World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(RESEARCH ARTICLE)

Check for updates

Profile of tuberculosis in adolescent at RSUD Dr. Soetomo Surabaya

Ajeng Zahra Maulita [1,*], Retno Asih Setyoningrum [2], Laksmi Wulandari [3] and Eko Budi Koendhori [4]

[1] *Faculty of Medicine, Universitas Airlangga, Surabaya.*
[2] *Department of Pediatrics, Dr. Soetomo General Academy Hospital, Surabaya.*
[3] *Department of Pulmonology and Respiratory Medicine, Dr. Soetomo General Academic Hospital, Surabaya.*
[4] *Department of Clinical Microbiology, Dr. Soetomo General Academic Hospital, Surabaya.*

World Journal of Advanced Research and Reviews, 2025, 26(03), 2750-2759

Publication history: Received on 19 May 2025; revised on 25 June 2025; accepted on 27 June 2025

Article DOI: https://doi.org/10.30574/wjarr.2025.26.3.2490

Abstract

Tuberculosis is one of the infectious diseases that remains a global public health challenge, including in Indonesia. Tuberculosis caused by the bacterium Mycobacterium tuberculosis. In high-burden settings, adolescents constitute a significant proportion of both the general population and tuberculosis patients. To determine the profile of adolescent tuberculosis patients in RSUD dr. Soetomo Surabaya from January 2023 to December 2024. This study is conducted using a descriptive retrospective study design using a total sampling technique from medical records. Data on adolescent tuberculosis patients (aged 10–19 years) in RSUD dr. Soetomo Surabaya for the 2023–2024 period included 98 patients, with the majority in the 15–19 age group (60%), while the lowest prevalence was in the 10–14 age group (40%). Female patients outnumbered male patients, accounting for 65% and 35%, respectively. Most patients were diagnosed with pulmonary tuberculosis (53%), while the remaining 47% were diagnosed with extrapulmonary tuberculosis. The majority of adolescents had moderate nutritional status, with 31 patients (31%). The most frequently used specimen for the molecular rapid test was sputum (63%), and the majority of these samples tested positive for TB (63%). A total of 81% of adolescent patients showed abnormalities on CXR. Most adolescent TB patients in Surabaya (2023–2024) were aged 15–19 and female. Pulmonary TB was more common, with moderate nutritional status being typical. Sputum was the most used specimen for testing, with a high positivity rate, and 81% showed chest X-ray abnormalities. These findings highlight the importance of tailored TB approaches for adolescents.

Keywords: Tuberculosis; Adolescent; Alinical profile; Microbiology; Radiology

1. Introduction

Tuberculosis (TB) is one of the infectious diseases that remains a global public health challenge, including in Indonesia (1). Tuberculosis caused by the bacterium Mycobacterium tuberculosis (MTB) (2). Tuberculosis can be transmitted through the air from individuals who have tuberculosis. Individuals who suffer from tuberculosis in adolescents have a greater chance of developing lung cavities, either progressive or chronic (3). Since the early 20th century, it has been known that a significant rise in the incidence of tuberculosis occurs during adolescence (4).Adolescents, in contrast to children and adults, undergo dynamic and multifaceted development across physical, psychological, emotional, cognitive, and social domains. Despite the significance of this developmental stage, the specific health needs of adolescents have historically been underrecognized and insufficiently addressed in tuberculosis treatment, control, and research initiatives (5). There is growing recognition of adolescence as a period of increased risk and rising burden of tuberculosis; however, adolescents have yet to be addressed as a distinct population in tuberculosis control efforts.(6).

