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Full Length Research Paper

Barriers and facilitators to childhood tuberculosis detection in Marondera District, Mashonaland East Province, Zimbabwe

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Abstract

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Background: Tuberculosis (TB) remains a significant public health threat, particularly in children in low health resource settings. Despite national efforts in Zimbabwe, childhood TB case detection in Marondera District, Zimbabwe is still below 12.0% of the national target of TB notifications. The study investigated the factors associated with childhood TB case detection in Marondera District. **Methods:** An analytic cross- sectional study was conducted between July and November 2025 to identify barriers and facilitators to childhood TB case detection. Structured questionnaires were administered to healthcare workers and community healthcare workers. Data were analyzed using univariate and multivariate regression in Stata 19, with statistical significance defined as p<0.050. Adjusted Odds Ratio (AOR) was used to interpret facilitators and barriers to TB case detection. **Results:** Key facilitators for case detection were competence in TB screening (AOR= 1.9; C.I=1.4-2.5; p=<0.001), prior contact with childhood TB (AOR=1.3; 95% C.I=1.1-1.5; p=<0.001), and TB co-infection (AOR=1.3; 95% C.I=1.1-1.5; p=<0.001). Caregiver social support (AOR=1.4; 95% C.I=1.2-1.7; p=0.002), Health education (AOR=1.8; 95% C.I=1.3-2.5; p=0.005), and community awareness (AOR=1.3; 95% C.I=1.1-1.6; p=0.033) also promoted healthcare seeking. Barriers included cultural beliefs (AOR=0.6; 95% C.I=0.5-0.8; p=0.005), lack of awareness (AOR=2.3; 95% C.I=1.6-3.3; p=<0.001), and geographical barriers (AOR=0.6; 95% C.I=0.5-0.8; p=0.002). **Conclusion:** Improving childhood TB case detection in low health resource settings requires strengthening healthcare workers' clinical capacity and enhancing community-level awareness and support. Targeted interventions addressing socioeconomic and access-related barriers are essential to reduce morbidity and mortality among children.

Keywords: Barriers to TB detection; Community awareness to TB detection; TB Detection Competence; Facilitators for TB detection; TB in low health resource settings.

INTRODUCTION

Every year, 1.1 million children around the world contract Tuberculosis (TB), yet only 400,000 cases are reported. In 2020, the case detection gap for tuberculosis was highest among children under 5 years at 72.5%, while among 5-14 years it was 55.4% (WHO, 2021). Tuberculosis is an infectious bacterial disease primarily affecting the lungs, though it can involve other parts of the body. It is caused by the bacterium Mycobacterium tuberculosis (acid-fast bacillus), and it spreads through the air when an infected person coughs or sneezes.

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Tuberculosis can present as latent, in which the bacteria are present in the body without causing symptoms, or as active, in which the bacteria multiply and cause illness (WHO, 2023). Tuberculosis (TB) is one of the leading causes of morbidity and mortality in children globally; however, diagnosing and treating TB continues to have significant challenges. Treatment of TB infection in children and adolescents is critical to prevent the progression of TB disease and severity of the disease through early detection and treatment (Jagannath, 2022).

Tuberculosis (TB) is a preventable and usually curable disease. However, in 2023, TB returned to being the world's leading cause of death from a single infectious agent, following 3 years in which COVID-19 replaced it, and it caused almost double as many deaths as HIV/AIDS. More than 10 million people globally continue to fall ill with TB every year, and the number has been rising since 2021. Of note, in 2023, 55.0% of people who developed TB were men, 33.0% were women, and 12.0% were children below 15 years (WHO, 2024). Additionally, globally, Tuberculosis is reported to be the 13th leading cause of death and the second leading infectious killer after COVID-19 (WHO, 2023). It has been noted that TB in children presents with unique symptoms that are mostly accompanied by other infections, leading to delays in diagnosis and treatment (Ravi, 2022).

Childhood Tuberculosis (TB) disease has long been neglected among other pediatric illnesses of public health interest. The World Health Organisation (WHO) estimates that half a million children are diagnosed with TB every year. However, the disease's true burden is unknown globally (WHO, 2022). Zimbabwe adopted the WHO guidelines, which recommend that member states detect at least 90.0% of the estimated TB notification rates (Zimbabwe, Ministry of Health and Child Care, Tuberculosis Program Strategic Plan 2017-2020).

In Zimbabwe, childhood TB is an important public health concern with a special focus on rural areas such as parts of the Marondera district, where access to healthcare services may be limited and health-seeking behaviors are influenced by socio-cultural factors (Gumbo et al., 2019).

The WHO (2021) reports that the diagnosis of TB in children is often delayed or missed due to obstacles such as inadequate diagnostic tools, the asymptomatic nature of early-stage disease, and poor health-seeking behaviors among caregivers.

It has been observed that in many cases, children are diagnosed with TB after they have developed some form of advanced TB disease, which increases the risk of poor health outcomes (Chirenda, 2020). Furthermore, Marondera district, like many rural regions, faces similar challenges, including insufficient healthcare infrastructure, a shortage of trained healthcare personnel, and a lack of community awareness about TB (Moyo, 2021).

Several factors contribute to delayed childhood case detection, such as socioeconomic challenges, poor healthcare access, and the presence of co-morbidities such as HIV, which complicates the diagnosis and treatment of TB among children Zimbabwe National TB Control Programme (ZNTBCP), 2022). Furthermore, there is a need to address cultural attitudes and the stigma associated with TB in the communities, which may prevent timely diagnosis and treatment initiation (Nyamurundira, 2020). Therefore, it is important to investigate the factors associated with childhood TB case detection in Marondera district, Mashonaland East Province, to better understand how they contribute to childhood TB detection rates in the district.

