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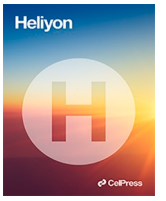

Research article

Routine tuberculosis contact investigation yield and preventive treatment cascade in central Ethiopia

Getachew Seid [a,b,*], Ayinalem Alemu [a,b], Getu Diriba [a], Betselot Zerihun [a], Yeshiwork Abebaw [a,b], Shewki Moga [a,b], Saro Abdela [a], Solomon Habtemariam [b], Balako Gumi [b]

[a] *Ethiopian Public Health Institute, P.o.box 1242, Addis Ababa Ethiopia*
[b] *Aklilu Lemma Institute of Pathobiology, Addis Ababa University, Po. Box 1176, Addis Ababa, Ethiopia*

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ABSTRACT

Introduction: There is a global gap between tuberculosis incident cases and the notified cases. Active household contact investigation is one of the strategies to narrow this gap. It has the advantage of giving early diagnosis and preventive treatment to vulnerable and eligible groups. This study assessed the practice of contact investigation and tuberculosis preventive treatment adherence in central Ethiopia.

Method: A cross-sectional study covering all registered bacteriologically confirmed pulmonary tuberculosis patients and their close contacts was conducted in central Ethiopia from January 1, 2022, to December 30, 2022.

Result: A total of 1372 household contacts were declared by the index cases. From these 79.44 % (1090) contacts received a one-time tuberculosis screening giving a total of four (0.36 %) active TB cases. Among 484 household contacts of drug-resistant tuberculosis index cases, 5.53 % (14) had presumptive tuberculosis and 0.79 % (2) had active tuberculosis. While among 837 household contacts of drug-susceptible tuberculosis index cases presumptive TB cases were 1.91 % (16) and active TB cases were 0.23 % (2). Of the 142 eligible under 15 children 81.69 % (116) had started tuberculosis preventive treatment and 84.48 % (98) completed the treatment. On multivariable logistic regression, the associated factor for tuberculosis preventive treatment non-adherence was age 2–5 years (aOR, 0.02, 95 % CI (0.002–0.20) and age 5–15 years (aOR, 0.04,95 % CI (0.002–0 0.95)) P=<0.05).

Conclusion: There was low contact screening practice in the DR-TB index cases as compared to national and global targets. The yield of routine contact investigation was low and it indicates the quality of screening. Tuberculosis preventive treatment initiation and completion rates were also low as compared to those of many other countries and global achievements which need further improvement, especially for completion. Alternative mechanisms should be planned to increase the yield of tuberculosis screening and tuberculosis preventive treatment adherence.

* Corresponding author.
E-mail address: gech1365@gmail.com (G. Seid).

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1. Introduction

When a patient with active infectious pulmonary tuberculosis (TB) coughs or sneezes droplets containing *Mycobacterium tuberculosis*, people nearby inhale droplets and cause tuberculosis infection. Due to an immunological response, inhaled bacilli reach lung alveoli and become encapsulated in granulomas, which are contagious to other individuals even in the absence of TB. Favorable conditions make the bacilli evade the immune system and multiply, causing active infectious pulmonary TB disease [1].

World Health Organization (WHO) recommended tuberculosis post-exposure management includes active TB diagnosis and provision of effective tuberculosis preventive treatment (TPT) for vulnerable and eligible persons. The group is classified based on age and risk group. The WHO has increased the age range for latent TB treatment in children to under 15 years [2]. Active tuberculosis should be ruled out before starting TPT [3].

In 2022, globally 10.6 million people (95 % UI: 9.9–11.4 million) contracted tuberculosis. There was a global gap between tuberculosis incident cases and the notified cases. In this year, 55 % of TB cases were contributed by men, 33 % were women, and 12 % were children (aged 0–14 years). The number of household contacts enrolled in TB preventive treatment was 1.9 million in 2022 [4]. Globally, in 2021, only 32 % of children household contacts (less than five years old) received TPT [5]. Community participation is a key component of the global end-TB strategy designed to reach the goals [6].