Tuberculosis (TB) is a disease that can generally be prevented and effectively treated. However, in 2022, it ranked as the second leading cause of death globally from a single infectious agent, following coronavirus disease (COVID-19), and

* Corresponding author: Ajeng Zahra Maulita

was responsible for nearly twice the number of deaths compared to HIV/AIDS. (7). It is estimated that nearly one-third of the world's population has been infected with Mycobacterium tuberculosis, the bacterium responsible for tuberculosis (TB) (8). An estimated 10.8 million people globally fell ill with TB in 2023, an increase from 10.7 million in 2022. This rise was largely attributed to population growth. The global TB incidence rate remained nearly stable, with a slight increase of 0.2% between 2022 and 2023. TB caused approximately 1.25 million deaths in 2023, including 161,000 among people living with HIV. This represents a decrease from 1.32 million deaths reported in 2022. The Southeast Asia Region accounted for 54% of TB deaths among people without HIV, while the African Region contributed 27% (7).

Indonesia is among the five countries with the largest gap between the estimated number of tuberculosis cases and the number of cases that are officially diagnosed and reported. In 2022, Indonesia accounted for approximately 10% of the total global tuberculosis cases (1). In 2023, West Java Province recorded the highest number of tuberculosis (TB) cases in Indonesia, with a total of 203,226 cases reported during the year (9). East Java ranked second, reporting 116,752 TB cases in 2024 (10). Surabaya ranked first as the city with the highest number of tuberculosis (TB) cases in East Java Province in 2022. According to the East Java Health Office report, Surabaya recorded 10,382 TB cases that year (11). In high -burden settings, adolescents constitute a significant proportion of both the general population and tuberculosis patients. Despite the increasing recognition of adolescence as a period marked by heightened risk and a growing tuberculosis burden, adolescents have yet to be systematically addressed as a distinct population within tuberculosis control initiatives (12). Symptoms of TB in adolescent are generally similar. In adults, bacteriological confirmation is often found in the sputum and cavity chest x-ray examination, so there is a high risk of transmission at home and in general places, such as in schools, dormitories for tutoring, places for social activities, etc (13).

This study is intended to provide a comprehensive overview of adolescent tuberculosis cases at RSUD Dr. Soetomo, while simultaneously contributing to the enhancement of public knowledge and awareness regarding tuberculosis. Ultimately, it is anticipated that this will empower communities to conduct early detection and implement preventive measures to curb the spread of the disease. Moreover, the study aims to deliver a clearer understanding of tuberculosis manifestations in adolescents, thereby serving as a foundation for more targeted diagnostic interventions and the development of effective tuberculosis control programs (Snow et al., 2020). Research on the characteristics of tuberculosis (TB) in adolescents remains limited, particularly in Indonesia. Therefore, it is essential to comprehensively understand the profile of TB in adolescents, encompassing demographic, clinical, microbiological, and radiological aspects This research was conducted to identify the profile of adolescent tuberculosis at RSUD Dr. Soetomo, Surabaya, during the period from January 2023 to December 2024, based on demographic, clinical, microbiological, and radiological characteristics.

2. Material and methods

2.1. Research Design and Type

This study employs a cross-sectional research design, which is a type of observational research that analyzes data from a population at a specific point in time. In this case, the study utilizes secondary data collected from the medical records of adolescent tuberculosis patients treated at RSUD Dr. Soetomo Surabaya. The research period spans from January 2023 to December 2024. Cross-sectional research is particularly appropriate for this study because it allows the researcher to analyze the profile of adolescent tuberculosis patients by examining variables such as age, gender, type of tuberculosis, nutritional status, molecular rapid test results, and chest x-ray findings at one specific period.

2.2. Research Population

The population in this study includes all adolescent tuberculosis patients treated at RSUD Dr. Soetomo from January 2023 to December 2024. The population is specifically defined as patients within the age range of 10 to 19 years who have been diagnosed with tuberculosis and have complete medical records available at the hospital's medical record center.

2.3. Research Sample

The sample in this study consists of adolescent tuberculosis patients whose medical records meet the inclusion criteria established by the researcher. This selection ensures that the data analyzed is relevant and accurately represents the characteristics of adolescent tuberculosis patients treated at RSUD Dr. Soetomo within the specified timeframe.