METHODOLOGY

An analytical cross-sectional study design was used. This approach enabled the collection of data from participants at a single point in time to assess the facilitators and barriers of childhood TB case detection in the Marondera district. The design was appropriate because data collection was conducted once without follow-up, which reduced costs and improved efficiency. It also allowed for the examination of associations between potential facilitators or barriers and childhood TB case detection. However, as a cross-sectional study, it only identifies associations and does not establish causal relationships between variables. The study was non-interventional and observational, posing minimal ethical risks to participants. Additionally, the design was useful for generating hypotheses for future research.

The study was conducted in Marondera District, Mashonaland East Province. The district has 25 health facilities. Based on the 2022 Zimbabwe population census, Marondera district has a total population of 202,377 people, with a rural population of 136,173 (68,180 males and 67,993 females while the urban population constitutes 66,204 (30,810 males and 35,394 females). The sample size was calculated using Epi Info version 7.

A total of 20 facilities participated in the study. Considering a 95% confidence interval, an expected frequency of 50.0%, a margin of error of 10.0%, and a design effect of 1. The selected facilities included high-volume, low-level, and district hospitals, covering all geographical areas, such as urban clinics, Rural clinics, and farms, to serve all populations. The facilities included Mahusekwa District Hospital, Chiota Rural Hospital, Dombotombo Clinic, Nyameni Clinic, Kushinga Phikelela Clinic, Mudzimurema Clinic, Chimbwanda Clinic, and Nyembanzvere Clinic, as well as Marondera Rural District Council Clinic, Chipararwe Clinic, Wenimbe Clinic, Dimbiti Clinic, Igava Clinic, Lustleigh Clinic, and Masikana Clinic. Other sites include Border Church Clinic, Rukodzi Clinic, Arcadia, and Wardlove Clinic. The facilities comprised both urban and rural settings to enable the investigator to capture a broad range of factors influencing the detection of childhood TB cases in the district, as urban and rural areas often have distinct healthcare access, resources, and challenges.

The study focused on healthcare workers (HCWs) involved in detecting and managing childhood tuberculosis (TB) in Marondera District, Mashonaland East Province, Zimbabwe. The study included professionals across various health system roles, specifically those involved in childhood TB case detection and treatment. This included doctors, nurses, environmental health technicians, laboratory technicians, and microscopists. The community was represented by community healthcare workers.

The inclusion criteria applied to all healthcare professionals working in the following departments: outpatient department, family child health clinic, Pediatric wards, laboratory, and environmental office, which include doctors, nurses, environmental health technicians, and laboratory scientists. Additionally, community healthcare workers who work at the selected facilities were interviewed. The exclusion criteria for this study were non-clinical staff such as general hands, nurse aides, and newly engaged staff. Additionally, those who refused to participate in the study.

The sample size of this study was calculated using the Dobson formula for a single proportion, assuming a 95% confidence level, a prevalence of 94.0%, a margin of error of 6.0%, and a 10.0% non-response rate. The calculated minimum sample ranged from 61 to 68 participants. However, during data collection, all eligible healthcare workers and community healthcare workers available in the selected facilities, and who consented to participate, were included to enhance representativeness. Consequently, a total of 75 participants were recruited, comprising 55 healthcare workers and 20 community healthcare workers.

Sampling procedure

Stratified random sampling was used to select healthcare workers involved in TB case finding. The strata included nurses from clinics, the outpatient department (OPD), the Family and Child Health (FCH) department, and the children's ward. Environmental Health Technicians (EHTs) were selected using a two-stage process. First, six health facilities were randomly selected from each of the selected 20 facilities in the district. Second, one EHT was randomly selected from each of the selected facilities.

Microscopists were randomly selected from the two facilities that had microscopists, while doctors from the district hospital and a laboratory scientist were randomly selected from their respective departments.

Within each facility or department, eligible staff members on duty were listed, and the required number of participants was selected using simple random sampling. In facilities with fewer staff than required, additional participants were recruited from larger facilities to meet the target sample. Community healthcare workers (CHCWs) were selected using a similar approach, with one Community Healthcare worker randomly selected from each of the 20 facilities. Where a selected participant declined to participate, another individual was randomly selected.

The investigator used stratified random sampling due to its several advantages, which make it a preferred sampling method, including eliminating bias by accounting for differences in roles and locations, ensuring everyone has an equal chance of being selected in each department, thereby reducing the risk of favouritism or systematic errors. It also ensured that the sample was representative, making the findings more accurate and generalizable. Furthermore, the method ensured fairness and diversity in sample collection, as everyone had an equal chance of being selected. Additionally, it was straightforward to administer.

Data collection

The researcher collected data for this study using structured questionnaires that include both closed- and open-ended questions. The research questionnaires were developed with guidance from the reviewed literature and identified gaps in the literature. In addition to questionnaires, the researcher utilized a structured key informant interview guide to gather information from key individuals and beneficiaries.

Two structured questionnaires were used for data collection: one for healthcare workers (HCWs) and another for community healthcare workers (CHCWs). The questionnaires were developed based on existing literature on childhood TB case detection and aligned with the study objectives.

The healthcare worker questionnaire consisted of five sections (A-E). Section A collected demographic information. Section B assessed health system-related barriers and facilitators to childhood TB case detection. Section C explored healthcare workers' perspectives on socioeconomic, individual and community factors influencing childhood TB case detection, as HCWs frequently interact with patients and communities and are therefore able to observe these challenges during service delivery. Section D examined environmental and geographical factors affecting the detection of TB in children. Section E collected participants' recommendations for improving childhood TB case detection.

The CHCW questionnaire also consisted of four sections. Section A captured demographic characteristics and participants' roles within the community. Section B and C explored facilitators and barriers to childhood TB case detection at the community level, drawing on CHCWs' direct engagement with households and communities. Section D collected recommendations for improving childhood TB case detection.