Household contacts primarily children could be infected with tuberculosis after having close contact with an active pulmonary tuberculosis patient (index TB patient) in their household [1]. Children with TB infection have a 10 % risk of developing TB disease in their lifetime. In the first three months of exposure, 83 % of children exposed to TB develop the disease [7]. Patients who have bacteriologically confirmed pulmonary tuberculosis have a significant risk of transmitting *Mycobacterium tuberculosis* to their children [8]. Infected children have a larger chance of developing TB than adults [9]. Tuberculosis preventive treatment lowers the risk of contracting TB disease in all children exposed to active pulmonary TB patients by 63 % [1].

The implementation of TB contact investigation in resource-limited areas with high TB burden, despite being nationally approved, remains onerous and sup-optimal [10]. Individualized TPT should be implemented in high-risk HHCs exposed to RR-TB "after an in-depth risk assessment, including the degree of exposure, the certain of the source of disease, reliable information on the source's drug resistance pattern, and potential adverse drug reaction" [3].

Achieving the WHO's goal of eliminating TB as a public health issue by 2035 will be impossible with the current facility and patient-delivered-based -based method of TB detection [11]. Household contact investigation is an approach in which healthcare professionals visit the homes of patients with newly confirmed infectious tuberculosis to screen co-habitats or close contacts for tuberculosis and refer individuals at risk to TB clinics for diagnosis and treatment [7].

Even though Ethiopia included active contact investigation in its TB management guidelines, there was a 'patient-delivered contact screening' practice that was contrary to WHO recommendations. Health extension workers (HEWs) screened a smaller number of household contacts (HHC) than expected. The Ministry of Health recommends that all contacts of bacteriologically confirmed index cases should be evaluated. However, only 66 % of contacts of bacteriologically confirmed TB index patients were screened in 2022 [12].

In Ethiopia, the tuberculosis case detection rate is low. It shows that persons in their homes face prolonged exposure to drug-susceptible tuberculosis (DS-TB) or multi-drug resistance tuberculosis (MDR/RR-TB) and have the risk of developing the disease. It is essential to evaluate household contacts' health and prevent them from developing the disease [13].

This research was conducted to assess the practice of contact screening and TPT provision among contacts of bacteriologically confirmed (index patients) pulmonary tuberculosis patients in central Ethiopia.

2. Method

2.1. Study setting, period, and design

A cross-sectional study was conducted covering all registered bacteriologically confirmed pulmonary tuberculosis (PTB) patients and their close contacts in central Ethiopia from January 1, 2022, to December 30, 2022. Central Ethiopia is one of the most populated areas in the country. Addis Ababa, the capital of Ethiopia, is found in central Ethiopia. It also includes highly congregated areas in Addis Ababa and some regional cities, but most of the land was held by farmers and industrial zones [14].

2.2. Sampling procedure

In central Ethiopia, there are seven drug-resistant tuberculosis (DR-TB) treatment initiative centers (TICs). We selected five of them randomly. The inclusion of the remaining ten direct observed treatment (DOT) sites was made by their reported caseload from the previous year. Based on caseload sites were categorized into high, medium, and low. From each group, three sites were included and one additional site was added based on the lottery method and it was from the high TB case load group.

2.3. Contact investigation and tuberculosis preventive treatment process in Ethiopia

According to the Ethiopian National Tuberculosis and Leprosy (NTP) management guidelines healthcare providers and health extension workers (HEW) are expected to conduct home visits of infectious TB patients. Health extension workers have formal educational qualifications: graduation from 10th grade in rural settings and a nursing diploma in urban areas. Health extension

workers attend a one-year pre-service education on eighteen health extension program packages. Prevention and control of tuberculosis was included in the package. Tuberculosis case diagnosis was routinely practiced both at the community (by HEW) and health facility levels. Health extension workers examine presumptive tuberculosis patients at health posts or during regular home visits for tuberculosis symptoms. Health professionals routinely undergo TB screening services for household/close contacts of infectious TB patients registered to receive TB treatment.

Household contacts having exposure to the bacteriologically confirmed TB index case were examined for active TB through WHO-recommended symptoms-based TB screening algorithms (two or more weeks of cough, haemoptysis, fever, night sweats, and weight loss). If the index case was DS-TB and the contact was clinically well and had no active TB at the time of evaluation the HEW either gave TPT based on eligibility requirements or advised the contact to seek medical attention as soon as possible if they became ill in the next two years.

