of 259 school-age records did not yet contain a final outcome, outcome comparisons should be interpreted as interim programme findings rather than definitive end-of-cohort estimates.

In the context of the present study, instrumental analysis refers to the performance of GIS-based digital mapping as a surveillance and case-management instrument. It does not refer to chemical or laboratory instrumentation. Digital mapping integrated the routine TB register with facility-specific worksheets, enabling community nurses to identify the geographical locations of school-age patients, visualise case distribution, support household and school-linked investigation, and prioritise patients requiring follow-up. The most important programme finding was the higher level of documented contact investigation among digitally mapped patients. Contact investigation was documented for 16 of 66 patients (24.2%) in the digital-mapping cohort, compared with 23 of 193 patients (11.9%) in the comparison cohort. Digital mapping was therefore associated with 2.37 times higher odds of documented contact investigation (OR = 2.37; 95% CI: 1.16–4.82; Fisher's exact $p = 0.027$). This was the only measured indicator demonstrating a statistically significant difference between the cohorts.

The result suggests that digital mapping strengthened the operational visibility of school-age TB patients. Knowledge of patient location may help community nurses plan household visits, coordinate with schools, identify close contacts, and refer symptomatic contacts for further examination. This function is particularly relevant in Central Papua, where dispersed settlements, geographical barriers, and limited transport infrastructure can restrict conventional contact-tracing activities. GIS-based surveillance can assist health programmes in visualising disease distribution, identifying geographical clusters, and allocating limited resources to high-priority areas. The finding is consistent with evidence that digital technologies primarily improve surveillance quality, patient monitoring, and continuity of TB services. It is also supported by the WHO digital-health framework, which emphasises the integration of digital technologies into routine TB programmes to strengthen case notification, contact tracing, and patient-centred monitoring. For children and adolescents, improved contact investigation is particularly important because TB infection commonly follows exposure within households, schools, or other close-contact environments.

However, the digital-mapping system should be regarded as a programme-support instrument rather than a stand-alone diagnostic technology. The available dataset did not consistently include geographical coordinates, dates of mapping, dates of symptom onset, or intervals between symptom onset and diagnosis. Therefore, the system's effect on the actual time required for early diagnosis could not be directly determined. Its demonstrated benefit was improved case visibility and documentation of contact investigation.

### 3.3 Biological Activity

This research did not evaluate a plant extract, chemical compound, or pharmaceutical preparation, "biological activity" is interpreted as the observed clinical and programme-related treatment outcomes among school-age TB patients. These outcomes included treatment success, cure, treatment completion, loss to follow-up, death, and transfer or absence of evaluation.

Final treatment outcomes were documented for 120 patients, comprising 31 patients in the digital-mapping cohort and 89 in the comparison cohort. Among these patients, treatment success was recorded in 87.1% of the digital-mapping cohort and 84.3% of the comparison cohort. Although treatment success was numerically higher among digitally mapped patients, the difference was small and statistically non-significant (OR = 1.26; Fisher's exact $p$ = 1.000). Thus, the available data did not demonstrate that digital mapping independently increased the probability of treatment success.

Loss to follow-up was lower in the digital-mapping cohort than in the comparison cohort (9.7% versus 13.5%), but this difference was also not statistically significant ($p$ = 0.757). The observed direction of effect nevertheless suggests that improved patient localisation and monitoring may help community nurses identify patients at risk of interrupting treatment. Digital mapping could support follow-up by providing location-based information, facilitating household visits, and improving communication between healthcare facilities, patients, families, and schools. However, a larger sample and complete follow-up would be required to confirm this potential effect.

The cure category was proportionally higher in the digital-mapping cohort, whereas treatment completion without bacteriological confirmation was more common in the comparison cohort. This pattern may correspond with the higher proportion of bacteriologically confirmed cases in the digital-mapping group. Nevertheless, these outcome categories should be interpreted cautiously because they depend on the availability of bacteriological testing and the completeness of follow-up documentation.

