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An Assessment of Childhood Tuberculosis Detection in Public Sector Health Facilities in Zimbabwe

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Abstract

Introduction: Zimbabwe has consistently failed to meet the World Health Organization's target of 10 to 15% of Tuberculosis (TB) notifications being children below 15 years, with the country experiencing a proportionate decline in childhood TB contribution to national notifications from 9% in 2011 to 5% in 2017.

Methodology: We conducted a descriptive cross-sectional study in 20 public sector health facilities across 4 districts. We abstracted childhood TB screening, diagnosis and treatment data from facility registers for the year 2019. Study was approved by local ethics committee and a waiver of consent was obtained for accessing patient data.

Results: Data for 21,791 children who accessed health services were abstracted, and 1,116 had documented TB management data. Overall, 3.1% of children were screened for TB; 0.8% for children below 5 years, 5.2% for ages 5-9, and 7.3% for ages 10-14 years. TB screening was significantly higher in referral (6.9%) than primary level (1.7%) facilities ($p<0.05$). About 63.2% of presumptive TB children had TB diagnostic tests; 51.2% for children below 5 years, 55.8% for ages 5-9 and 71.4% for ages 10-14 years. A majority (71.9%) of tests were conducted on GeneXpert MTB Rif platform and 17.9% were by microscopy. About 9.3% of tested children were diagnosed with TB, and 93.5% of these were initiated on treatment. Treatment outcomes for 65% of eligible children were evaluated.

Conclusion: TB screening and diagnostic testing for children below 5 years was very low. There is need to screen all children presenting to primary level facilities.

Keywords: ***Screening, Testing, Detection, Tuberculosis, Zimbabwe.***

Introduction

Tuberculosis (TB) is one of the top 10 causes of death globally, and the leading cause of mortality from a single infectious agent (WHO, 2019). TB is caused by the Mycobacterium tuberculosis, a bacillus which is spread from person to person through inhalation of respiratory droplets containing the causative agent. There were an estimated 10.4 million people who developed TB in 2016, and of these only 6.3 million (61%) were diagnosed and initiated on treatment (WHO, 2019). It is estimated that childhood TB contributes between 15 and 40% of all TB cases (Nelson et al, 2004; Huang et al, 2005; Yeh et al, 2005). Childhood TB reflects ongoing transmission, and children are mostly affected in areas where the adult TB epidemic is poorly controlled (Marais B.J, 2011). Globally, an estimated 13% of TB patients are HIV positive, with most of these residing in the African region (WHO, 2019). Most people with TB can be cured with timely diagnosis and treatment; TB treatment also curtails onward transmission of infection. TB incidence and mortality rates can be reduced by reducing health-related risk factors such as smoking, HIV infection and diabetes, providing preventive therapy to people with a latent TB infection (LTBI), as well as multi-sectoral interventions on broader determinants of TB infection and disease (WHO, 2019).

An estimated 19.3% of the global TB notifications in 2018 were from the African region, and 9% of all TB notifications in Africa were children below 15 years of age, below the World Health Organization (WHO) target of 10-15% of all notifications. TB treatment coverage in 2018 was very low (56%), but the continent had the highest case fatality ratio of 25% (WHO,

2019). Critical gaps in TB case detection and treatment in Africa are contributing to the burden of undiagnosed TB, with estimates indicating that more than 50% of people with TB in Western, Central and Southern African regions remain undiagnosed (Global Fund, 2018).

TB is a major public health problem in Zimbabwe, with the country having an estimated incidence of 210 cases / 100 000 people in 2018 (WHO, 2019). There were an estimated 25, 775 notifications in 2018, of which 6% were children below 15 years of age. Zimbabwe is one of the countries that meets all the three WHO lists of countries with high per capita incidence of TB, TB/HIV and Multi – Drug Resistant TB (MDR-TB) (WHO, 2019). There were an estimated 8, 000 deaths attributed to TB alone in 2018 (Zimbabwe TB report, 2018). The high HIV prevalence in Zimbabwe, estimated to be 14.6% among adults aged 15-64 years, is one of the major contributors to the high TB incidence in the country (ZIMPHIA, 2015-16).