The country uses a 'patient-initiated pathway' to eliminate potential barriers to early case detection. The country applied the systematic tracking of people with presumptive active TB in a predetermined and prioritized target group, using sensitive TB screening tools. TB contact tracing method is recommended for conducting home visits or inviting contacts to the health facility for evaluation. But in practical household contacts were screened through a patient-delivered system at the health facility. It depends on the willingness and interest of the contact. It also recommends the provision of treatment for TB or TPT as per eligibility [15].

Currently in Ethiopia TPT regimen alternatives include six months of isoniazid preventive therapy (6H), three months of weekly isoniazid plus rifapentine (3HP) for those over the age of 2 years, and three months of daily isoniazid plus rifampicin (3HR) for those under the age of 2 years. Tuberculosis preventive treatment is not recommended by the NTP for close contacts of drug-resistant patients. Rather, close contacts of DR-TB patients should undergo careful clinical follow-up every three months (including at least one chest x-ray screening) for at least two years [2].

2.4. Operational definition

- Central Ethiopia in the current study covers the former so-called 'Shewa Kiflehager' within, a 200 KM radius of the capital Addis Ababa.
- Child: A person under 15 years of age.
- Bacteriologically confirmed pulmonary tuberculosis: case referred to a pulmonary TB patient with biological specimen positive by Acid-Fast Bacilli (AFB) smear microscopy, Xpert MTB/RIF assay or TB culture, indifference with drug susceptibility profile.

2.5. Data collection

The primary data sources were the TB unit registration book and contact registration book; a hard copy-based register containing demographic and clinical data on all TB cases.

A data extraction form was used to collect data from the registers. From the TB unit register, demographic and clinical characteristics of the index cases were collected. Specifically, socio-demographic data, HIV status, type of case (new or relapse, failure), nutritional status, number of contacts, and nutritional status during treatment initiation other individual-level demographic and clinical data were collected. We extracted data from the contact tracing register on the number of times contact tracing was conducted for a given index case, number of contacts elicited, type of contact, number of contacts screened for TB symptoms, number of presumptive TB cases, number of presumptive TB cases evaluated for active TB, number of eligible contacts who start TPT, TPT regime, weight, TPT status and number of presumptive TB cases with active TB.

2.6. Data quality assurance and analysis

Data was double-entered into MS Excel and double-coded to reduce the error that could occur while obtaining information from the registers. The data were imported into STATA 17 software for statistical analysis. Descriptive analysis such as frequency, percentage, and mean were used to characterize the study participants (index cases and their contacts).

The yield of active tuberculosis is described using proportion and per 100, 000 contacts with a 95 % confidence interval (95 % CI). Multivariable logistic regression was employed to assess the association of clinical and demographic factors of the children and index cases with TPT completion status. Variables with a p-value less than 0.2 in the bi-variable logistic regression model and those variables with a p-value <0.05 in the adjusted model were considered to have a statistically significant difference.

Ethical approval

Ethical approval for this study was obtained from the Addis Ababa University, the Institute of Pathobiology (ALIP IRERC/94/2015/23) and the Ethiopian Public Health Institute Institutional Review Board (EPHI-IRB) with protocol number EPHI-IRB-456-2022. Each health facility office gave written permission to extract data from the registers.

3. Result

In the study period, 1527 tuberculosis cases were reported in the TB department registration book. Among all cases, 534 (34.97 %) were bacteriologically confirmed PTB. Of these, 135 were DR-TB cases and 399 were DS-TB cases. The bacteriologically confirmed

index cases declared a total of 1372 close contacts of which 160 were eligible for TPT (under 15 years children). Among the declared contacts 888 (64.72 %) were DS-TB index case contacts and 484 (35.28 %) were DR-TB index case contacts. DR-TB patients had more close contact than DS-TB cases (2.22 and 3.58 contacts per index case in DS-TB and DR-TB cases, respectively). More close contacts were screened for tuberculosis in DS-TB cases than in DR-TB cases (94.25 % of contacts in DS-TB cases and 52.27 % among DR-TB cases). All DR-TB cases had at least one close contact while 111 (27.82 %) of DS-TB patients had no close contact. The prevalence of presumptive tuberculosis was lower among close contacts of DS-TB cases (1.92 %) than DR-TB cases (5.53 %) (Fig. 1).