2.4. Inclusion Criteria

The inclusion criteria for this study are as follows:

- Patients aged 10 to 19 years.
- Patients who were diagnosed with tuberculosis at RSUD Dr. Soetomo.
- Patients who underwent diagnosis and/or treatment during the period from January 2023 to December 2024.
- Patients whose medical records are complete and accessible for research purposes. These inclusion criteria ensure that the selected sample is homogeneous and specifically relevant to the research objectives.

2.5. Exclusion Criteria

The exclusion criteria for this study include:

- Patients with incomplete or missing medical records that prevent comprehensive data analysis.
- Patients who were referred to or admitted from other healthcare facilities during treatment, resulting in incomplete follow-up data.
- Patients who passed away during the treatment period, as this may interfere with the availability of complete data.
- Patients whose age falls outside the 10 to 19-year range. These criteria are essential to maintaining the accuracy, consistency, and integrity of the data used in the analysis.

2.6. Sampling Technique

The sampling technique employed in this study is total sampling. Total sampling is a method in which all subjects that meet the inclusion criteria within the defined population are selected as the sample. This approach is suitable for studies with a specific and limited population, such as adolescent tuberculosis patients at RSUD Dr. Soetomo within the defined research period. Total sampling helps ensure that the study captures comprehensive data and provides an accurate depiction of the research subject.

2.7. Research Variables

The variables analyzed in this study include:

- Age of the patient.
- Gender of the patient.
- Type of tuberculosis (pulmonary or extrapulmonary).
- Nutritional status based on BMI-for-age percentiles.
- Type of molecular rapid test (MRT) specimen used.
- MRT results indicating the presence or absence of Mycobacterium tuberculosis complex and rifampicin resistance.
- Chest x-ray radiography findings indicating normal or abnormal lung conditions.

2.8. Operational Definitions of Variables

Table 1 Operational Definitions of Variables

Variable	Operational Definition	Criteria	Data Scale
Age	Age as recorded in the patient's medical record calculated based on date of birth and examination date	1. 10–14 years 2. 15–19 years	Nominal
Gender	Physical and biological characteristics indicating whether the patient is male or female	1. Male 2. Female	Nominal
Types of Tuberculosis	Classification of tuberculosis based on the site of infection	1. Pulmonary tuberculosis 2. Extrapulmonary tuberculosis	Nominal
Nutritional Status	Nutritional status determined using BMI-for-age percentiles based on CDC 2000 Growth Charts	1. Normal 2. Severe malnutrition 3. Moderate malnutrition 4. Mild malnutrition 5. Overweight 6. Obesity	Nominal
MRT Specimen	Type of biological specimen used for tuberculosis molecular rapid testing	1. Sputum 2. Others	Nominal
MRT Result	Result of molecular rapid testing detecting Mycobacterium tuberculosis complex (MTBC) and rifampicin resistance	1. Detected (Positive) 2. Not Detected (Negative)	Nominal
Chest X-Ray	Interpretation of chest x-ray images showing lung condition related to tuberculosis	1. Normal 2. Abnormal	Nominal

2.9. Research Materials

The materials used in this study are secondary data derived from medical records of adolescent tuberculosis patients at RSUD Dr. Soetomo Surabaya. These records include demographic data, clinical examination results, molecular rapid test outcomes, and chest x-ray findings from the period January 2023 to December 2024.

2.10. Research Instruments

The instruments used in this study are:

- Medical record documentation of adolescent tuberculosis patients.
- Microsoft Excel software to input, organize, and analyze the collected data. These instruments ensure accurate data retrieval and systematic data processing for further analysis.

2.11. Research Location

This research is conducted at the Central Medical Records Department and the Information and Communication Technology Installation (ITKI) of RSUD Dr. Soetomo, Surabaya. These facilities store the medical records used in this study and provide the technological support necessary for data processing.