Children are at high risk of developing severe and disseminated forms of TB (WHO, 2019). The diagnosis of TB in children is difficult as the disease can mimic many common diseases such as pneumonia, HIV infection or malnutrition. In addition, the paucibacillary nature of the disease in children, coupled with difficulties children have in expectorating sputum makes diagnosis difficult (Zar et al, 2005). It is estimated that only 10 to 15% of childhood sputum samples reveal acid-fast bacilli, and about 70% of cases with probable TB will have negative sputum culture (Marais et al, 2006). Diagnosis of childhood TB depends on assessment of available evidence from history of exposure to TB, clinical examination and relevant diagnostic investigations. All children accessing health services in Zimbabwe should have TB screening based on a symptom enquiry of any of fever, night sweats, loss of weight and cough for more than 1week; for HIV infected people, current cough of any duration (Zimbabwe TB control guidelines, 2016-2020). In addition, all children should have nutritional assessment including weight for height, height for age, weight for age and mid upper arm circumference (MUAC). All children with a positive symptom inquiry or are undernourished or have a positive history of TB contact should have a chest X-ray. All children with symptoms presumptive of TB should have a specimen of the child obtained and tested for TB using the Xpert MTB/Rif or Ultra assay. The Tuberculin Skin Test (TST) is particularly useful for supporting diagnosis of TB in children with suggestive clinical features but with a negative bacteriologic test result or cannot produce sputum (Zimbabwe TB control guidelines, 2016-2020). Improving childhood TB detection depends partly on optimization of TB screening and diagnosis among clients accessing health services, which is critical for achievement of national targets in line with the global End TB Strategy (WHO, 2015). A study conducted in Tanzania exploring primary level facility staff perceptions and challenges with regards to childhood TB detection found that HCWs perceived childhood TB to be uncommon, and TB was rarely considered as a likely diagnosis among children (Bjerrum et al, 2012).

Zimbabwe has consistently failed to meet the WHO recommended target of 10-15% of total TB notifications being children below 15 years. The country experienced a proportionate decline in the contribution of childhood TB to overall country notifications from 9.7% in 2010 to 6% in 2018. The country has been consistently performing below the global benchmark target for effective TB care and prevention of at least 90% treatment coverage and 90% treatment success rate. In 2018, TB treatment coverage and success rate was 71% and 83% respectively (Zimbabwe TB report, 2018). Low TB detection rates leads to increased transmission and high TB prevalence rates, as each active TB case has the capacity to infect 10-15 people per year (Borgdorff et al, 2000). It was not clear why the country was failing to detect TB in children; whether this was a result of health system failure or poor health seeking behavior of clients or a combination of both. A limited number of studies have been conducted focusing on childhood TB detection rates and interventions that can increase childhood TB screening and diagnosis within primary and referral public sector facilities. Findings from this study will be useful for development of interventions such as HCW capacity building to address low childhood TB detection in primary level public sector health facilities, thereby contributing to optimized childhood TB management. This study assessed rates of TB screening and diagnosis among children accessing health services is selected

primary and referral public sector health facilities in Zimbabwe.

Methods

Study design

A descriptive cross-sectional study was conducted in 20 public sector health facilities across 4 districts in Zimbabwe.

Study setting

The study was conducted in 20 public sector health facilities with high TB notifications across 4 districts; multi-stage stratified sampling was used to select districts and facilities.

Study participants

These were children aged 0 to 14 years who presented to study sites between 1 January and 31 December 2019 and whose records of clinical services they received were documented in facility registers; the recorded TB management data were abstracted.

Sample size

The sample size were all children aged 0 to 15 years who presented to study sites between 1 January and 31 December 2019.