3.1. Demographic and clinical characteristics of index cases

The mean age of the index bacteriologically confirmed cases was 33.09(SD ± 13.83) ranging between 1 year and 76 years. In DS-PTB cases it was 32.98 years (SD ± 13) and 33.21 years (SD 13.53) in DR-TB cases. In the risk group column of the registration book, out of 399 DS-TB cases, only 3 (0.75 %) were identified as contacts of another person. Two-thirds (65.16 %) of DS-TB index patients were male. Health extension workers (HEW) and PPM contributed only 13.53 % and 15.78 % of the bacteriologically confirmed pulmonary tuberculosis cases, respectively. One-fifth (19.09 %) of the reported DS-TB cases were HIV positive. Of the total 399 bacteriologically confirmed DS-TB cases 7 (1.75 %) were drivers. The proportion of relapse cases among total reported cases was 8.77 %. Of the drivers, 4 (57.14 %) had not declared any contact. The majority (80.0 %) of DS-TB index cases who had no registered closest respondent person address had not declared close contact (Table 1).

Thirteen (9.63 %) of the 135 DR-TB patients were isoniazid resistance tuberculosis (Hr-TB) cases, whereas 67.41 % were Rifampicin Resistant (RR) cases. The proportion of male and female cases that were recorded was comparable. Of the recorded DR-TB cases,15 (11.11 %)cases were HIV positive and all have initiated anti-retroviral treatment (ART). About half of the individuals with complete data were on longer DR-TB treatment regimens (Table 2).

3.2. Yield of active TB case

Among 534 bacteriologically confirmed pulmonary TB cases, contact investigation was conducted for 350 (65.54 %) index cases. Out of 1090 close contacts that received a one-time tuberculosis screening, a total of four (0.36 %) active TB cases were found. The yield of active TB per 100, 000 contacts was thus 360/100, 000.

Among 837 close contacts of 269 DS-TB index cases 16 (1.91 %) and 2 (0.23 %) had presumptive and active TB, respectively. In DS-TB contacts, to identify one TB the number of contacts needed to screen (NNS) was 435 and the number of contacts needed to test (NNT) was 8 (Fig. 1). Of 484 close contacts of MDR-TB index cases, 253 (52.27 %) received a one-time TB screening. Of these, 14 (5.53 %) had presumptive TB and 2 (0.79 %) had an active TB. In DR-TB contacts, to identify one TB the NNS was 126 and the NNT was 7