The absence of a significant difference in treatment success is consistent with previous evidence showing that digital-health technologies may improve surveillance, adherence support, and service efficiency without necessarily producing an immediate or substantial change in clinical outcomes (Miladi, 2025; Ologun et al., 2025). Digital mapping does not directly exert antimicrobial activity against *Mycobacterium tuberculosis*. Its contribution occurs indirectly by strengthening the care pathway through improved patient identification, contact investigation, monitoring, referral, and continuity of treatment.

Interpretation of the treatment outcomes is limited by incomplete outcome documentation. Of the 259 eligible patients, 139 did not have a recorded final outcome. Some patients registered later in 2025 may still have been receiving treatment when the data were extracted. Consequently, these results should be considered interim programme outcomes rather than definitive estimates for a closed treatment cohort. In addition, the retrospective design could not control fully for differences in disease severity, healthcare access, facility staffing, diagnostic capacity, or referral patterns.

Overall, GIS-based digital mapping demonstrated its clearest activity at the surveillance level by significantly improving the documentation of contact investigation. Although treatment success was slightly higher and loss to follow-up was lower among mapped patients, these differences were not statistically significant. The findings support the use of digital mapping as an enabling component of comprehensive TB care, particularly for locating school-age patients and directing community-nursing interventions in geographically challenging settings.

### 3.4 Discussion

This retrospective comparative analysis indicates that GIS-based digital mapping was most clearly associated with improved documentation of contact investigation among school-age tuberculosis patients (Engineering et al., 2023). Patients linked to the mapping cohort had more than twice the odds of documented contact investigation (Z. Liu et al., 2024). This finding is programmatically important because children and young adolescents often acquire tuberculosis following close household or community exposure, and identifying where patients live can help health teams prioritise household visits, school-linked investigation, and referral of symptomatic contacts (Fariani Syahrul et al., 2025) dan (Yuen et al., 2022).

This finding is consistent with (Gunasekera et al., 2023), who reported that childhood tuberculosis is predominantly pulmonary and frequently lacks bacteriological confirmation because paediatric disease is paucibacillary, while (F. Liu et al., 2025) similarly observed that demographic characteristics contribute less to treatment outcomes than delays in diagnosis and inadequate contact investigation, and (Brubacher et al., 2026) concluded that digital technologies primarily strengthen surveillance quality, patient monitoring, and continuity of tuberculosis care rather than altering baseline clinical characteristics.

These results are further supported by the Natural History of Childhood Tuberculosis Theory proposed by (Diel & Nienhaus, 2023), which explains that childhood tuberculosis progresses from exposure to latent infection and active disease, emphasizing that early identification of exposed children and comprehensive contact investigation are essential for interrupting disease progression and community transmission. Moreover, the WHO digital health framework described by (Chilala et al., 2025) and evidence from (Teixeira et al., 2025) indicate that integrating digital surveillance into routine tuberculosis programmes enhances timely case identification and facilitates household contact tracing (Oga-omenka et al., 2026), particularly in geographically challenging settings where conventional surveillance is often insufficient (Oliveira et al., 2025). The findings indicate that any improvement in tuberculosis control indicators can be more confidently attributed to the implementation of GIS-based digital mapping by community nurses in Central Papua.

The difference in treatment success was modest and statistically non-significant. This pattern is consistent with the broader digital-health literature, which shows that digital technologies can improve surveillance visibility, adherence support, and service efficiency without invariably producing large short-term changes in clinical outcomes (Ologun et al., 2025). A systematic review of randomised trials reported mixed effects of digital health technologies on tuberculosis treatment completion and cure, while a more recent meta-analysis found only a modest overall improvement in treatment success and substantial heterogeneity across intervention types and settings (Ologun et al., 2025). These findings support interpreting digital mapping as an enabling component of a wider care pathway rather than as an isolated treatment intervention (Anghel et al., 2025).

The higher proportion of bacteriologically confirmed disease in the digital-mapping cohort, although not statistically significant, may indicate improved diagnostic linkage or more complete follow-up of laboratory results (Id et al., 2024). Alternatively, it may reflect differences in the case mix or health-facility practices. The very high proportion of patients receiving treatment according to national standards in both cohorts suggests that treatment initiation was already strong across the district (Mcgaughey et al., 2021). Therefore, the incremental value of digital mapping may lie primarily in locating patients, visualising underserved areas, supporting contact investigation, and reducing missed follow-up rather than changing the drug regimen itself (David-olawade et al., 2026).