Sampling techniques

A multi-stage stratified sampling design was used to select districts and health facilities. All 62 health districts in Zimbabwe were stratified into 3 categories i.e. rural, urban and boarder areas. One district was randomly selected from each stratum using the lottery method; a fourth urban district was purposively selected. Twenty (20) public sector health facilities, five from each of the four selected districts participated in the study. Health facilities were stratified into two strata i.e. primary level and referral. Childhood TB notifications data were used to purposively select one referral and 4 primary level facilities with the highest number of childhood TB notifications in 3 districts; 2 referral and 3 primary level facilities were selected in the 4th district. All children aged 0 to 14 years who presented at study sites between 1 January and 31 December 2019 and whose records of TB screening, diagnosis and treatment services they received were documented in health facility registers were selected to participate.

Data collection: A data abstraction tool was used to collect TB screening, diagnosis and treatment services uptake data from the Ministry of Health and Child Care (MOHCC) health facility-level registers.

Inclusion and exclusion criteria: All children aged 0 to 14 years presenting at the 20 study sites between 1 January and 31 December 2019 and with age and date of clinic visit documented in health facility registers were included in the study. Clients presenting to study sites without documented age and / or date of clinic visit were excluded from the study.

Data analysis

TB screening, diagnosis and treatment data abstracted from facility registers were analyzed using Epi Info package.

Permission and ethical considerations

Study was approved by the Medical Research Council of Zimbabwe (MRCZ/A/2581). Permission to conduct study was granted by the MOHCC national, provincial, district and facility-level health managers. Waiver of consent was obtained for accessing client records during abstraction of data on childhood TB management.

Results

A total of 21,791 children aged 0 to 14 years accessed health services at study sites during the review period and 12,387 (56.8%) were below 5 years of age, 4,689 (21.5%) were aged 5 to 9 years, and 4,715 (21.6%) were aged 10 to 14 years. Data for 1,166 children with TB screening, diagnosis and treatment services recorded in facility registers were abstracted and 206 (17.7%) were below 5 years of age, 413 (35.4%) were aged 5 to 9 years and 547 (46.9%) were aged 10 to 14 years (Table 1). Overall, 27.4% of children with TB management data recorded in health facility registers were HIV positive and 36.5% had no documented HIV status. Harare (the capital city) had the highest HIV positivity rate (35.3%) and Beitbridge (border district) had the lowest (21.9%).

Table 1. Demographic characteristics of children accessing health services at study sites

District	Health Facility	Number of children			Total
		<5 years	5 to 9 years	10 to 14 years	
Chipinge	Chipinge hospital	784	193	344	1,321
	Chibuwe clinic	107	67	49	223
	Gaza clinic	188	165	104	457
	Madhuku clinic	93	34	42	169
	St Peters hospital	142	22	127	291
Bulawayo	Mpilo hospital	685	233	406	1,324
	Mzilikazi clinic	789	154	164	1,107
	Cowdry Park clinic	1018	432	344	1,794
	Princes Margaret clinic	481	330	172	983
	Magwegwe clinic	387	92	269	748
Beitbridge	Beitbridge hospital	1221	456	521	2,198
	Dite clinic	380	113	164	657
	Shabwe clinic	105	64	66	235
	Shashe clinic	147	71	74	292
	Dulibadzimu clinic	1043	379	471	1,893
Harare	Beatrice road hospital	96	367	416	879
	Mabvuku clinic	1658	515	193	2,366
	Kuwadzana clinic	1055	470	331	1,856
	Mbare clinic	1216	188	361	1,765
	Hopley clinic	792	344	97	1,233
Total		**12,387**	**4,689**	**4,715**	**21,791**

About 3.1% (684/21,791) of children who accessed health services were screened for TB; 0.8% of children below 5 years, 5.2% of children aged 5 to 9 years, and 7.3% of children aged 10 to 14 years were screened (Table 2). TB screening was low across all districts with Chipinge recording 8.4%, Bulawayo 4.1%, Beitbridge 3.1% and Harare 0.8%. A majority (72.4%) of children accessed health services at primary level facilities, and 64.5% of children were managed in urban health facilities. TB screening was significantly higher at referral facilities (6.9%) compared to primary level facilities (1.7%), $p<0.05$. TB screening was higher in rural districts (4.7%) than in urban districts (2.3%).