Figures

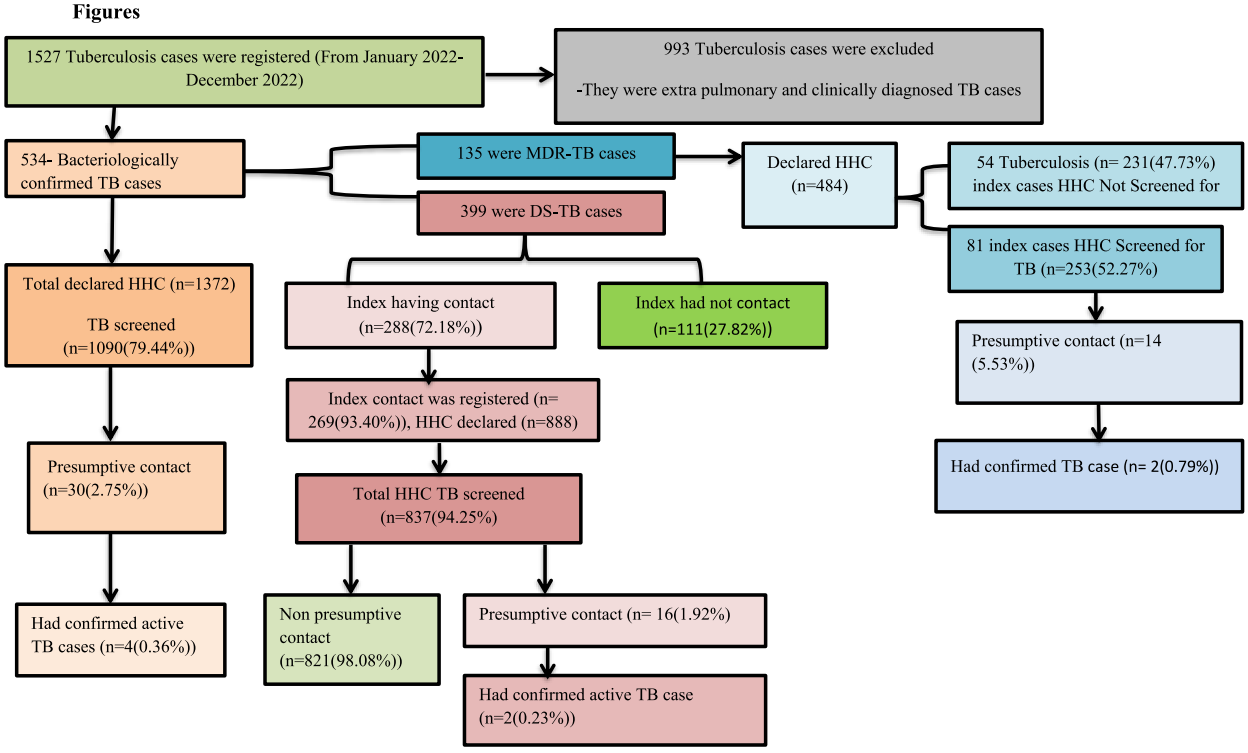

Fig. 1. Contact screening practice and active tuberculosis yield in central Ethiopia, January–December 2022.

Table 1
Demographic characteristics of DS-TB Index cases by having close contact or not in central Ethiopia, January–December 2022.

Characteristic	Frequency (n = 399)	Had close contact (n = 288 (72.18 %)	Had no close contact (n = 111 (27.82 %)	P-value
sex				**0.02**
Male	260	178 (68.46)	82 (31.54)	
Female	139	110 (79.13)	29 (20.87)	
Age group				**0.004**
<15	14	12 (85.71)	2 (14.29)	
15-20	36	22 (61.11)	14 (38.89)	
21-45	284	206 (72.53)	78 (27.47)	
>45	65	48 (73.84)	17 (26.16)	
Patient risk group				**<0.001**
General population	151	116 (76.82)	35 (23.18)	
Congregate	86	72 (83.72)	14 (16.28)	
Key affected population	13	13 (100)	0 (0)	
Homeless	37	11 (29.72)	26 (70.28)	
Diabetes	7	6 (85.71)	1 (14.29)	
Contact	3	1 (33.34)	2 (66.66)	
Driver	7	3 (42.85)	4 (57.15)	
Other	95	66 (69.47)	29 (30.53)	
Category				0.91
New	364	263 (72.25)	101 (27.75)	
Relapse	35	25 (71.42)	10 (28.58)	
Contact person registered				**<0.001**
Yes	359	280 (77.99)	79 (12.01)	
No	40	8 (20.0)	32 (80.0)	
Linked by				0.06
PPM	63	48 (76.19)	15 (23.81)	
PHF	281	194 (69.03)	87 (30.97)	
HEW	55	46 (83.63)	9 (16.37)	
Nutritional status				0.41
Normal	207	142 (68.60)	65 (31.40)	
SAM	57	43 (75.43)	14 (24.57)	
MAM	92	71 (77.17)	21 (22.83)	
Unspecified	43	32 (74.41)	11 (25.59)	
HIV result				0.71
Positive	78	55 (70.51)	23 (29.49)	
Negative	321	233 (72.58)	88 (27.42)	

PPM=Public private mix, PHF=Public health facility, HEW=Health extension worker, SAM = severely acute malnutrition, MAM = Moderate acute malnutrition.

(Fig. 1).

3.3. TPT initiation and completion

From the total DS-TB index cases160 child contacts were identified; of these 142 (88.75 %) were evaluated for TB and all were eligible for TPT. One hundred sixteen of them (81.69 %) had started TPT. Only 98 (86.21 %) of them completed the course of treatment (Fig. 2).