The questionnaires were pretested at a health facility outside the study area to assess clarity, relevance, and comprehensibility of the questions. Feedback from the

pretest was used to refine the wording and structure of the instruments before the main data collection.
The questionnaire was used because it was versatile, allowing for self-reporting. Talbot (1995) posits that it is a direct way to ask about things that cannot be easily obtained or observed, such as feelings, perceptions, behavior, attitudes, and beliefs. There were several advantages to using questionnaires, including anonymity, a standardized format for all respondents, a fast way to gather information from a larger population, and lower time and financial resource costs. Additionally, it was one of the simplest ways to test the instrument's validity and reliability. In addition to questionnaires, the investigator used a key informant interview guide and an observation checklist to collect more information on the barriers and facilitators to childhood TB detection.
The investigator sought permission from the Provincial Medical Director, the District Medical Officer, the Matrons, and the Sister-in-Charge of the study sites to collect data for the study. Upon arrival at the facility, the investigator introduced himself to the Sister-in-charge and explained the objective of the visit. The investigator presented the following documents to the Sister-in-Charge for confirmation: the student's identity card and the District Medical Officer's permission to conduct research. The sister-in-charge assisted the investigator in identifying respondents based on the facility's sample size and introduced the investigator to them. The investigator was assisted by the Sisters-in-charge in sampling participants according to the study's sampling procedure.
The investigator explained the study's objectives to the respondents and ensured they understood them. The issue of anonymity and confidentiality was also explained and reassured. After agreeing to participate in the study, the respondents were given consent forms. The investigator also explained that they were free to withdraw at any given time if they felt like it. This was followed by giving the respondents structured questionnaires to complete.
The investigator gave the questionnaires to the participants in the morning for the respondents to complete. They were collected in the afternoon before the business closure on the same day, guarding against a low return rate. The researcher adhered to ethical standards of preserving respect, confidentiality, and anonymity. In addition to the questionnaires, the investigator conducted key informant interviews with district health executive members. A document review of TB management tools was conducted, including observation of activities.

Analysis and organization of data

Questionnaire data were checked for completeness before being entered into Excel and then imported into Stata. Univariate and bivariate analyses generated frequencies. Multivariate logistic regression analysis was used to identify independent factors associated with childhood case detection. The unit of analysis was the individual participant. The statistical significance was defined as $p<0.05$, two-tailed. The logistic regression models were employed, and adjusted odds ratios were obtained by exponentiating the regression coefficients. Adjusted odds ratios greater than 1 were interpreted as indicating increased likelihood of the outcome, while values less than 1 indicated decreased likelihood, consistent with standard epidemiological practice.
Qualitative data from individual participants and key informants were grouped into similar thematic areas, coded according to participants' views, and analyzed manually. Data from a review of facility records, including TB presumptive registers, TB facility registers, TB laboratory registers, and TB monthly and quarterly return forms, were analyzed.

RESULTS

Marondera TB notifications 2023-2024

Of the total 278 TB notifications in Marondera district in 2024, 21 (7.5%) were children. In 2023, 10 (4.0%) of the 239 notifications were children as shown by figure 1 below. The district is implementing the TB STAMP strategy as one of the TB case-finding strategies.

Demographic characteristics of healthcare workers and community healthcare workers

Table 1 below provides more details on the demographic information of healthcare workers and community healthcare workers. The median age of the healthcare workers (HCWs) was 41 years, indicating that the central tendency lies in the early forties. The interquartile range (IQR) was 17 years, meaning that the middle 50% of ages spanned a 17-year interval. The overall range was 38 years (23-91 years), reflecting a wide age distribution. The skewness was close to zero, indicating a relatively symmetrical distribution with no pronounced tails. Table 1 shows that of the 55 HCWs, (72.7%) were female and (27.3%) were male. Their denomination was varied; however, the majority (52.7%) were Pentecostals. Of the 55 HCWs, nurses contributed the majority (81.8%), Environmental health officers (10.9%), and Microscopists (3.6%), while Doctors and Laboratory Scientists contributed (1.8%) each.
The mean age of the CHCWs was 45.95, while the median was 45.5, suggesting the age groups are fairly balanced, as the mean and median are very close. The range was 36, indicating that the age groups spanned from 32 to 68 years. The interquartile range (IQR) was 13, which indicates moderate variability in the middle 50.0% of the age groups. On the other hand, the age groups showed a slightly right-skewed distribution. On the other hand, CHCWs' professional experience varied. The mean professional experience among participants was 8.6

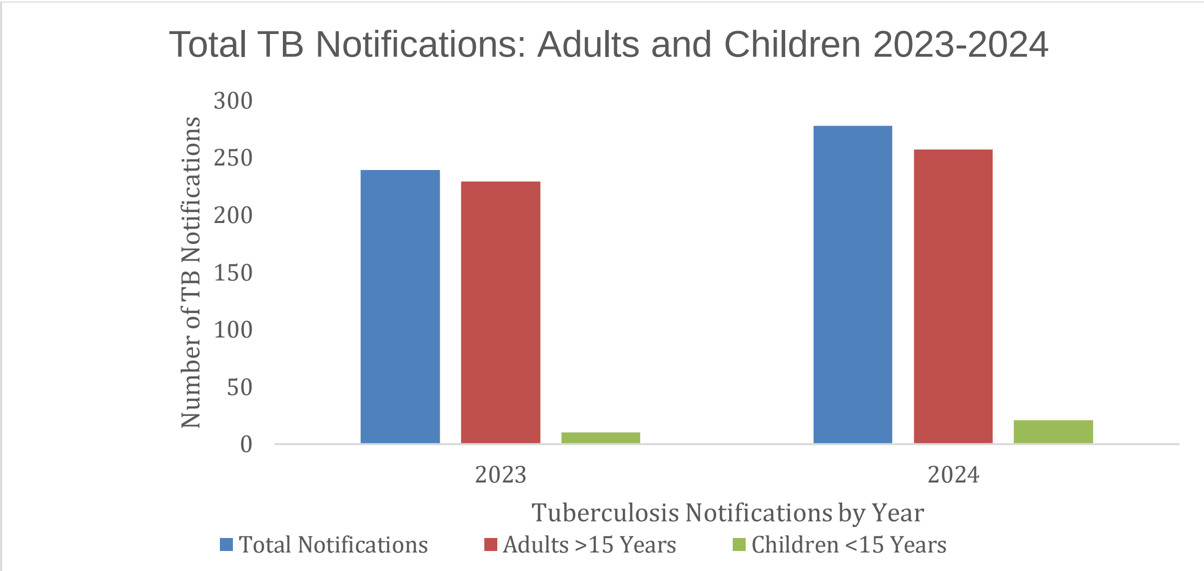

Figure 1: Number of TB notifications in Marondera District, Zimbabwe 2023 – 2024
Source: Authors