Table 2. TB screening among children accessing health services at study sites

District	Health Facility	Number of children screened for TB			Total n(%)
		<5 years n(%)	5 - 9 years n(%)	10 - 14 years n(%)	
Chipinge	Chipinge Hospital	33(4.2)	20(10.4)	102(29.7)	155 (11.7)
	Chibuwe clinic	0(0)	5(7.5)	9(18.4)	14(6.3)
	Gaza clinic	1(0.5)	4(2.4)	6(5.8)	11(2.4)
	Madhuku clinic	0(0)	0(0)	4(9.5)	4(2.5)
	St Peters Hospital	4(2.8)	7(31.8)	11(8.7)	22(7.6)
Bulawayo	Mpilo Hospital	21(3.1)	33(14.2)	41(10.1)	95(7.2)

	Mzilikazi clinic	7(0.9)	31(20.1)	13(7.9)	51(4.6)
	Cowdry Park clinic	4(0.4)	21(4.9)	19(5.5)	44(2.5)
	Princes M. clinic	1(0.2)	17(5.2)	22(12.8)	40(4.1)
	Magwegwe clinic	0(0)	3(3.3)	17(6.3)	20(2.7)
Beitbridge	Beitbridge Hospital	23(1.9)	57(12.5)	61(11.7)	141(6.4)
	Dite clinic	0(0)	0(0)	3(1.8)	3(0.5)
	Shabwe clinic	0(0)	5(7.8)	1(1.5)	6(2.6)
	Shashe clinic	0(0)	3(4.2)	2(2.7)	5(1.7)
	Dulibadzimu clinic	0(0)	4(1.1)	1(0.4)	5(0.3)
Harare	Beatrice R. Hospital	0(0)	0(0)	0(0)	0(0)
	Mabvuku clinic	0(0)	21(4.1)	18(9.3)	39(1.6)
	Kuwadzana clinic	0(0)	11(2.3)	8(2.4)	19(1.0)
	Mbare clinic	0(0)	1(0.5)	1(0.3)	2(0.1)
	Hopley clinic	0(0)	2(0.6)	5(5.2)	7(0.6)
Total		**94(0.8)**	**245(5.2)**	**345(7.3)**	**684 (3.1)**

N/B: **Denominator for uptake percentage are children aged 0 to 14 accessing health services.**

A total of 530 (77.4%) out of 684 children screened for TB had symptoms presumptive of TB; 14.7% were below 5 years, 33.8% were aged 5 to 9 years, and 51.5% were aged 10 to14 years. About 63% (335/530) of children with symptoms presumptive of TB had diagnostic investigations for TB; 11.9% of these were below 5 years of age, 29.8% were aged 5 to 9 years, and 58.2% were aged 10 to 14 years. The proportion of presumptive TB children with diagnostic investigations were 51.2% for children below 5 years of age, 55.8% for children aged 5 to 9 years and 71.4% for children aged 10 to 14 years. TB testing among children with presumptive TB was 55.1% for Chipinge, 81.8% for Bulawayo, 38.5% for Beitbridge and 96% for Harare. About 71.7% of the TB diagnostic tests were conducted on the Gen Xpert MTB RIF platform and 17.9% were smear microscopy (Figure 1). A total of 31 (9.3%) out of the 335 children with TB diagnostic investigations tested positive. The overall TB positivity yield for Gen Xpert across all age groups was 10.8% and the smear microcopy yield was 3.3%.