The observed treatment-success rates among records with completed outcomes were high in both cohorts. However, almost half of the school-age records lacked a documented final outcome at the time represented in the workbook. Some patients registered later in 2025 may still have been receiving treatment, making missingness partly administrative or time dependent. Future evaluations should use a closed cohort with sufficient follow-up time and should distinguish ongoing treatment from genuinely missing outcomes. Time-to-event analysis could then examine whether digital mapping accelerates diagnosis, contact investigation, treatment initiation, or outcome documentation.

The findings also have practical relevance for geographically dispersed settings such as Central Papua. A digital map linked with routine programme records can help managers visualise case concentrations, identify villages or schools requiring outreach, and allocate limited staff and transport more efficiently. WHO guidance supports context-specific use of digital technologies as part of person-centred tuberculosis care, while emphasising implementation planning, data quality, usability, and continuous evaluation. For school-age populations, privacy protections are especially important: maps used operationally should avoid publicly displaying precise household coordinates or personally identifying information.

## 4. CONCLUSION

GIS-based digital mapping strengthened the operational visibility of school-age tuberculosis patients in Nabire Regency and was associated with significantly higher documentation of contact investigation. Treatment success was slightly higher and loss to follow-up slightly lower in the mapped cohort, but these differences were not statistically significant. Digital mapping should therefore be viewed as a promising surveillance and case-management support tool whose greatest immediate benefit may be improved localisation, contact investigation, and follow-up. A prospective, closed-cohort evaluation incorporating verified facility allocation, geospatial coordinates, diagnostic timelines, school and household contact tracing, and multivariable adjustment is recommended to determine its causal effect on tuberculosis-control outcomes.

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**AUTHOR CONTRIBUTIONS**

SS conceptualized and designed the study, developed the digital mapping application, supervised data collection, performed data analysis and interpretation, and drafted the original manuscript. MF assisted in the study design, coordinated data collection across the 16 puskesmas, and provided critical administrative support. YP assisted in the study design, coordinated data collection, reviewed all statistical analyses, and critically revised the manuscript for important intellectual content. AW assisted in the study design, coordinated data collection, reviewed statistical analyses, and critically revised the manuscript for important intellectual content. All authors read and approved the final version of the manuscript.

**CONFLICT OF INTEREST**

The authors declare that there are no financial, professional, or personal conflicts of interest related to this study, which was developed solely from the original research findings and is reported exclusively to improve tuberculosis control services and contribute to scientific knowledge in the field of tuberculosis prevention and management.

**ETHICS STATEMENT**

This study was conducted in accordance with the ethical principles of the Declaration of Helsinki and the applicable Indonesian laws and regulations governing health research involving human data. Ethical approval was obtained from the Health Research Ethics Committee of Universitas Strada Indonesia under approval number 0423403/EC/KEPK/I/03/2026, dated March 5, 2026. Permission to access and analyze routine tuberculosis program data was granted by the Nabire District Health Office, Central Papua, Indonesia. As this retrospective study used previously collected secondary programme data and involved no direct contact or intervention with patients, the requirement for individual informed consent was waived by the ethics committee. All records were anonymised before analysis, and patient names, identification numbers, residential addresses, precise household coordinates, and other personally identifiable information were excluded from the analytical dataset and manuscript. Data involving patients aged 6–15 years were used exclusively for the approved research purposes and were handled confidentially to protect the privacy and welfare of the children.

**DATA AVAILABILITY STATEMENT**

The data supporting the findings of this study were obtained from routine tuberculosis programme records maintained by the Nabire Regency Health Office, Central Papua, Indonesia. Because the dataset contains confidential health information concerning school-age patients, including potentially identifiable clinical and geographical data, it is not publicly available or accessible through an online repository. De-identified data may be made available by the corresponding author upon reasonable written request, subject to approval from the Nabire Regency Health Office and the relevant research ethics committee, and in accordance with applicable data-protection requirements.

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