2.12. Research Time

The research will be carried out over a five-month period, from December 2024 to April 2025. This timeframe includes the preparation of research permits, ethical approval processing, data collection, data analysis, and report writing.

2.13. Data Collection

Procedures Data collection will be conducted after the research proposal is approved and ethical clearance is granted. The process includes the following steps:

- Submission of the research proposal to the Health Research Ethics Committee (KEPK) of RSUD Dr. Soetomo.
- Ethical approval processing and clearance issuance.

- Retrieval of secondary data from the medical records of adolescent tuberculosis patients diagnosed and/or treated at RSUD Dr. Soetomo between January 2023 and December 2024.
- Systematic extraction of relevant data variables, including patient demographics, diagnosis, test results, and radiological findings.

3. Results

3.1. Demographic Characteristic

The demographic characteristics of tuberculosis patients based on the data obtained from RSUD Dr. Soetomo is that the number of female patients diagnosed with tuberculosis was higher compared to male patients, with 64 female patients (65%) and 34 male patients (35%). The sample was subsequently categorized into two age groups based on the WHO classification: adolescents aged 10-14 years and adolescents aged 15-19 years. The results of the study indicated that the highest prevalence of tuberculosis was observed in the 15-19 year age group, with 59 patients (60%), while the lowest prevalence was found in the 10-14 year age group, with 39 patients (40%).

Table 2 Demographic Characteristic

Variable	**Amount (n=98)**	**Percentage (%)**
Gender		
Female	64	65 %
Male	34	34 %
Age		
Adolescents 10-14 years	39	40 %
Adolescents 15-19 years	59	60 %

3.2. Clinical Characteristics of Research Subject

The clinical characteristics of the research subjects, based on data obtained from RSUD Dr. Soetomo, indicated that the majority of patients were diagnosed with pulmonary tuberculosis (53%). In this study, nutritional status was assessed using the CDC growth charts. The distribution of nutritional status showed that the majority of adolescents had moderate nutritional status, with 31 patients(31%).

Table 3 Clinical Characteristics

Variable	**Amount (n=98)**	**Percentage (%)**
Types of Tuberculosis		
PulmonaryTuberculosis	52	53 %
Extrapulmonary Tuberculosis	46	47 %
Tuberculosis of intestines, peritoneum and mesenteric glands	11	24 %
Tuberculosis of bones and joints	11	24 %
Tuberculosis of skin and subcutaneous tissue	1	2 %
Tuberculous peripheral lymohadenopathy	8	18 %
Tuberculosis of the central nervous system	7	15 %
Miliary tuberculosis	8	17 %
Variable	Amount (n=98)	Percentage (%)
Nutritional Status		
Normal	26	27%

Severe malnutrition	14	14%
Moderate malnutrition	31	31 %
Mild malnutrition	16	16%
Overweight	7	7%
Obesity	4	4%

3.3. Microbiological Characteristics

Table 4 Microbiological Characteristics

Variable	Amount (n=98)	Percentage (%)
Molecular Rapid Test Specimen		
Sputum	61	63 %
Gastric lavage	8	8 %
Tissue	12	12 %
Liquor Cerebrospinal	7	7 %
Feces	10	10 %
Molecular Rapid Test Result		
Detected (Positif)	62	63 %
RIF Sensitif	51	82 %
RIF Resisten	6	10 %
RIF Indeterminate	5	8 %
Not Detected (Negative)	36	

The microbiological characteristics of adolescent tuberculosis (TB) patients, based on data from the Molecular Rapid Test, indicate that the highest number of examinations were conducted using sputum specimens, with 61 patients (63%) tested using this sample type. This reflects the characteristic preference for sputum as the primary specimen in diagnosing pulmonary TB in adolescents. Regarding diagnostic outcomes, the test results showed that 62 patients (63%) had a *Detected* result, indicating a positive TB diagnosis, while 36 patients (37%) had a *Not Detected* result, indicating a negative diagnosis. These microbiological characteristics suggest that the MRT method demonstrates high sensitivity in detecting *Mycobacterium tuberculosis*, particularly in adolescent patients.

