

Original Research Article

Pathways to diagnosis in children and adolescents with tuberculosis in Kenya

Evaline Jumwa Baya*, Elizabeth Maleche Obimbo, Ruth Nduati

Department of Infectious Diseases, University of Nairobi, Kenya

Received: 20 December 2025

Accepted: 02 February 2026

*Correspondence:

Dr. Evaline Jumwa Baya,

E-mail: d.s.okenyuru@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Tuberculosis in children signals active community transmission. About one million children develop TB annually, but most remain undiagnosed or face delayed treatment. Atypical presentations and limited diagnostic tools increase the risk of late or missed diagnoses, emphasizing the urgent need for enhanced screening, timely detection and effective management strategies to reduce morbidity and transmission.

Methods: This facility-based cross-sectional study was conducted from January to September 2025 at KNH, Mbagathi County Hospital and KEMRI, Nairobi. It included mothers of children aged ≤ 19 years with clinical or bacteriologically confirmed TB who provided consent/assent. A sample of 218 participants was selected using Yamane's (1967) formula via consecutive sampling. Data were collected with structured questionnaires and analyzed using SPSS version 26.0.

Results: Among 117 children with TB, most were female (56.4%) and aged 0–5 years (66.7%). The majority visited two or more facilities (61.5%), primarily referral hospitals (43.6%). Extreme diagnostic delays (>8 weeks) occurred in 46.2%, with significant factors including the first health worker's cadre ($p=0.017$) and parental age >35 years ($p=0.021$).

Conclusions: This study found significant delays in childhood tuberculosis diagnosis, with 46.2% experiencing delays over eight weeks and 56% delayed after facility presentation. Most children visited two or more facilities (61.5%), mainly referral hospitals (43.6%). Delays were significantly associated with the cadre of the first health worker consulted ($p=0.017$) and parental age above 35 years ($p=0.021$), emphasizing the need for improved health system efficiency, parent education and targeted training of healthcare workers to enhance timely TB detection and management.

Keywords: Childhood tuberculosis, Diagnostic delay, Health-seeking pathways, Kenya, Paediatric TB

INTRODUCTION

Tuberculosis (TB) is caused by *Mycobacterium tuberculosis* bacilli whose transmission is through infectious aerosolized droplet generated through coughing, talking, laughing or sneezing.¹ Its presentation can be either pulmonary or extra pulmonary. Extra pulmonary TB is observed more frequently in children compared to adults because lymph hematogenous spread is high. The screening and diagnosis of TB among

children, especially for the under 5 years old is challenging, which leaves many children undiagnosed and condition picked much later with possible complications.^{2,3}

Globally, TB is the leading cause of death from a single infectious disease and continues to be a major concern of public health globally. Roughly a million children contract tuberculosis annually, but due to screening and diagnosis challenges, majority of those TB positive children are never diagnosed or started on treatment. In

2020 1.1 million children are reported to have fallen ill with TB globally with estimates suggesting that an estimated 25% of the children with tuberculosis succumb from the disease and TB related complications.⁴ According to the World Health Organization (WHO), Kenya falls in the category of the 30 countries highly burdened by TB.⁵

The burden among the children is further illustrated by a report by the Kenyan National TB guidelines, which showed that 9% of TB cases notified affected children aged below 15 years. The rate is significant considering most of the TB cases among children are unidentified or unreported.⁶

The impact of *M. tuberculosis* infection in children below age 5 years is further demonstrated by the high risk of disease-related complications compared to adults with the disease. These risks decline slowly with age and the incidence rises again in adolescents who mainly develop adult type disease. The prevalence of PTB is high in adolescents despite a significant proportion of the cases not detected through routine screening.⁷ Even worse is the presence of TB in children and teens with immunocompromised status or with preexisting conditions. These facts validate the importance of following the group closely and remaining more vigilant in ensuring TB is diagnosed early enough to commence appropriate interventions. Early diagnosis is crucial for infants and children for averting the high prevalent disease complications.⁸ Therefore, this study therefore focuses to describe the pathway pathways to diagnosis in children and adolescents with Tuberculosis in Nairobi, Kenya.