Table 1: Demographic information of healthcare workers and community healthcare workers.

Health Care Worker/ Community health Care worker category		Healthcare Workers (N=55) n (%)	Community Healthcare Workers (N=20) n (%)
Sex	Females	40 (72.7)	15 (75.0)
	Males	15 (27.3)	5 (25.0)
Religion	Apostolic	12 (21.8)	7 (35.0)
	Orthodox	2 (3.6)	2 (10.0)
	Other	12 (21.8)	2 (10.0)
	Pentecostal	29 (52.7)	9 (45.0)
Profession	Doctor	1 (1.8)	-
	EHT/EHO	6 (10.9)	-
	Lab Scientist	1 (1.8)	-
	Microscopist	2 (3.6)	-
	Nurse	45 (81.8)	-
	Community Healthcare workers	-	20 (100%)
Level of education	Diploma/Degree/Masters	55(100%)	-
	Certificate in Community Health	-	4 (20.0)
	Primary Education	-	4 (20.0)
	Secondary Education	-	12 (60.0)

EHT= Environmental Health Technician; EHO=Environmental Health Officer.
Source: Authors

years, with a median of 8 years, and an interquartile range (IQR) of 8 years. The range was 15, and the distribution of work experience was slightly positively skewed.

Of the 20 CHCWs who participated in the study, 75.0% were female, while 25.0% were male. The majority of the CHCW were Pentecostal (45.0%), while the remaining

Table 2: Logistic regression of facilitators and barriers to childhood TB detection among healthcare workers (N=55).

Health Care Worker characteristics		Adjusted Odds Ratios	95% C.I of Odds ratio	P-Value
Clinical Presentation	Age	1.0	1.0-1.0	0.647
	Sex	1.1	0.9-1.4	0.298
	Profession	1.1	1.0-1.3	0.444
	TB Co-infection	2.2	1.8-2.8	0.001
	Experience in TB Management	1.0	1.0-1.0	0.236
	Competence in TB Screening	1.1	0.9-1.3	0.660
	Availability of TB screening tools	0.8	0.4-1.6	0.383
TB Co-infection	Contact with Childhood TB	1.3	1.1-1.5	0.001
	Access to facility	0.9	0.7-1.1	0.589
	Household monthly income	0.9	0.7-1.2	0.384
	Transport availability	1.2	0.9-1.5	0.187
	Community Awareness of TB	3.0	0.3-29.1	0.340
Effectiveness of TB guidelines	Availability of TB Guidelines	0.6	0.3-1.4	0.211
	Training in TB management	1.2	0.6-2.4	0.683
	Type of training	1.0	0.6-1.6	0.974
	Competence in TB Screening	1.9	1.4-2.5	0.001
	Experience in TB Management	1.0	1.0-1.0	0.372
Caregiver willingness to seek healthcare services early	Community TB Campaign	1.0	0.8-1.3	0.980
	Care Giver Social Support	1.1	1.0-1.3	0.182
	Access to facilities	0.8	0.6-1.0	0.340
	Transport availability	1.3	1.0-1.7	0.099
	Community awareness of TB	1.3	1.1-1.6	0.033
Community awareness of TB Symptoms	Community TB Campaign	1.2	0.8-1.8	0.304
	Outreach for TB screening	1.0	0.7-1.5	0.855
	Availability of TB guidelines	1.3	0.6-2.8	0.469
	Caregiver social support	1.4	1.2-1.7	0.002
Caregiver Social Support	Household Monthly Income	1.0	0.6-1.8	0.930
	Community awareness of TB	1.7	1.2-2.4	0.005
	Access to facilities	1.2	0.8-1.9	0.468
	Transport availability	0.9	0.5-1.5	0.628