3.4. Radiological Characteristics

Based on the radiological examination of 98 adolescents suspected of having tuberculosis (TB), the majority exhibited abnormal findings on chest radiographs. A total of 81% of the adolescents showed abnormalities on chest X-rays, indicating that most adolescent TB cases present with evident radiological manifestations.

Table 5 Radiological Characteristics

Variable	Amount (n=98)	Percentage (%)
Chest X Ray		
Normal	19	19 %
Infiltrat	58	59 %
Cavitary lession	20	20 %
Pleural effusion	29	30 %

Fibrosis	33	34 %
Hilar lymphadenopathy	11	11 %
Atelectasis	8	8 %
Milliary pattern	12	12 %
Cardiomegaly	2	2 %

4. Discussion

This study utilized a retrospective descriptive method, analyzing secondary data collected from the Medical Record Installation and the Communication and Information Technology Installation (ITKI) at RSUD Dr. Soetomo Surabaya during the years 2023 and 2024. The medical records of 98 adolescent tuberculosis (TB) patients were meticulously reviewed to present a comprehensive overview of the condition of adolescent TB within the study period. The focus was on the demographic, clinical, microbiological, and radiological profiles of the patients, along with the challenges and limitations encountered throughout the research process.

The demographic data revealed that adolescents aged 15-19 years accounted for the highest prevalence of Mycobacterium Tuberculosis infection, comprising 60% of the total cases. This indicates that older adolescents are more vulnerable to TB infection, corroborated by a study that analyzed TB prevalence across 30 high-burden countries categorized by the World Health Organization (WHO). These countries collectively contribute to approximately 86% to 90% of the global TB burden, with findings that the TB incidence significantly escalates in the 15-19 year age group compared to the 10-14 year bracket. The gender-based risk ratio also increases with age, peaking among adolescents aged 15-19 years. A global estimate suggests that around 1.8 million adolescents (aged 10-19 years) and young adults (aged 20-24 years) are affected by TB annually, reinforcing the susceptibility of older adolescents to this disease. The period of adolescence is universally recognized as a critical window of heightened TB risk.

At RSUD Dr. Soetomo, the study found a higher proportion of female TB patients, accounting for 65% (64 individuals), compared to 35% (34 individuals) male patients. This gender disparity may stem from a complex interplay of biological, social, and behavioral factors. Hormonal fluctuations during adolescence can modulate immune system efficacy, with several studies indicating that estrogen may increase female susceptibility to TB infection or reactivation. Social dynamics, particularly in certain cultural contexts, may further expose adolescent girls to TB, especially within domestic settings where undiagnosed or untreated cases persist. Additionally, puberty-induced hormonal transitions may temporarily weaken immune defenses, particularly among females.

Supporting evidence from Marais et al. (2023) indicates that female adolescents globally experience a higher TB burden due to differences in immune system maturation and exposure risk. Thakur (2021) also highlighted a higher incidence of pulmonary TB among females in a study involving 983 patients, with a male-to-female ratio of 1:1.5. Similar patterns were observed in Cape Town, South Africa, where adolescent females aged 15-19 years bore a disproportionate TB burden. Contributing factors in this demographic included HIV co-infection, teenage pregnancy, and limited access to adolescent-friendly healthcare services. The findings at RSUD Dr. Soetomo align with these global trends, reinforcing the gender-specific vulnerabilities in TB epidemiology among adolescents. The clinical distribution of TB cases at RSUD Dr. Soetomo indicated that 53% of the adolescents were diagnosed with pulmonary tuberculosis, while 47% were diagnosed with extrapulmonary tuberculosis (EPTB). This finding aligns with Thakur (2021), who reported that pulmonary TB predominates among pediatric and adolescent populations, accounting for 85.7% of cases. Extrapulmonary TB manifestations were notably diverse, with intestinal, peritoneal, and mesenteric gland TB, as well as bone and joint TB, each constituting 24% of the EPTB cases. Central nervous system TB accounted for 15% of the cases, while peripheral lymphadenopathy and miliary TB represented 17% each, and cutaneous or subcutaneous TB was the least frequent at 2%.