METHODS

The study was facility-based observational cross-sectional design which was conducted between July 2024 and July 2025 at Kenyatta National Hospital (KNH), Mbagathi County Hospital and the Kenya Medical Research Institute (KEMRI), Centre for Respiratory Disease Research (CRDR), in Nairobi County, Kenya. KNH is the largest referral and teaching hospital in Kenya and East-Central Africa and hosts the country's largest pediatric TB diagnostic unit, identifying approximately 20–30 pediatric TB cases monthly. Mbagathi County Hospital, a Level 5 public hospital, similarly manages 20–30 new pediatric TB cases per month, with children accounting for about 11% of all TB diagnoses. KEMRI-CRDR conducts nationally relevant research on respiratory diseases of public health importance.

The study population comprised children and adolescents aged 0–19 years who presented to the study sites during the study period and had either a clinical or bacteriologically confirmed TB diagnosis made within the preceding two weeks. Written informed consent was obtained from parents or legal guardians for all minors and assent was sought from children where applicable.

Children whose parents or guardians were unavailable or unwilling to consent were excluded.

The sample size was calculated using Yamane's formula with a 7.5% margin of error, yielding a minimum sample of 128 participants.⁹ Consecutive sampling was employed to enroll all eligible and consenting participants at each site within the study timeframe, minimizing selection bias. Ethical approval was obtained from the University of Nairobi/Kenyatta National Hospital Ethics Review Committee, with additional approvals from the University of Nairobi Department of Pediatrics and Child Health and participating facilities. Data were collected using a structured, pretested questionnaire, cleaned and analyzed using SPSS version 26.0. Descriptive statistics were summarized as frequencies and proportions, while Chi-square tests were used for inferential analysis, with statistical significance set at $p < 0.05$ and a 95% confidence interval.

RESULTS

Demographic and clinical characteristics

Regarding the demographic and clinical characteristics of the study participants. A total of 117 children and adolescents were included, with females constituting the majority at (56.4%) and were predominantly young children aged 0–5 years (66.7%). Most parents or guardians were married (61.5%), self-employed (43.6%) and had attained at least secondary level education, with completed secondary education being the most common (30.8%). Over half of the children were not attending school (53.8%), largely due to their young age. Among those attending school, walking was the most common means of transport. Clinically, most participants were HIV negative (74.4%) and the majority had no history of prior contact with a person diagnosed with pulmonary tuberculosis (89.7%). Result is as shown in table 1 below.

Determine the number of visits that they make to health facilities and type of health facilities visited

The results revealed that majority of patients visited more than one health facility before receiving care, with most having attended at least two facilities. Specifically, visiting two facilities was the most common pattern (33.3%), followed closely by those who visited three facilities (28.2%), indicating frequent multiple health-seeking encounters prior to definitive management. Overall, the number of facilities visited ranged from one to four, with a median of two facilities and an interquartile range of one to three, underscoring repeated care-seeking among most patients. Results are as shown in Table 2.

Regarding the type of facility first visited, the majority initially sought care at higher-level facilities, with referral hospitals being the most common first point of contact (43.6%), followed by county hospitals (33.3%). In

contrast, relatively few patients first visited lower-level facilities such as health centres (5.1%), private hospitals (10.3%) or chemists (5.1%). Results are as shown in Table 3.

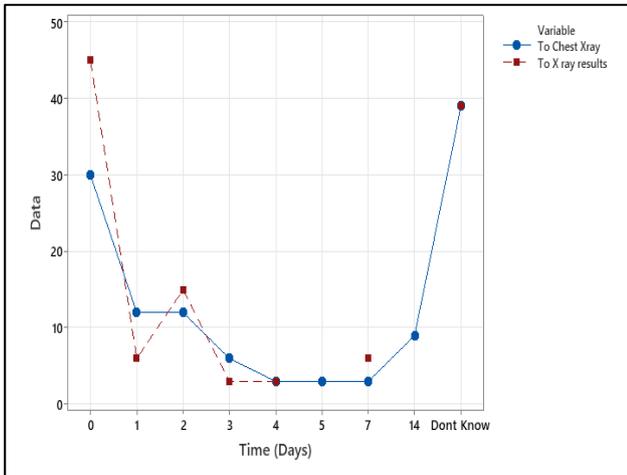


Figure 1: Line plot of timelines to chest X-ray and the results.