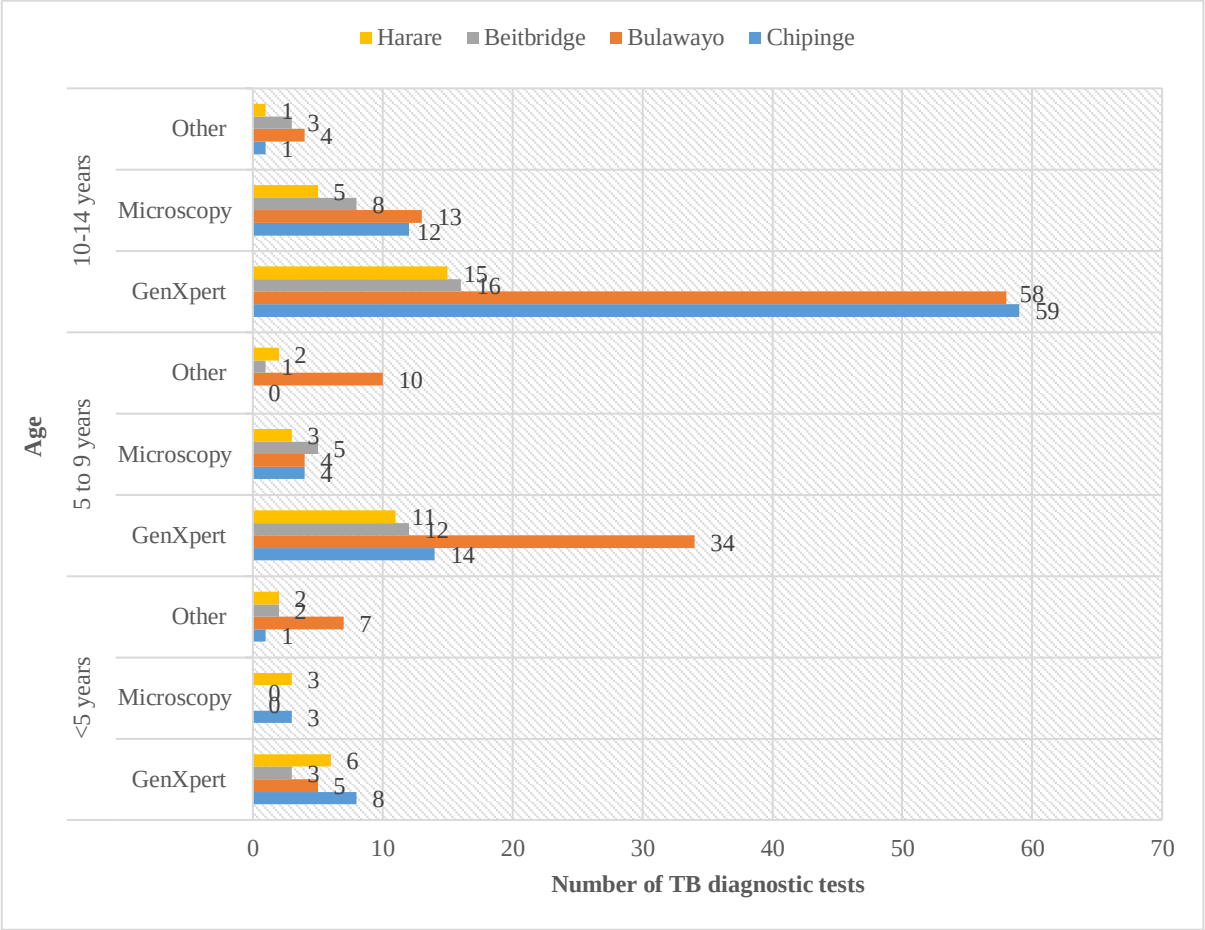

Figure 1. Distribution of TB diagnostic tests by age and district

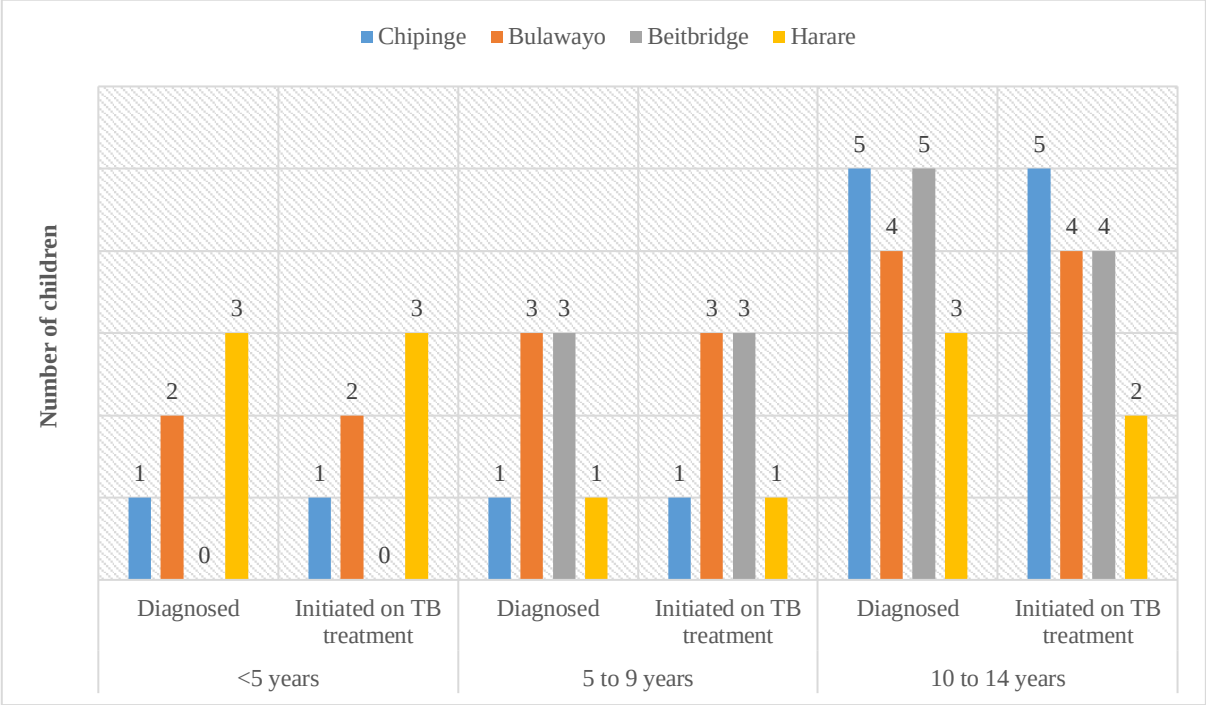

Figure 2. Treatment initiation among children with TB diagnosis

A total of 29 (93.5%) out of the 31 children diagnosed with TB were initiated on treatment (Figure 2). A total of 17 out the 26 eligible children had documented treatment outcomes; 10 (37%) had completed treatment, 4 (14.8%) were cured and 3 (11%) died.