The diversity of EPTB manifestations highlights the need for broad clinical vigilance in adolescent TB diagnosis and management. Modern diagnostic methods, such as the Gene-Xpert Ultra molecular test, have proven instrumental in detecting EPTB in pediatric and adolescent populations. Studies report that Gene-Xpert Ultra confirmed EPTB diagnoses in 72% of suspected cases, demonstrating its utility in rapid and accurate TB diagnosis. Gomes et al. (2014) reported that EPTB constitutes approximately 13.4% of total TB cases, underscoring its clinical significance despite being less common than pulmonary TB. Tuberculosis profoundly affects the nutritional status of adolescents, a critical concern given their developmental stage. According to WHO (2013), TB is closely associated with malnutrition, which in turn exacerbates disease progression and impairs treatment outcomes. In this study, the majority of adolescent TB patients

were found to have moderate nutritional status, with 31 patients (31%). However, a significant proportion also exhibited varying degrees of malnutrition, highlighting the bidirectional relationship between TB and nutritional deficiencies. Nutritional status assessments based on the CDC 2000 growth charts provided valuable insights into the impact of TB on adolescent health. Micronutrients and macronutrients are essential for robust immune responses, serving as enzymatic cofactors and substrates for immune cell proliferation. Malnourished adolescents with TB typically exhibit compromised cell-mediated immunity and heightened systemic inflammation, increasing the likelihood of severe disease manifestations and complicating treatment efficacy.

The Molecular Rapid Test (MRTTCM) was the primary diagnostic tool employed in this study due to its speed and reliability, particularly for adolescent patients. WHO (2020) strongly recommends MRT as the first-line diagnostic method for TB, including among adolescents. Sputum specimens were the most frequently utilized sample type, accounting for 63% of the cases. Other specimens included tissue, stool, gastric lavage, and cerebrospinal fluid. A study conducted at the Octávio Mangabeira Specialist Hospital in Salvador, Brazil, demonstrated that MRTTCM, specifically the Xpert MTB/RIF assay, significantly improved TB detection rates compared to traditional sputum smear microscopy, enhancing detection by approximately 59.9%. This underscores the pivotal role of sputum specimens in adolescent TB diagnosis. Moreover, Kay et al. (2024) emphasized the potential of stool specimens as a viable diagnostic alternative, particularly when sputum collection is challenging, such as in younger adolescents or severely ill patients. Within this study, 63% of the patients tested positive for Mycobacterium tuberculosis using the Xpert MTB/RIF Ultra assay, while 37% tested negative. These results affirm the diagnostic accuracy and sensitivity of molecular rapid tests in adolescent populations. Dorman's (2018) research further validates the superiority of sputum specimens for TB detection using MRT, reinforcing the approach adopted in this study. The inclusion of alternative specimens, although less sensitive, provides a broader diagnostic spectrum, ensuring more comprehensive case identification. Radiological evaluations revealed that 81% of the adolescent TB patients exhibited abnormal chest X-ray findings. Infiltrates were the most prevalent abnormality, observed in 59% of the cases, followed by fibrosis or scarring, pleural effusion, and cavitary lesions. These radiographic patterns are consistent with global findings on adolescent TB. Sant'Anna (2011) reported similar results in a Brazilian cohort of 850 adolescents, where infiltrates dominated the radiological profiles, followed by cavitary lesions and bilateral lung involvement. These patterns suggest that adolescent TB frequently resembles adult-type TB in terms of radiographic presentation, characterized by advanced and potentially transmissible disease forms.