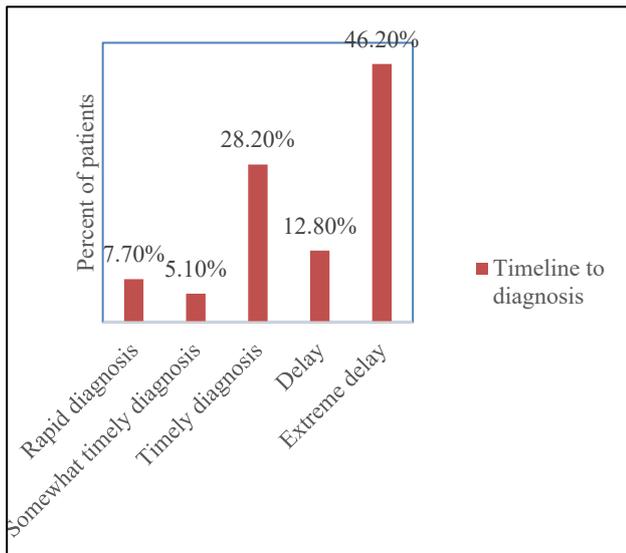


Figure 2: Timelines from onset of symptoms to diagnosis.

Describe the investigations that they are advised to undertake during their pathway to diagnosis and proportion with successful access to the investigation

During the pathway to tuberculosis diagnosis, patients were advised to undergo both general and TB-specific laboratory investigations, with varying levels of access and uptake.

Among the general investigations requested, a full blood count was the most commonly advised test, with 90 patients (76.9%) successfully accessing and undergoing the investigation. Other general tests were less frequently

requested and completed, including malaria testing in 21 patients (18.0%) and typhoid testing in 18 patients (15.4%). Result is as illustrated in Table 4. With regard to TB-specific investigations, GeneXpert testing was the most frequently requested and successfully accessed investigation, undertaken by 72 patients (61.5%), reflecting its central role in TB diagnosis. This was followed by sputum microscopy for TB, which was accessed by 27 patients (23.1%), while the Mantoux test was the least commonly accessed TB-specific investigation, conducted in 12 patients (10.3%). Overall, these findings indicate that while most patients were able to access at least one recommended investigation, access was highest for essential tests such as full blood count and GeneXpert, with lower uptake observed for other general and TB-specific diagnostic investigations (Table 5).

Regarding the imaging investigations formed a key component of the diagnostic pathway for TB among the study participants. The most frequently requested imaging modality was chest X-ray, which was advised for 84 patients (71.8%), while chest CT scan was requested for a much smaller proportion, 9 patients (7.7%); 15 patients (12.8%) were advised to undergo other, unspecified imaging investigations (Table 6).

The majority of patients accessed chest X-ray imaging on the same day it was requested (38.5%) and most also received their chest X-ray results on the same day (57.7%). Additionally, a substantial proportion of participants reported being unable to recall the exact time taken to access the chest X-ray or receive the results (33.3%). Result is as shown in Figure 1.

Determine the time taken from symptom onset to final diagnosis

The result revealed that the majority of patients experienced significant delays in TB diagnosis. From symptom onset to diagnosis, most patients, 54 (46.2%), faced extreme delays of more than eight weeks. Similarly, from presentation at a health facility to diagnosis, a substantial proportion, 66 (56%), experienced delays of more than two weeks. Result is illustrated in Figure 2.

Evaluate factors associated with time to diagnosis of TB

The results revealed that the overall delay to TB diagnosis identified two factors that were statistically significant. First, the cadre of the health worker initially consulted was significantly associated with delay: patients who first saw a clinical officer were less likely to experience delay compared to those who saw a doctor (OR=0.29, 95% CI: 0.08–0.92, p=0.017).