Conclusion

TB screening among children accessing health services was very low, with only 3.1% of children having been screened. This is despite the Zimbabwe national TB guidelines recommending that all children presenting to health facilities should be screened for TB using a symptom enquiry. In addition, studies have shown utility of symptom-based approach to diagnosis of childhood TB. A study conducted in South Africa among children under 13 years of age showed that the combined presence of persistent and non-remitting cough for more than 2 weeks' duration, objective weight loss and reported fatigue provided good diagnostic accuracy in HIV negative children, with sensitivity, specificity and positive predictive value of 62.6%, 89.8% and 83.6% respectively (Marais et al, 2006). TB screening is the entry point to care and management of TB and should therefore be optimized in all health facility entry points. TB screening was lowest among children below 5 years of age (0.8%) and highest among older children aged 10 to 14 years (7.3%). Out of all children screened for TB, only 13.7% were below 5 years of age. This is despite children below 5 years contributing the bulk (56.8%) of all children presenting to health facilities. The South African study by Marais et al also demonstrated that the presence of a persistent, non-remitting cough and weight loss provided an accurate diagnosis of TB in children under 3 years of age with sensitivity, specificity and positive predictive value of 68.3%, 80.1% and 82.1% respectively. These results illustrate the importance of regular weight monitoring in young children. Our study findings showed that TB screening among younger children was not prioritized by HCWs, and therefore represent missed opportunities for TB diagnosis. In Zimbabwe, children below 5 years of age present to health facilities more often than older children as they receive routine care including vaccination and growth monitoring, which are opportunities for integrating TB screening within maternal, newborn and child health settings. Studies have shown that younger children with presumptive TB progress faster to TB disease than older children (Maya et al, 2016).

TB diagnostic investigations among children presumed to have TB was suboptimal, with an overall uptake percentage of 63.2%. Children below 5 years contributed the lowest proportion of those with diagnostic investigations (11.9%), whilst older children between 10 and 14 years contributed the bulk (58.2%). Nearly 40% of presumptive TB children did not have diagnostic investigations. A study conducted in south-western Ethiopia had similar findings; 35.2% of TB suspects did not have requests for microscopic examination of sputum smear (Desalegn et al, 2017). For our study, the low proportion of younger children with diagnostic tests might be a result of limited capacity of healthcare workers to screen for and conduct TB investigations in children. Results from a SWOT analysis conducted by the Zimbabwe national TB control program in 2016 revealed that limited healthcare worker capacity for screening and diagnosis of childhood TB was one of the major factors contributing to low childhood TB detection in Zimbabwe (Zimbabwe TB guidelines, 2016-20). Similarly, the Ethiopia study also found that shortage of trained healthcare workers was one of the major factors for low TB case identification (Desalegn et al, 2017). Most of TB tests were on the Gen Xpert MTB RIF platform, and this was in line with national guidelines.

Overall treatment initiation among children was high (93.5%). These findings indicate that the biggest childhood TB management gap was with TB screening (3.1%), and TB diagnosis (63.2%). Interventions to improve TB management should therefore target screening, and collection and testing of specimens from all presumptive TB children. Ascertainment of TB treatment outcomes was suboptimal; 9 out the 26 eligible children did not have their outcomes ascertained. This implies that children may continue taking TB medicines beyond the recommended treatment periods. In addition, emergence of drug resistant TB pose challenges especially where TB treatment outcomes are not timeously evaluated with appropriate tests.

TB screening and diagnosis among children accessing health services at public sector

facilities was very low, and children below 5 years of age had the lowest TB screening and diagnosis rates, despite this age group contributing most of the children presenting to health facilities. HIV testing among children with presumptive TB symptoms was suboptimal, with 36% of them having no documented HIV status. Provision of TB diagnosis services followed the national TB management guidelines, with most of the diagnostic tests conducted on the Gen Xpert MTB Rif platform. There were high TB treatment initiation rates among children diagnosed with TB, but low ascertainment of childhood TB treatment outcomes. Childhood TB screening should be optimized through interventions such as availing symptom screening tools in all health facility entry points where children are managed including outpatients, pediatric in-patients, nutrition, HIV and under-five clinics. Other interventions include capacity building of healthcare workers through trainings and on-site mentorship, adding TB screening to the integrated management of childhood illness protocols, provision of childhood TB management job aids, providing logistical support to primary level facilities that ensures uninterrupted supply of commodities, incorporating childhood TB screening indicators on the monthly data report forms to enforce screening, as well as exploring use of non-clinical staff such as nurse aids at primary level facilities to screen for TB during client registration.

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