According to Ethiopian TB treatment guidelines, different TPT regimens are recommended based on the age group and HIV status of the child. Approximately 50 % of the children enrolled in TPT were between the ages of 5 and 15. Around half (52.59 %) were on 3HP treatment regimen. Seventy-two (62.07 %) were household contacts of the index case. In registered contacts, the quarterly screening rate for tuberculosis symptoms was poor (1.72 %) (Supplementary Table 1).

The multivariable analysis showed age group and TPT drug regime of children had an association with TPT non-adherence (Table 3). Female cases were less likely than male cases to complete TPT (adjusted OR (aOR): 0.26, 95 % CI (0.05–1.19)). A child with age 2–5 was less likely to complete TPT compared with age less than 2 (aOR: 0.02, 95 % CI (0.002–0.20)), as were those children aged 5–15 years (aOR: 0.04,95 % CI (0.002–0 0.95)). Those children who were on 3RH drug regime had 58 times the odds to complete TPT cascade compared to those children who were on 3RH drug regime (aOR:58.79,95 % CI (5.46–232.88)) (Table 3).

4. Discussion

The major findings from our study for the programmatic management of contact investigation were; a high proportion of pulmonary DS-TB cases without any contact and sub-optimal contact screening and low quarterly contact screening practice. The yield of active tuberculosis was very low. Even though most of the children were on a short TPT regimen there was a high rate (15.52 %) of TPT interruption.

In the present study, 72.18 % of bacteriologically confirmed DS-TB pulmonary TB patients had at least one contact. Among the registered HHCs, 94.25 % of them received baseline TB screening. This result was consistent with the report from Chennai District,

Table 2
Demographic and clinical characteristics of DR-TB cases in central Ethiopia, January–December 2022.

Characteristic	Frequency (%)
Sex	
Male	65 (48.15)
Female	70 (51.85)
Age group	
<15	7 (5.19)
15-20	14 (10.37)
21-45	94 (69.63)
>45	20 (14.81)
Resistance Type	
MDR-TB	31 (22.96)
RR-TB	91 (67.41)
Hr-TB	13 (9.63)
Site of disease	
Pulmonary	125 (92.59)
Extra pulmonary	10 (7.41)
HIV Result	
Positive	15 (11.11)
Negative	119 (88.15)
Unspecified	1 (0.74)
Treatment eligibility	
Shorter	44 (32.59)
Longer	65 (48.15)
Individualized	2 (1.48)
N.done	15 (11.11)
Nutritional status	
Normal	44 (32.59)
MAM	32 (23.70)
SAM	49 (36.30)
Not specified	10 (7.41)

MDR-TB = Multidrug resistance tuberculosis, RR-TB=Rifampicin resistance tuberculosis, Hr-TB=Isoniazid resistance tuberculosis, SAM = severely acute malnutrition, MAM = Moderate acute malnutrition.

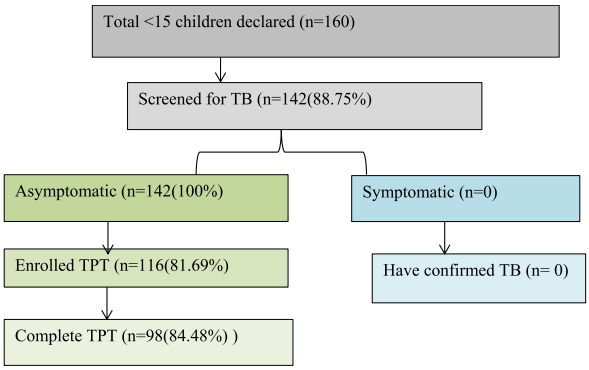

Fig. 2. Tuberculosis preventive treatment cascade in <15 contacts of DS-TB patients in central Ethiopia, January–December 2022.

India (93 %). In Afghanistan study using seven-year data reported that 81 % of household members were screened for tuberculosis [15]. In Ethiopia, previous studies reported different findings in different times and places, 55.7 % in rural areas [16] and 55.3 % in south Wollo [17]. The period allows improving contact screening practice and their sample size may contribute to the big difference between the two studies. Most of our study sites were urban and the average number of contacts per index was low which may be the reason for the relatively high screening rate. Convincing household contacts who feel healthy to undergo TB diagnosis and evaluation was a big challenge for healthcare workers.