Second, parental age showed a significant effect on delay: children whose parents were older than 35 years were much more likely to experience a delay in diagnosis compared to those with parents younger than 35 years

(OR = 0.1, 95% CI: 0.002–0.9, p=0.021). Other factors, including child age, sex, parental marital status, type of

facility visited and availability of tests, were not significantly associated with diagnostic delay (Table 9).

Table 1: Summary table of demographic and clinical characteristics.

Variable	Categories	Count (%)
Sex	Males	51 (43.6)
	Females	66 (56.4)
Age of patients (years)	0-5	78 (66.7)
	6-12	36 (30.8)
	>13	3 (2.6)
Parent marital status	Married	72 (61.5)
	Single	21 (18.0)
	Divorced	15 (12.8)
	Widow/er	9 (7.8)
Parent employment status	Self-employed	51 (43.6)
	House wife	45 (38.5)
	Unemployed	21 (18.0)
Parent level of education	No formal education	3 (2.6)
	Some primary education	21 (18.0)
	Completed primary	24 (20.5)
	Some secondary	21 (18.0)
	Completed Secondary	36 (30.8)
	Tertiary	12 (10.3)
Type of school attending	No school going child	63 (53.8)
	Public	33 (28.2)
	Private	21 (18.0)
Means of transport to school (n=18)	Private means	3 (2.6)
	Public means	9 (7.7)
	Walking	42 (35.9)
HIV status	Negative	87 (74.4)
	Positive	24 (20.5)
	Don't know	4 (5.1)
History of prior contact with person with pTB	Contact	12 (10.3)
	No contact	105 (89.7)

Table 2: Number of facilities visited by patients.

Number of facilities visited	Frequency	%	Cumulative %
1	36	30.8	30.8
2	39	33.3	64.1
3	33	28.2	92.3
4	9	7.7	100.0
Total	117	100	100

Table 3: Type of health facility visited first.

First health facility visited	Frequency	%
County hospital	39	33.3
Referral hospital	51	43.6
Health centre	6	5.1
Private hospital	12	10.3
Chemist	6	5.1

Table 4: Type of general laboratory investigations requested.

Type of general investigations	Frequency (%) n=117
Full blood count	90 (76.9)
Malaria	21 (18.0)
Typhoid test	18 (15.4)

Table 5: Type of TB specific laboratory investigations.

Type of TB specific investigation	Frequency (%)
Gene Expert	72 (61.5)
Sputum microscopy TB	27 (23.1)
Mantoux test	12 (10.3)

Table 6: Type of imaging requested.

Type of Imaging investigation	Counts	%
Chest X-ray	84	71.8
Chest CT Scan	9	7.7
Other, Unspecified	15	12.8

Table 7: Determinants of overall delay to diagnosis.

Factor	Detail	No delay		Delay		Odds ratio	95% CI	P value
		Frequency (row %)	Frequency (row %)	Frequency (row %)	Frequency (row %)			
Child age category	<10 years	42 (43.8)	54 (56.3)	0.5	0.04 – 3.8	0.46		
	10+ years	6 (28.6)	15 (71.4)					
Child sex	Male	21 (41.2)	30 (58.8)	0.99	0.44 – 0.23	0.987		
	Female	27 (40.9)	39 (59.1)					
Marital status of parent	Married	33 (45.8)	39 (54.2)	1.1	0.5 – 2.8	0.837		
	Single	15 (33.3)	20 (66.7)					
Type of facility visited	Referral (ref)	24 (35.3)	33 (64.7)	0.7	0.3 – 1.6	0.379		
	County	12 (30.8)	27 (69.2)					
	Health Center	6 (100.0)	0 (0)					
	Private	6 (50)	2 (50)					
	Chemist	3 (50)	1 (50)					
Cadre of health worker	Traditional healers	3 (100)	0 (0)	0.29	0.08 – 0.92	0.017		
	Doctor (ref)	36 (36.4)	63 (63.6)					
	Clinical officer	6 (100)	0 (0)					
	Pharmacist	0 (0)	3 (100)					
	Herbalist/Traditional healer	3 (100)	0 (0)					
Availability of tests	I don't know	3 (50)	3 (50)	1.1	0.4 – 2.7	0.939		
	Yes	36 (41.4)	51 (58.6)					
Age of parent	No	12 (40)	18 (60)	0.1	0.002 – 0.9	0.021		
	<35	45 (51.7)	42 (48.3)					
	>35	3 (10.0)	27 (90.0)					