C.I = Confidence interval; TB= Tuberculosis
Source: Authors

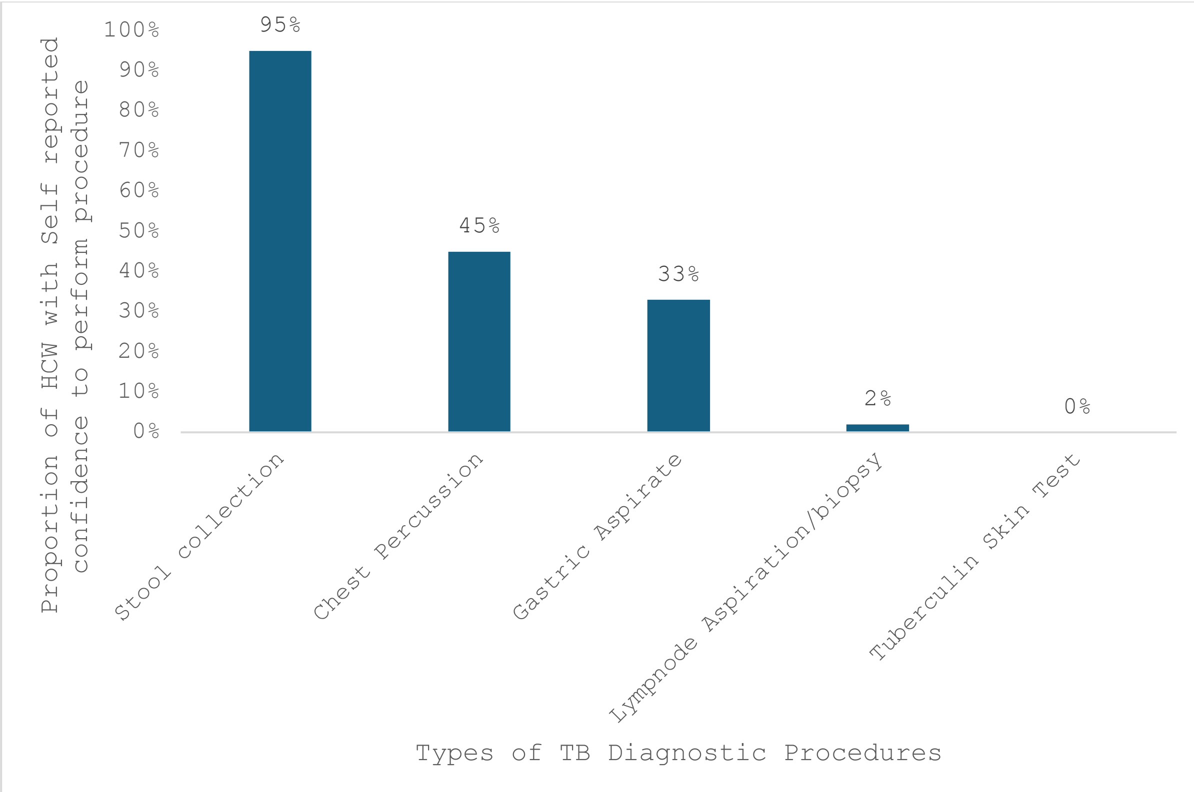

Figure 2: Proportion of healthcare workers with self-reported confidence in performing the TB diagnostic procedure.

55.0% were apostolic (35.0%), orthodox (10.0%), and traditional (10.0%). The majority of CHCW (60.0%) attained secondary education, a certificate in community health (4.0%), and primary education (4.0%), as shown by the table below.

Logistic regression analysis of facilitators and barriers of childhood TB detection.

Logistic regression analyses to identify facilitators and barriers to childhood TB detection yielded varied findings, as shown in Table 2. The logistic regression analysis of clinical presentation showed that complicated clinical presentation was the dependent variable, and the independent variables were profession, TB co-infection, experience in TB management, competence in TB screening, and availability of TB screening tools. The results showed that TB Co-infection (AOR=2.2; 95% CI=1.8-2.8; p=<0.001) was the only significant predictor of clinical presentation, indicating that TB co-infection strongly facilitates the recognition of TB in children due to pronounced clinical manifestation. However**,** this can be a barrier, as competent healthcare workers and adequate resources are needed to support it.

The logistic regression analysis was conducted with TB co-infection as the dependent variable and previous healthcare worker contact with childhood TB, access to facilities, household monthly income, transport availability, and community awareness of TB symptoms as independent variables. The results showed that previous contact with childhood TB and TB co-infection had a significant positive association (AOR=1.3; 95% C.I=1.1-1.5; p=<0.001). This indicates that prior exposure to childhood TB among healthcare workers facilitates the detection of childhood TB. The other independent variables did not show a statistically significant association with TB co-infection, as indicated in the table below: access to health facilities (AOR=0.9; 95% C.I=0.7-1.1; p=0.589), household income (AOR=0.9; 95% C.I=0.7-1.2; p=0.384) transport availability (AOR=1.2; 95% C.I=0.9-1.5; p=0.187), and community awareness of TB (0R=3.0; 95% C.I=0.3-29.1; p=0.340).

Further logistic regression analysis on the effectiveness of TB guidelines showed that skilled and competent health workers are essential facilitators of effective TB management, as competence in TB screening was a statistically significant predictor of TB guideline effectiveness (AOR=1.9; 95% C.L=1.4-2.5; p=< 0.001). The findings indicate that the presence of guidelines or training without sufficient competence may not improve implementation. These include the availability of TB guidelines (AOR=0.6; 95% C.I=0.3-1.4; p=0.211), training in TB management (AOR=1.2; 95% C.I=0.6-2.4; p=0.683), type of training (AOR=1.0; 95% C.I=0.6-1.6; p= 0.974),

Table 3: Logistic regression analysis of barriers and facilitators to childhood TB detection among community health workers (N=20).

Role category for community healthcare worker in TB Investigation		Adjusted Odds Ratio	95% C.I of Odds Ratio	P-Value
TB Investigation Referral role	TB Symptoms familiarity	0.9	0.6-1.4	0.789
	Case referrals	0.6	0.3-1.1	0.113
	Health education	0.3	0.1-0.6	0.004
	Limited facility access	1.2	0.7-2.0	0.533
Role of Socioeconomic	Financial constrains	0.7	0.3-1.8	0.494
	Family support	2.5	1.1-5.8	0.053
	Community reluctance	1.1	0.5-2.5	0.914
	Cultural beliefs	0.4	0.2-0.9	0.055
Case Referral role	Level of education	1.1	0.9-1.3	0.315
	Working experience	1.1	1.1-1.1	0.016
	Health education	1.8	1.3-2.5	0.005
	TB Symptoms familiarity	0.8	0.6-1.0	0.060
	Cultural beliefs	0.6	0.5-0.8	0.005
	Lack of awareness	2.3	1.6-3.3	0.001
	Financial constrains	1.0	0.7-1.4	0.813
	Geographical barriers	0.6	0.5-0.8	0.002

Source: Authors

and experience in TB management (AOR=1.0; 95% C.I=1.0-1.0; p=0.372) all showed non-significant effects. The model's overall findings (R^2=0.32; p=0.002) highlight the importance of developing practical skills in TB control, showing that although some factors play a role, proficiency in TB screening stands out as the leading enabler of the practical application of TB guidelines.