In this study, the total HHC was lower than expected (2.22 HHC per index). This finding contradicts the country's NTP contact calculation using the factor 3.1 HHC [13] contacts per index case. The reason for this could be that the majority of the study sites were in urban areas and the NTP calculation rate was not changed for ten years [12]. This prediction was strengthened by our study findings, which revealed that all MDR-TB cases (from rural areas) had close contacts. Another reason could be that index cases were reluctant to

Table 3
Multivariable analysis of demographic and clinical characteristics of children and index for TPT completion in central Ethiopia, January–December 2022.

Characteristics	Complete (%)		AOR (95%CI)	P-value
Sex	Yes	No		
Male	54 (93.10)	4 (6.90)	1	0.084
Female	44 (75.86)	14 (24.14)	0.26 (0.05–1.19)	
Age group				
<2	41 (95.35)	2 (4.65)	1	
2-5	16 (59.26)	11 (40.74)	0.02 (0.002–0.20)	**0.001**
5-15	41 (89.13)	5 (10.87)	0.04 (0.002–0 0.95)	**0.047**
Contact type				
HHC	60 (83.33)	12 (16.67)	1	
Close Contact	38 (86.36)	6 (13.64)	1.39 (0.24–7.87)	0.703
TPT drug regime				
3RH	38 (69.09)	17 (30.91)	1	
3HP	60 (98.36)	1 (1.64)	58.79 (5.46–232.88)	**0.001**
Weight group				
<10.0 Kg	17 (70.83)	7 (29.17)	1	
10–20 Kg	41 (85.42)	7 (14.58)	3.21 (0.38–26.79)	0.280
>20 kg	40 (90.91)	4 (9.09)	5.58 (0.27–115.42)	0.266
Sex of the index case				
Male	52 (91.23)	5 (8.77)	1	
Female	46 (77.97)	13 (22.03)	0.37 (0.11–1.18)	0.094
The age group of an index case				
<15	2 (50.00)	2 (50.00)	1	
15-25	9 (90.00)	1 (10.00)	7.80 (0.44–135.77)	0.159
25-45	75 (87.21)	11 (12.79)	4.30 (0.52–35.42)	0.175
>45	12 (75.00)	4 (25.00)	2.07 (0.20–20.73)	0.535

1 = Reference variable, Kg = Kilogram, HHC=Household contact.

list their contacts to avoid stigma. Our study revealed that four out of seven driver index cases were registered without any close contact. However, a driver in a country like Ethiopia may have many more close contacts and maybe the currently used HHC registration system was not able to detect such contact behavior. Contact screening is currently limited to household members living under one roof, but people living together like Ethiopia's extended family members have very close daily interactions.

In the present study, the yield of active tuberculosis from HHC of DS-TB (0.23 %) was similar to the report from Ghana Accra (0.31 %) [18]. However, it was lower than the reports from Uganda (2 %) [19], 4.3 % in Delhi India [20] 1 % in Chennai India [21], and 3 % reported globally [7]. Unfortunately, no contact was evaluated for tuberculosis in 6 % of index patients, and over 38 % of index cases had no contacts at all.

This could explain why the yield of contact tracing among DS-TB in our study was very low. Further, it raised questions on the quality of screening. The yield could have been higher if chest X-rays in combination with symptom screening had been used. Additionally, there must be rapid diagnostic methods for children. Although every MDR-TB index case had contacts, only 52.27 % of those contacts were evaluated for tuberculosis. This result affected the yield of active tuberculosis among their contacts (0.79 %). Drug resistance tuberculosis contact screening produces more presumptive TB and active TB than DS-TB index cases contact. This finding was contrary to the report from a previous study in Ethiopia [22]. This might be due to the nature of the study that our study data was extracted from a registration book which was exposed to bias during registration at the time of screening.

In comparison with DS-TB cases, in MDR-TB index cases, a low rate (52.27 %) of HHC was screened for tuberculosis. There were only 65 MDR-TB TICS in Ethiopia to service the entire population and the TIC treatment follow-up site communication was weak [12]. Each DR-TB patient must travel a long distance to receive treatment. This had an impact on the number of household contacts who undergo tuberculosis screening.