DISCUSSION

Demographic and clinical characteristics

The demographic and clinical characteristics observed in this study are largely consistent with findings from other

pediatric tuberculosis studies in sub-Saharan Africa and similar high-burden settings. The predominance of young children aged 0–5 years aligns with reports from studies in Kenya, Uganda and South Africa, which have shown that younger children are more vulnerable to TB due to immature immune systems and close contact with adult

caregivers, yet often present with non-specific symptoms that complicate diagnosis. The higher proportion of females observed in this study is comparable to findings from Tharaka-Nithi County and parts of Ethiopia, although other studies have reported either male predominance or no significant sex differences, suggesting that gender patterns in pediatric TB may vary by context. The majority of caregivers having at least secondary education is higher than reported in some rural Kenyan and Ethiopian studies, where lower educational attainment was common, potentially reflecting the urban setting of Nairobi. Similar to findings from India and Malawi, most children in this study were HIV negative, reinforcing evidence that pediatric TB frequently occurs outside the context of HIV infection. Additionally, the low proportion of reported prior TB contact mirrors observations from other studies, highlighting ongoing challenges in contact tracing and the often-unrecognized transmission pathways in childhood TB.

Number of visits to health facilities and type of health facilities visited

The study revealed that the majority of pediatric TB patients in Kenya visited more than one health facility prior to receiving a definitive diagnosis highlighting the complexity of the healthcare-seeking pathway for children with TB, where caregivers often navigate multiple levels of the health system before obtaining appropriate care. This is consistent with previous studies in sub-Saharan Africa, which have documented that repeated visits to multiple facilities are common among pediatric TB patients due to misdiagnosis, limited diagnostic capacity at primary care facilities and perceived inadequacies in care at initial points of contact.¹⁰

The majority of patients in this study initially sought care at higher-level facilities, with referral hospitals being the most common first point of contact. Lower-level facilities were less frequently utilized as initial points of care. This preference for referral hospitals suggests that caregivers perceive these facilities as offering superior expertise, comprehensive diagnostic services and specialized care for TB. The findings are in line with a study conducted in Nairobi found that caregivers frequently bypassed primary care facilities in favor of higher-tier hospitals, citing concerns over diagnostic accuracy, availability of medications and access to specialized personnel.¹¹ In Uganda, it was reported that caregivers of children with suspected TB commonly sought care at multiple facilities, with district and regional hospitals being preferred for initial evaluation due to perceived competence and availability of laboratory services.¹²

The diversity in facility types visited in the current study reflects the multifaceted nature of healthcare access in Kenya, where formal and informal sectors coexist. While the lower use of primary health centres and chemists as first points of contact suggests limited trust in these

facilities, it also points to potential gaps in decentralizing TB diagnostic services. This was in agreement with a study from India which highlighted that repeated visits across different facility types were common due to diagnostic delays at peripheral health centers.¹³ The reliance on higher-level facilities as the first point of care has important implications for healthcare planning. Centralized care at referral and county hospitals may lead to congestion and resource strain, particularly in urban settings where patient volumes are high. Strengthening diagnostic and treatment services at primary care and lower-level facilities could reduce unnecessary referrals and repeated visits, streamline care pathways and minimize delays in TB diagnosis among children. This approach aligns with WHO recommendations on decentralized TB care, which advocate for empowering community and primary health facilities with rapid diagnostic tools, trained personnel and clear referral protocols to facilitate timely and equitable access to care.¹⁴