The logistic regression analysis on caregiver willingness to seek healthcare services early results showed that transport availability was associated with higher odds of caregiver willingness to seek health (AOR=1.3; 95% C.I=1.0-1.7), although this association did not reach statistical significance (p=0.099). Community awareness of TB (AOR=1.3; 95% C.I=1.1-1.6; p=0.033) was an important factor influencing caregiver willingness, which is essential for detecting tuberculosis in children. On the other hand, a significant obstacle to caregiver willingness is limited access to health facilities (AOR=0.8; 95% C.I=0.6-1.0; p=0.340). The effects of caregiver social support (AOR=1.1; 95% C.I=1.0-1.3; p=0.182) and community TB campaigns (AOR=1.0; 95% C.I=0.8-1.3; p=0.948) on willingness were not statistically significant. Overall, the results showed that raising community awareness, facilitating access to transportation, and removing barriers related to health facilities may increase carer involvement and, eventually, support efforts to detect tuberculosis in children.

On the other hand, logistic regression analysis on community awareness of TB symptoms showed that stronger social support for carers can help detect childhood TB. The logistic regression results show that only caregiver social support had a statistically significant positive effect on community awareness of childhood TB among the examined factors (AOR=1.4; 95% C.I=1.2-1.7; p=0.002). Availability of TB Guidelines (AOR=1.3; 95% C.I=0.6-2.8; p=0.469), Outreach for TB Screening (AOR=1.0; 95% C.I=0.7-1.5; p=0.855), and Community TB Campaign (AOR=1.2; 95% C.I=0.8-1.8; p=0.304) were not statistically significant, indicating that although these initiatives may raise awareness, their current implementation may not be robust enough to have a discernible impact. Overall, the results emphasize the importance of caregiver social support in raising community awareness of tuberculosis, while other factors appear to have little bearing on the study.

Two statistically significant predictors were identified in the logistic regression analysis evaluating factors influencing caregiver support for childhood TB detection, based on 55 observations. With (OR=1.0; 95% C.I=0.6-1.8; p=0.930), suggest that household income was not significantly associated with childhood TB case detection. Community

Table 4: Observed availability of childhood TB detection guidelines and diagnostic capacity at health facilities.

Observed Category	Frequency n=20	Percent (%)
Availability of TB guidelines	20	100.0
Active TB screening in children during routine visits	13	65.0
Active monitoring of signs and symptoms of TB in children	13	65.0
Routine investigation of presumptive TB in children	9	45.0
Child-friendly sputum collection techniques	12	60.0
Stool collection	15	75.0
Performing chest percussion on site	1	5.0
Performing a gastric aspirate on site	1	5.0
Availability of Gene Xpert on-site	2	10.0
Functional sample transportation systems of samples to the next level for diagnosis	20	100.0
Availability of X-Ray on site	1	5.0
Performs TST on site	1	5.0
Availability of TB Laboratory request forms	20	100.0
Availability of the current version of the presumptive and TB register	20	100.0
Availability of sputum/stool jars	19	95.0
Designated area for sputum collection	20	100.0

Source: Authors

Awareness of TB showed (AOR=1.7; 95% C.I=1.2-2.4; p=0.005, indicating that greater awareness significantly improves caregiver involvement, a crucial facilitator of TB case detection.

The fact that other variables, such as transport availability (AOR=0.9; 95% C.I=0.5-1.5; p=0.628) and access to facilities (AOR=1.2; 95% C.I=0.8-1.9; p=0.468), were not statistically significant suggests that logistical factors alone may not have a substantial impact on caregiver support. The model's statistical validity is supported by an R^2 of 0.273, indicating that these predictors account for approximately 27.3% of the variance in caregiver support.

Competence in performing the TB diagnostic procedure

Of the 55 participants, the majority, 52 (95.0%) were able to collect stool for diagnosing TB using the gene Xpert, and 25 (45.0%) did chest percussion to facilitate sputum exploration, 18 (33.0%) gastric aspirate, and 1 (2.0%) lymph node aspiration or perform a biopsy. At the same time, none of the staff had performed a Tuberculin Skin Test (TST) as shown by the figure 2 below.

Suggested areas for improvement in childhood TB detection by healthcare workers

Several areas identified by health professionals, based on their clinical practice, may improve TB case detection in children. Of the 55 healthcare workers, 100.0% suggested targeted community screening, diagnosis, and treatment. A total of 98.2% of them suggested that TB training programs for healthcare workers and community healthcare workers are key for childhood TB detection. Some of the suggested areas include community awareness campaigns (96.4%), more financial support for TB programs (83.6%), mobilization of additional diagnostic resources (80.0%), and an improved referral system (63.6%).

Logistic regression analysis of facilitators and barriers to childhood TB detection among Community Healthcare Workers

To better understand the barriers and facilitators of TB case detection in the community, it was prudent to explore information from community healthcare workers. Several logistic regression analyses were done. As a crucial part of comprehending the barriers and facilitators of childhood TB detection, a logistic regression analysis was performed to evaluate the factors influencing CHCWs' referral of TB investigations. Health education was found to have a statistically significant negative association with TB investigation referral (AOR=0.3; 95% C.I=0.1-0.6; p=0.004). This suggests that CHCWs, who focus primarily on health education, may make fewer TB referrals, possibly due to a barrier in which education activities are not effectively integrated with active case detection.

No significant correlation was found between TB referral practices and other variables, including CHCW familiarity with TB symptoms (AOR=0.9; 95% C.I=0.6-1.4; p=0.789), CHCW role in case referral (AOR=0.6; 95% C.I=0.3-1.1; p=0.113), and limited facility access (AOR=1.2; 95% C.I=0.7-2.0; p=0.553). These results suggest that, although community-based education remains essential, early childhood TB detection could be facilitated. Enhancing CHCW referral capacity, defining referral roles, and integrating education with active surveillance could reduce barriers to community-based TB detection initiatives.