Further supporting evidence from Sant'Anna (2009) emphasized that post-primary TB, commonly observed in adolescents, often presents with infiltrates, cavitary lesions, and tuberculous pneumonia. These findings align with this study's observations, reinforcing the notion that adolescent TB exhibits complex and mature radiological features. Local research by Ghaesani (2020) at Dr. Hasan Sadikin General Hospital in Bandung also reported a predominance of pulmonary infiltrates among pediatric TB patients, though cavitary lesions were less common in younger children. This suggests a progressive radiological complexity correlating with patient age, with adolescents demonstrating more advanced patterns akin to adult TB cases. In summary, the radiological data from this study validate the critical role of chest radiography in adolescent TB diagnosis, offering essential visual evidence that complements microbiological and clinical assessments.

The reliance on secondary data introduces inherent limitations, particularly concerning data completeness and consistency. Medical records occasionally lacked comprehensive details on clinical symptoms, prior TB treatment history, or follow-up diagnostics, potentially biasing the analysis and limiting the depth of patient characterization. Additionally, the unavailability of certain laboratory parameters or longitudinal imaging data constrains the ability to accurately classify disease subtypes or assess severity over time. This study did not systematically incorporate socioeconomic or environmental determinants, which are known to significantly influence TB epidemiology and patient outcomes. Factors such as household density, socioeconomic status, educational background, and psychosocial stressors were not captured, resulting in a potentially incomplete portrayal of the risk landscape and treatment barriers faced by adolescent TB patients. Adolescent patients exhibit considerable heterogeneity in immune function, nutritional status, and comorbidities, all of which can modulate disease presentation and progression. The study design did not fully accommodate this variability, which may have influenced the observed clinical and radiological profiles. Future research should consider stratified analyses or prospective designs to better elucidate these individual differences. The cross-sectional nature of this study, confined to a specific period, limits its ability to capture longitudinal disease trajectories, treatment responses, and recurrence patterns. Although the total sampling approach ensured comprehensive inclusion of eligible cases, the restricted timeframe provided only a snapshot of adolescent TB epidemiology at RSUD Dr. Soetomo. Extended follow-up studies are warranted to track disease dynamics and assess long-term treatment outcomes, which could provide more robust insights into the adolescent TB burden and its evolution over time.

5. Conclusion

The majority of tuberculosis patients are adolescents aged 15–19 years, with a higher proportion of females at 65% compared to males at 35%. This indicates that older adolescents are more susceptible to tuberculosis diagnosis, possibly due to physiological changes during puberty and social factors such as increased mobility and environmental exposure. Most adolescents diagnosed with tuberculosis suffer from pulmonary tuberculosis, totaling 52 individuals or 53%, while the other 46 individuals or 47% have extrapulmonary tuberculosis, showing a relatively balanced distribution between intrapulmonary and extrapulmonary cases. Among the extrapulmonary cases, the most common sites are the intestines, peritoneum, and mesenteric glands at 24%, as well as bones and joints at 24%. This finding demonstrates that extrapulmonary tuberculosis remains a significant concern among adolescents and presents a different pattern from younger children, who predominantly have primary pulmonary tuberculosis. The study also revealed that most adolescents experienced poor nutritional status, with moderate malnutrition being the most common at 31%, followed by mild malnutrition at 16% and severe malnutrition at 14%, while only 27% of patients had normal nutritional status. These findings strengthen the link between poor nutritional status and susceptibility to tuberculosis infection, as malnutrition can impair cellular immunity. The molecular rapid test most commonly used sputum specimens at 63%, followed by tissue specimens at 12% and gastric lavage at 8%, indicating that although sputum remains the primary specimen, alternative specimens are necessary, especially in extrapulmonary tuberculosis cases. Among all patients examined, 63% tested positive for Mycobacterium tuberculosis through MRT, with the majority of positive cases (82%) showing sensitivity to rifampicin, while 10% were resistant and 8% had indeterminate results. This highlights the importance of paying close attention to the possibility of drug resistance in adolescents as it directly influences treatment regimen choices. Based on radiological examinations of 98 adolescents suspected of having tuberculosis, the majority exhibited abnormal findings on chest X-rays, with 81% showing abnormalities, indicating that most adolescent tuberculosis cases present with evident radiological manifestations. Therefore, the standardization of medical record documentation in health facilities must be improved to support data quality. Chest X-rays and molecular rapid tests should remain the standard procedures in evaluating adolescents suspected of tuberculosis, considering the high occurrence of radiological abnormalities and the importance of detecting drug resistance. Health education programs specifically targeting adolescents are essential to raise awareness of tuberculosis symptoms, emphasize the importance of early diagnosis, and promote prevention of transmission. Additionally, given the discovery of rifampicin resistance in adolescents, routine monitoring of drug resistance patterns is necessary to support tuberculosis control programs and optimize treatment regimens. Further research with larger sample sizes and longitudinal methods is needed to track the progression of tuberculosis in adolescents from initial diagnosis to the completion of treatment. Future studies are also recommended to analyze the types of specimens and molecular rapid test (GeneXpert) results in adolescents, considering the limited number of existing studies addressing this topic.