Time taken from symptom onset to final diagnosis

The findings of this study highlight the critical role of both laboratory and imaging investigations in the pediatric TB diagnostic pathway and reveal variations in access and uptake among patients. Full blood counts (FBC) were the most frequently requested general laboratory test, with majority of patients successfully completing it. This indicated the routine availability and low cost, facilitating its widespread use in both tertiary and secondary-level facilities. The findings were consistent with prior studies indicating that general hematological investigations are commonly used in pediatric evaluations to rule out other infectious or hematologic conditions before a TB diagnosis is confirmed.^{15,16}

TB-specific investigations were accessed less consistently. GeneXpert was the most commonly requested TB-specific test, with majority of patients completing it. Suggesting the growing recognition of GeneXpert as a rapid and sensitive molecular diagnostic tool for pediatric TB and this was in line with WHO recommendations for early detection.¹⁴ The Mantoux test was the least commonly used test, a trend that mirrors findings from other regional studies where the tuberculin skin test is less relied upon due to operational challenges, variability in interpretation and reduced sensitivity in BCG-vaccinated populations.¹⁷

Regarding the imaging, Chest X-ray was advised for majority of patients and was the most accessed imaging modality, showing its importance in evaluating pulmonary involvement in pediatric TB. The finding was consistent with studies from sub-Saharan Africa, where chest X-ray remains a frontline tool due to its accessibility and utility in identifying suggestive TB lesions.^{18,19} In terms of the timeline to access chest X-ray and receive results revealed that more than have of the

patients obtained the imaging on the same day and received results immediately. While this demonstrates efficiency for some patients, a significant proportion could not recall the timing, suggesting inconsistent experiences and potential delays in reporting or communication. Similar findings have been reported in Kenya and Uganda, where diagnostic delays are often linked not only to patient behavior but also to healthcare system factors, including equipment availability, workflow inefficiencies and staffing constraints.^{19,20}

The study also observed that many patients underwent non-TB related tests on the path to diagnosis. While these tests may be clinically justified, they can contribute to diagnostic delays, increased costs and confusion in clinical reasoning. This finding emphasizes the need for standardized pediatric TB diagnostic algorithms, clear communication of investigations required and improved training of healthcare providers to prioritize high-yield tests while avoiding unnecessary investigations.²¹

Factors associated with time to diagnosis of TB

With regard to child age category, the study showed that the majority of participants were younger than 10 years and this group accounted for most cases both with and without diagnostic delay. This association was not statistically significant indicating that health system and caregiver factors may play a more critical role than the child's age. This finding suggests that age alone may not be a strong independent determinant of diagnostic delay in this setting. Similar findings have been reported in other pediatric TB studies, where delays were observed across age groups, largely due to the non-specific clinical presentation of TB in children.²²

In terms of child sex, a slightly higher proportion of females experienced diagnostic delay compared to males; however, this difference was minimal and not statistically significant. This implies that, within this study population, sex did not independently influence the time to TB diagnosis. These findings are consistent with several studies conducted in similar settings, which have reported no clear sex-based disparities in pediatric TB diagnostic timelines.²³

Concerning the marital status of the parent or guardian, children of single parents showed a higher proportion of diagnostic delay compared to those with married parents, although this association was not statistically significant. This finding may reflect underlying social and economic challenges faced by single caregivers, such as reduced social support and competing responsibilities, which can affect timely health-seeking and follow-up. Similar outlines have been described in other studies, where lack of social support structures contributed to delays in accessing care, even though marital status itself did not emerge as a statistically significant predictor.²⁴

Pertaining to the type of facility visited, no statistically significant association was found between the level of health facility first visited and diagnostic delay. Although a higher proportion of delays was observed among children who visited county hospitals, private facilities, chemists or traditional healers compared to referral hospitals, these differences did not reach statistical significance. This suggests that delays may occur across different levels of care, possibly due to systemic issues such as low clinical suspicion of pediatric TB, referral bottlenecks and fragmented care pathways. Similar findings have been reported in other studies, indicating that simply accessing higher-level facilities does not automatically guarantee timely diagnosis.²⁵