Further analysis of the effect of socioeconomics showed that only the family support was associated with increased likelihood of childhood TB case detection (AOR=2.5). The confidence interval (95% C.I=1.1-5.8), suggest that the effect is likely positive, though the wide range indicates variability in the strength of association. The borderline p-value (0.053) implies that while the finding does not reach convectional statistical significance, it points toward a potentially important role of family support in facilitating TB case detection among children. The other independent variables did not show a statistically significant association with the effect of socioeconomic status on childhood TB detection.

The community healthcare worker's role in childhood TB case referral, a critical factor in removing barriers and strengthening facilitators of childhood TB detection, was examined using a multiple linear regression analysis. Results showed that community awareness (AOR=2.3; 95% C.I=1.6-3.3; p=<0.001), health education engagement (AOR=1.8; 95% C.I=1.3-2.5; p=<0.001), and working experience (AOR=1.1; 95% C.I=1.1-1.1; p=0.016) were significant facilitators, suggesting that seasoned CHCWs and those actively engaged in community education are more adept at detecting and referring suspected TB cases.

On the other hand, traditional misconceptions and restricted access to health facilities decreased CHCWs' referral capacity, and cultural beliefs (AOR=0.6; 95% C.I=0.5-0.8; p=0.005) and geographic barriers (AOR=0.6; 95% C.I=0.5-0.8; p=0.002) emerged as significant barriers. Financial constraints and educational attainment were not significant predictors, but familiarity with TB symptoms demonstrated a borderline negative association (AOR=0.8; 95% C.I=0.6-1.0; p=0.060). These results indicate that while cultural stigma and geographic inaccessibility are significant barriers that require targeted health system strengthening and community-based interventions, community engagement, field experience, and awareness-raising are essential enablers for enhancing childhood TB detection. The table below summarizes the analysis.

Observed availability of childhood TB detection guidelines and diagnostic capacity at health facilities

The table below shows that guidelines and SOPs, registers, and request forms were available at the facilities. All 20 (100.0%) facilities reported a functional Integrated Sample Transportation System (IST). However, it was observed that routine TB screening was suboptimal among children. For example, children with malnutrition had no evidence of TB screening. Performance of other diagnostic procedures was suboptimal for TB, such as TST, chest percussion, and gastric aspirate, which also aid TB diagnosis in children. It was noted that other health facilities had never collected stool samples from children for TB laboratory testing. The table below summarizes the focus areas observed and findings.

DISCUSSION

The study sought to determine the barriers and facilitators to childhood TB case detection in Marondera district, Mashonaland East Province, from January to December 2025. The discussions will focus on the results from insights from healthcare workers and community cadres. In this study, several facilitators and barriers were identified.

This study's results demonstrated several healthcare system facilitators and barriers, as well as community or patient-related facilitators and obstacles to childhood TB case detection. This discussion will start by highlighting facilitators and barriers in the healthcare system. Some insights from healthcare workers include the following: TB Co-infection, (AOR=2.2; 95% CI=1.8-2.8; p=<0.001) was a significant predictor of clinical presentation. This indicates that TB co-infection strongly facilitates the recognition of TB in children due to pronounced clinical manifestations.

However, this can be a barrier, as competent healthcare workers and the availability of resources should support it. The evidence that suggests that TB Co-infection is a facilitator to TB diagnosis in children, as the clinical presentation becomes visible, contradicts what was indicated by WHO, which posits that the clinical presentation of TB in children varies significantly when compared to adults. The presentation is usually non-specific, making it difficult to diagnose TB since it is mistaken for other diseases (WHO, 2023).

In addition to the above, children usually present with non-specific symptoms, making it difficult for healthcare professionals to immediately consider TB as a potential diagnosis, leading to delays in detection (Zar, 2016). Kumar (2019) further asserted that young children, particularly infants, may not exhibit the hallmark signs seen in adults, such as persistent cough or chest pains, further complicating the whole picture in early diagnosis and treatment. Therefore, while the findings suggest that co-infection can enhance clinical recognition, this may only act as a facilitator when competent healthcare workers and adequate diagnostic resources are available, given the generally non-specific nature of childhood TB presentation highlighted by WHO.

The results showed that healthcare workers' previous contact with childhood TB and TB co-infection showed a significant positive association (AOR=1.3; 95% C.I=1.1-

1.5; p=<0.001). It demonstrated that previous healthcare workers' contact with childhood TB facilitates childhood TB detection. This concurs with other study findings, which highlight that the availability of competently trained health personnel, from clinicians to laboratory staff and other professionals, plays an essential role in the early detection of childhood TB (WHO, 2019).

Their previous experience and exposure to childhood TB are good predictors of TB detection in children. Trained personnel play a critical role in creating awareness in the community, targeting at-risk populations such as mining areas and overcrowded locations, active TB contact tracing, and training the community lay cadres (WHO, 2021).

Based on the strong association with the effectiveness of guidelines and training, competence in TB screening is one of the predictors for early detection of TB in children. The results showed that skilled and competent health workers are essential facilitators of effective TB management, as the regression analysis shows that a statistically significant predictor of TB guideline effectiveness is competence in TB screening (AOR=1.9; 95% C.L=1.4-2.5; p=<0.001). The findings indicate that the presence of guidelines or training without sufficient competence may not improve implementation, even though the availability of TB guidelines (AOR=0.6; 95% C.I=0.3-1.4; p=0.211) training in TB management (AOR=1.2; 95% C.I=0.6-2.4; p=0.683), type of training (AOR=1.0; 95% C.I=0.6-1.6; p=0.974), and experience in TB management (AOR=1.0; 95% C.I=1.0-1.0; p=0.372) all showed non-significant effects. The model's overall findings (R^2 = 0.319, p =<0.002) highlight the significance of developing practical skills in TB control by showing that, although some factors play a role, proficiency in TB screening stands out as the leading enabler of practical application of TB guidelines.