Compliance with ethical standards

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

References

[1] World Health Organization. Report 20-23. Vol. t/malaria/. Geneva: WHO; January 2023.

[2] Thomas TA. Tuberculosis in children. Pediatr Clin North Am. 2017;64(4):893-909. doi:10.1016/j.pcl.2017.03.010.

[3] Bogart AR, Richards M, Sheeder J. Youth and guardian expectations of privacy in adolescent health care. J Adolesc Health. 2024;1-6. doi:10.1016/j.jadohealth.2024.03.016.

[4] Snow KJ, Cruz AT, Seddon JA, Ferrand RA, Chiang SS, Houben RMGJ, et al. Adolescent tuberculosis. Lancet Child Adolesc Health. 2021;4(1):68–79.

[5] Moscibrodzki P, Enane LA, Hoddinott G, Brooks MB, Byron V, Furin J, et al. The impact of tuberculosis on the well-being of adolescents and young adults. Pathogens. 2021;10(12):1–17.

[6] Astari P. Tuberkulosis intraokular. Nusant Med Sci J. 2019;4(1):1-6. doi:10.20956/nmsj.v4i1.4684.

[7] World Health Organization. Global tuberculosis report 2024. Geneva: World Health Organization; 2024.

[8] Houben RMGJ, Dodd PJ. The global burden of latent tuberculosis infection: A re-estimation using mathematical modelling. PLoS Med. 2016;13(10):1–13.

[9] Wulandini F, Hermawati E, Wulandari M, Indonesia U, Cina P. Indonesian Journal of Global Health Research. Indones J Glob Heal Res. 2019;2(4):519–28.

[10] Kementerian Kesehatan Republik Indonesia. Profil kesehatan Indonesia 2016. Jakarta: Kementerian Kesehatan RI; 2016.

[11] Rahmahdia AA, Shofiya S, Sari N, Astutik E. Epidemiologi deskriptif tuberkulosis di Kota Surabaya tahun 2018-2022. The Descriptive Epidemiology of Tuberculosis in the City of Surabaya from 2018 to 2022. 2024;652–8.

[12] Snow KJ, Sismanidis C, Denholm J, Sawyer SM, Graham SM. The incidence of tuberculosis among adolescents and young adults: A global estimate. Eur Respir J. 2018;51(2).

[13] Silva DR, Muñoz-Torrico M, Duarte R, Galvão T, Bonini EH, Arbex FF, et al. Risk factors for tuberculosis: Diabetes, smoking, alcohol use, and the use of other drugs. J Bras Pneumol. 2018;44(2):145–52.

[14] Ait-Khaled N, Enarson DA. Tuberculosis. Geneva: World Health Organization; 2017.