In regard to the cadre of health worker initially consulted, this study identified a statistically significant association with diagnostic delay. Children first seen by clinical officers were significantly less likely to experience delays compared to those initially seen by doctors. This finding may reflect differences in practice patterns, with clinical officers possibly adhering more strictly to TB screening algorithms and having a lower threshold for initiating TB investigations in high-burden settings. Comparable observations have been reported elsewhere, where frontline healthcare workers demonstrated greater vigilance for TB due to frequent exposure to TB cases.²⁶

In terms of availability of diagnostic tests, the study found no significant association between test availability and diagnostic delay. Although one might expect limited access to tests to contribute to delays, this finding suggests that factors such as timely test ordering, interpretation and communication of results may be more critical than availability alone. Similar conclusions have been drawn in other studies, emphasizing that strengthening clinical decision-making and diagnostic workflows is as important as expanding diagnostic infrastructure.²⁷

Finally, age of the parent or guardian was significantly associated with diagnostic delay. Children whose parents were older than 35 years were significantly more likely to experience delays compared to those with younger parents. This finding may be related to differences in health-seeking behavior, perception of illness severity or delayed recognition of TB symptoms among older caregivers. Comparable associations have been reported in other settings, highlighting the central role of caregivers in determining the timeliness of diagnosis.²⁸

CONCLUSION

The study revealed prominent delays in the diagnosis of tuberculosis among children and adolescents, with 46.2% experiencing extreme delays of over eight weeks from symptom onset and 56.0% delayed after presenting at a health facility. Most participants visited multiple facilities before diagnosis, with two facilities being the most common (33.3%) and referral hospitals were the primary

first contact (43.6%). Full blood count (76.9%) and GeneXpert testing (61.5%) were the most accessed investigations. Factors significantly associated with diagnostic delay included the cadre of the initial health worker consulted ($p=0.017$) and parental age over 35 years ($p=0.021$), emphasizing caregiver and health-system roles in timely TB diagnosis.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