The above insights concur with WHO recommendations that to detect TB early, there is a need to have robust TB screening programs in place to support the early detection of TB in children through the TB intensified case finding initiative at the facility and in the community. Having specific screening tools and guidelines that are specific for children a key instrument for early detection of TB in children, supported by competent healthcare workers (WHO, 2021).

The study results showed that transport availability was associated with higher odds of the outcome (AOR=1.3; 95% C.I=1.0-1.7), although this association did not reach statistical significance (p=0.099). Community awareness of TB (AOR=1.3; 95% C.I=0.6-1.0; p=0.034) was an important factor that influence caregiver's willingness, which is essential for detecting tuberculosis in children. On the other hand, limited access to health facilities (AOR=0.8; 95% C.I=0.6-1.0; p=0.340) was a significant obstacle that significantly reduces caregiver's willingness. The findings are consistent with other research, as highlighted by Chirenda (2020), that transport availability at lower cost and a road network supporting accessibility to health facilities are enablers of early TB detection. This supports easy access to health facilities, promotes health-seeking behavior, and caregiver willingness to seek services early.

A functional health system with access to sensitive diagnostic tests, including molecular assays and chest CT scans, could further aid early detection and management of TB in children (Dhedha, 2014).

Stronger social support for caregivers can help detect childhood TB. The logistic regression analysis results showed that caregiver social support had a statistically significant positive effect on community awareness of childhood TB among the factors examined (AOR=1.4; 95% C.I=1.2-1.7; p=0.002). This is consistent with other studies, which indicated that strong social support positively impacts health outcomes (Zar, 2016).

Additionally, the results consistently showed that the other two statistically significant predictors were identified in the regression analysis evaluating the factors influencing caregiver support for childhood TB detection, based on 55 observations. Community awareness of TB, on the other hand, had (AOR=1.7; 95% C.I=1.2-2.4; p=0.005), indicating that greater awareness significantly improves caregiver involvement, a crucial facilitator of TB case detection.

Results from community healthcare workers were consistent with findings from healthcare workers. For example, a logistic regression analysis was performed to evaluate the factors influencing community healthcare workers' referral of TB investigations. Results showed that health education was associated with a statistically significant negative association with TB investigation referral (AOR=0.3; 95% C.I=0.1-0.6; p=0.004). This suggests that CHCWs who focus primarily on health education may make fewer TB referrals, possibly because education activities are not effectively integrated with active case detection.

Additional results from the community healthcare workers showed that family support was associated with increased likelihood of childhood TB case detection (AOR=2.5). The confidence interval (95% C.I=1.1-5.8), suggest that the effect is likely positive, though the wide range indicates variability in the strength of association. The borderline p-value (0.053) implies that while the finding does not reach convectional statistical significance, it points toward a potentially important role of family support in facilitating TB case detection among children. This demonstrated that households with limited family support experience socioeconomic challenges that may prevent them from timely diagnosis of TB, which is consistent with the findings from healthcare workers described above. Nyamurundira (2020) further asserted that children depend on their parents or caregivers; therefore, it is necessary to ensure family support. He further states that factors such as income, education, and access to healthcare services significantly influence the detection of childhood TB cases.

Those living in poverty or low-income communities may lack the financial capacity to seek medical care or pay for diagnostic tests, such as X-rays, leading to delayed or missed diagnoses. This emphasizes the need for strong social support systems.

CONCLUSION

The findings from this study demonstrated that childhood TB detection is influenced by several factors, including those presented by both healthcare workers and community healthcare workers. The results showed that clinical competence, community engagement, and systemic support play vital roles in improving TB case finding.

Results from healthcare workers revealed significantly varied levels of competence, with firm reliance on TB co-infection as a clinical indicator. This either facilitates TB case detection because symptoms suggestive of TB will be easy to identify or becomes a barrier to TB case detection due to the complexity of diagnosing TB, as other conditions mask it, and healthcare workers may not prioritize investigating for TB. Additionally, the effectiveness of TB guidelines was significantly associated with the practical competence of the individual healthcare worker rather than with the availability of guidelines, standard operating procedures, protocols, or training. This outcome highlights the need for on-the-job training to enhance diagnostic accuracy and implement the guidelines.

Experienced healthcare workers with previous contact with children with TB stand a greater chance of early detection of TB in children. This suggests that previous experience is important in enhancing individual competencies in TB detection.

The results also revealed the strengths of community-level factors as powerful determinants of caregiver behavior. The findings suggest that community awareness and social support were consistently associated with increased caregiver willingness and support for TB detection. On the other hand, limited access to health facilities and transport barriers effectively impacted early healthcare-seeking behavior.

Study findings revealed variation in conducting TB diagnostic procedures such as gastric aspirate, lymph node biopsy, and TST. This healthcare worker gap becomes a barrier in TB detection, as children have difficulties producing sputum, the most common sample used for TB detection. Therefore, healthcare worker capacity becomes important in TB detection.

The overall recommendations from both healthcare workers and community healthcare workers suggest targeted support for community screening programs that enhance access to services where people are and address barriers such as transportation, travel costs, and other access issues. Targeted training, awareness campaigns, and resource mobilization are other key recommendations from both service providers. These priorities demonstrate a shared understanding that effective TB detection in children requires clinical excellence and functional community infrastructure.

In conclusion, improving childhood TB case detection requires a multisectoral approach. This approach should strengthen healthcare workers' clinical capacity and enhance community-level awareness and support systems. If these are addressed holistically, it will not only improve early diagnosis but also foster a more responsive and inclusive TB control strategy.

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