Understanding every phase of the children's TPT care cascade is critical because it could identify gaps in the pathway from tracing child contacts of an index case to TPT completion. In this study, there was a gap at each phase. First, the inability to screen all children (the first step in the TPT cascade), i.e. presentation of childhood contacts to the TB clinic for screening for TB symptoms and TPT eligibility. This leads to missed chances for prevention of progression to TB and early detection.

The other gap emphasized by this study was the failure to initiate TPT for all screened and eligible children, only 81.69 % initiated TPT. It was similar to the study finding reported from Afghanistan 85.9 % [15]. However, this TPT initiation performance was higher than from the study in South Africa [23] and in Lima Peru [24] which reported 70.25 % and 30.4 % TPT initiation rates, respectively. A study in Bamako, Mali reported a high initiation of TPT (98.5 %) and a lower completion rate (64.8 %) [25]. The decision to initiate TPT in children was determined by their caregiver and or family. Health care and HEW should emphasize unstoppable community teaching.

Another significant gap in the care cascade was the failure to complete the entire TPT course, with only 84.48 % completing TPT. It shows an increase in completion rate after implementing a shorter TPT regimen (3HP and 3RH). This finding was comparable with the report from Uganda (85 %) [26]. Lower completion results were reported from South Africa (52.2 %) [27], Brazil (63 %) [28], and Afghanistan (68.5 %) [29]. The shorter TPT drug regimens that were applied in the country might contribute to the high completion

rate. However, this study's finding was lower than the global report of 89 % [4]. Complete and intensified engagement of the existing structure of HEW and the women's development army could improve adherence to TPT [12].

Even though, the WHO suggests that high-risk household contacts of MDR/RR-TB patients may be offered TPT [3]. Ethiopia has not yet approved those recommendations [2]. Contacts of MDR/RR-TB source patients are at elevated risk compared with contacts of drug-susceptible TB patients [30]. Some studies suggest that TPT for MDR/RR-TB is effective [30,31].

We found that index and children characteristics play a significant role concerning TPT adherence. In our finding among children less than 15 years who received TPT, females were at higher risk of non-adherence than males. A similar result was reported from Eswatini [32]. This finding needs more qualitative and quantitative study to fully understand how gendered social norms affect equitable TPT delivery. Children on 3HP were less likely to interrupt TPT. This could be due to the time and duration the drug administered. Children with higher age were at higher risk for TPT non-adherence. Convincing asymptomatic household contacts to accept and complete the long TPT course was a challenge for healthcare workers. Programmatic management of contact investigation and TB preventive treatment needs monitoring and evaluation of its implementation as per the WHO recommendation.

This study has some limitations. First, this study could not account for possible missing information resulting from either the lack of data recording or the loss of hardcopy records during the study period. Second, this data relies on what we get recorded on the hard copy and does not give any assurance whether the recorded data is true or false.

5. Conclusion

The data from this study revealed several interesting key quality indicators that have the potential to be used as a monitoring mechanism for tuberculosis contact investigation. There was low contact screening practice in the MDR-TB index case as compared to national and global targets. The yield of contact investigation was low and it indicates the quality of screening was under question. Tuberculosis preventive treatment initiation and adherence rates are also low compared to the global performance. Alternative way of mechanisms should be addressed to increase the yield of screening and tuberculosis preventive treatment adherence.

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CRediT authorship contribution statement

Getachew Seid: Writing – review & editing, Writing – original draft, Formal analysis, Data curation, Conceptualization. **Ayinalem Alemu:** Writing – review & editing, Formal analysis, Data curation. **Getu Diriba:** Formal analysis, Data curation. **Betselot Zerihun:** Writing – review & editing, Formal analysis. **Yeshiwork Abebaw:** Writing – review & editing, Methodology, Data curation. **Shewki Moga:** Writing – review & editing, Formal analysis. **Saro Abdela:** Writing – review & editing, Formal analysis, Data curation. **Solomon Habtemariyam:** Writing – review & editing, Supervision, Formal analysis. **Balako Gumi:** Writing – review & editing, Supervision, Methodology.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

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