- Swalehe HM, Obeagu EI. Tuberculosis: Current diagnosis and management. *Elite J Publ Health*. 2024;2(1):23-33.
- Gunasekera KS, Vonasek B, Oliwa J, Triasih R, Lancioni C, Graham SM. Diagnostic challenges in childhood pulmonary tuberculosis—optimizing the clinical approach. *Pathogens*. 2022;11(4):382.
- Vonasek B, Ness T, Takwoingi Y, Kay AW, van Wyk SS. Screening tests for active pulmonary tuberculosis in children. *Cochrane Data Syst Rev*. 2021(6):79-81.
- Jaganath D, Beaudry J, Salazar-Austin N. Tuberculosis in children. *Infect Dis Clin North America*. 2022;36(1):49-71.
- Ngari MM, Rashid MA, Sanga D, Mathenge H, Agoro O. Burden of HIV and treatment outcomes among TB patients in rural Kenya: a 9-year longitudinal study. *BMC Infect Dis*. 2023;23(1):362.
- Onyango DO, Yuen CM, Masini E, Borgdorff MW. Epidemiology of pediatric tuberculosis in Kenya and risk factors for mortality during treatment: a national retrospective cohort study. *J Pediat*. 2018;201:115-21.
- Ma Z, He W, Zhou Y, Mai L, Xu L, Li C. Global burden of stroke in adolescents and young adults (aged 15–39 years) from 1990 to 2019: a comprehensive trend analysis based on the global burden of disease study 2019. *BMC Publ Heal*. 2024;24(1):2042.
- Wang X, Li Y, Shi T, Bont LJ. Global disease burden of and risk factors for acute lower respiratory infections caused by respiratory syncytial virus in preterm infants and young children in 2019: a systematic review and meta-analysis of aggregated and individual participant data. *Lancet*. 2024;403(10433):1241-53.
- Yamane T. Statistics: An introductory analysis. Available at: <https://www.gjimt.ac.in/wp-content/uploads>. Accessed on 21 August 2025.
- Starke JR, Erkens C, Ritz N, Kitai I. Strengthening tuberculosis services for children and adolescents in low endemic settings. *Pathogens*. 2022;11(2):158.
- Mohamoud G, Mash R. The quality of primary care performance in private sector facilities in Nairobi, Kenya: a cross-sectional descriptive survey. *BMC Prim Care*. 2022;23(1):120.
- Omogot S, Muttamba W, Najjingo I, Baruch Baluku J, Kitaka S. Strategies to resolve the gap in adolescent tuberculosis care at four health facilities in Uganda: The teenager's TB pilot project. *Plos one*. 2024;19(4):286894.
- Fatma N, Ramamohan V. Healthcare seeking behavior among patients visiting public primary and secondary healthcare facilities in an urban Indian district: a cross-sectional quantitative analysis. *PLOS Global Public Health*. 2023;3(9):1101.
- World Health Organization. Framework for collaborative action on tuberculosis and comorbidities. World Health Organization. 2022.
- Minardi ML, Fato I, Di Gennaro F, Mosti S. Common and rare hematological manifestations and adverse drug events during treatment of active TB: a state of art. *Microorganisms*. 2021;9(7):1477.
- Nolt D, Starke JR, Committee on Infectious Diseases. Tuberculosis infection in children and adolescents: testing and treatment. *Pediatrics*. 2021;148(6):968.
- Krishnan N, Priestman M, Uhía I. A noninvasive BCG skin challenge model for assessing tuberculosis vaccine efficacy. *PLoS Boil*. 2024;22(8):3002766.
- Abraham Y, Manyazewal T, Amdemariam Z, Petros H. Facilitators and barriers to implementing chest radiography in tuberculosis systematic screening of clinically high-risk groups in Ethiopia: A qualitative study. *SAGE Open Med*. 2024;12:20503121241233232.
- Turyasiima M, Niwampeire PM, Kaitiritimba R. Enhancing Diagnostic and Patient Safety in Healthcare Systems: Key Insights from the World Patient Safety Day 2024 Commemoration in Uganda. *Drug, Health Pat Saf*. 2025;3:135-43.
- Onyango OO, Willows TM, McKnight J, Schell CO. Third delay in care of critically ill patients: a qualitative investigation of public hospitals in Kenya. *BMJ Open*. 2024;14(1):72341.
- Wobudeya E, Bonnet M, Walters EG, Nabeta P, Song R. Diagnostic advances in childhood tuberculosis—improving specimen collection and yield of microbiological diagnosis for intrathoracic tuberculosis. *Pathogens*. 2022;11(4):389.
- Tchounga B, Tiam A, Masaba RO, Herrera N. Assessing tuberculosis clinical presentation, diagnosis and treatment outcomes among children under 5 years old: results from a cohort of children with presumptive TB in Cameroon and Kenya. *BMJ Public Health*. 2025;2(1):896.
- Horton KC. Understanding sex disparities in tuberculosis and assessing the potential impact of strategies to improve men's access to care (Doctoral dissertation, London School of Hygiene & Tropical Medicine). 2021.
- Ahmed HA, Mohamed BE. Relationship between morality, happiness, and social support among

- elderly people. *Middle East Curr Psych*. 2022;29(1):31.
25. Busono P, Kusuma AA, Suryana Y, Agastani T. Perspective Chapter: A Tele-Ultrasound Service Model for Early Detection of Fetal Stunting in Remote Areas of Indonesia. 2025.
26. Salifu RS, Hlongwana KW. Frontline healthcare workers' experiences in implementing the TB-DM collaborative framework in Northern Ghana. *BMC Health Serv Res*. 2021;21(1):861.
27. Baumfeld Andre E, Carrington N, Siami. The current landscape and emerging applications for real-world data in diagnostics and clinical decision support and its impact on regulatory decision making. *Clin Pharmacol Therap*. 2022;112(6):1172-82.
28. Kofke L, Pérez-Escamilla R, Gubert MB, Buccini G. Socio-demographic, maternal, and infant characteristics associated with early childhood development delays among children of young mothers in Brasília, Brazil. *Plos One*. 2022;17(3):266018.

Cite this article as: Baya EJ, Obimbo EM, Nduati R. Pathways to diagnosis in children and adolescents with tuberculosis in Kenya. *Int J Community Med Public Health* 2026;13:1125-33.