Assessment of routine screening of pediatric contacts of adults with tuberculosis disease in Tanzania

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<http://dx.doi.org/10.5588/pha.19.0034>

Setting: Ten selected healthcare facilities in Tanzania, March–April 2016.

Objective: To assess the implementation of screening among pediatric contacts of adults with tuberculosis (TB) disease.

Design: Using a mixed-methods approach, we conducted a questionnaire study among sputum smear-positive adult TB patients and abstracted data from their patient cards to assess the implementation of a child contact management (CCM) intervention. We also conducted in-depth interviews with healthcare workers (HCWs) to solicit their views on clinical practices and challenges in CCM.

Results: A total of 141 adult smear-positive TB patients reported 396 children living in households; detailed information on 346 (87.4%) was available. Only 37 (10.7%) children were clinically assessed for TB, 5 (13.5%) were diagnosed with TB, and 22 started on isoniazid preventive therapy (IPT) (59.0%). Of the 320 children whose caregivers responded to whether their children had undergone human immunodeficiency virus (HIV) testing, 55 (17.2%) had been tested and one (1.8%) was HIV-positive. Forty-one HCWs described passive CCM without use of contact or IPT registers.

Conclusion: We identified gaps in the implementation of TB screening, IPT provision, and HIV testing in pediatric contacts of adults with sputum smear-positive TB. Systematic efforts, including increasing HCW training and educating the community, may improve implementation.

Pediatric tuberculosis (TB) reflects ongoing transmission of TB within the community, and children most often acquire TB from adults in their households.¹ TB clinics are an important platform for household contact investigations of children exposed to adults with active TB disease and for child contact management (CCM). One of the World Health Organization's (WHO's) priorities for pediatric TB is to identify children eligible for isoniazid preventive therapy (IPT) living with human immunodeficiency virus (HIV) and HIV-negative children in contact with sputum smear-positive adults.² This can be done by using a CCM symptom-based screening approach.³ Identifying children in contact with adults with TB is one of the first steps for implementing IPT and preventing TB in children, thereby interrupting further transmission of TB within the community.^{3,4} HIV testing of pediatric contacts should be included in this process.²

In 2015, of the 62 180 cases of TB reported to the Tanzania National Tuberculosis and Leprosy Pro-

gramme (NTLP), 5699 (9.4%) were children aged <15 years.^{5,6} In 2015, IPT was initiated for an estimated 6.9% of children aged <5 years who were household contacts of adults with bacteriologically confirmed TB,⁵ and an estimated 91 000 children aged 0–14 years were living with HIV.⁷ A 2013 Tanzania national TB prevalence survey reported a TB prevalence of 295/100 000 in the adult population and a case detection rate of between 42% and 54%,⁸ suggesting that there may be children in the community with undiagnosed TB. Another study showed a gap between reported TB incidence in children aged <5 years and household exposure of children to adults with TB; estimated early childhood TB incidence was two to five times higher than recorded.⁹ Healthcare workers (HCWs) at TB clinics also play a critical role in implementing CCM, and few studies have explored HCW perspectives on how to improve this practice. We conducted this assessment to identify missed opportunities in TB screening, diagnosis, and IPT, as well as HIV testing to enhance TB program implementation.

STUDY POPULATION AND METHODS

Participants

We briefly interviewed 179 sputum smear-positive adults who were receiving TB treatment at 10 purposively selected health facilities in five high TB burden regions in Tanzania (March–April 2016). These facilities were selected to represent clinics with high numbers of pediatric TB patients and both urban and semi-urban areas (Figure 1). We also conducted in-depth interviews with 41 HCWs (nurses, medical officers, and clinical officers).

Conduct and analysis of TB patient interviews

Adult smear-positive TB patients presenting to the 10 healthcare facilities over a 2-week period were approached for a brief interview. Adults who provided written informed consent were asked whether they had any children aged <15 years living in their household currently or within 3 months of TB symptom onset, whether these children had been assessed for TB at a healthcare facility, whether the children were diagnosed with TB, and whether the children were offered IPT and tested for HIV. In addition, information on the date of adult TB treatment start, patient type, TB type, and sputum smear status was abstracted from the adult TB patient treatment card. The questionnaire was read in Kiswahili to the participant by the interviewer. Data from the questionnaires were entered

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ACKNOWLEDGEMENTS

The authors thank the patients and health care workers who participated in this evaluation and the Tanzania National TB and Leprosy Programme for their leadership and collaboration in this evaluation. This work was supported by the President's Emergency Plan for AIDS Relief (PEPFAR) through the US Centers for Disease Control and Prevention, under the terms of grant no 1U2GP002751. The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the funding agency. Conflicts of interest: none declared.

KEY WORDS

children; HIV; contact tracing

Received 2 June 2019
Accepted 28 August 2019

PHA 2019; 9(4): 148–152
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FIGURE 1 Clinic locations ($n = 10$) for assessment of routine screening of pediatric contacts of adults with tuberculosis in Tanzania.

into an Access database and analyzed (Microsoft, Redmond, WA, USA).

Conduct and analysis of interviews with HCWs

All HCWs at the TB clinics at the selected facilities were invited to participate in one-on-one in-depth interviews. Questions included how pediatric contacts of TB-positive adults were identified and evaluated and how CCM could be improved. To be eligible for study participation, HCWs had to work full time at the facility and to provide verbal informed consent. In-depth interviews were conducted by a trained interviewer in Kiswahili or English. The interviews were audio recorded, transcribed, translated into English, and independently coded by two trained social scientists. A codebook was developed a priori based on the study objectives, and additional themes were added based on the context of responses.

Ethics

This activity was reviewed in accordance with the US Centers for Disease Control and Prevention (CDC) human research protection procedures and was determined to be non-research, routine program evaluation. Ethical approval was also obtained from the National Health Research Committee of the Ministry of Health, Community Development, Gender, Elderly and Children (MOHCDGEC), Dar es Salaam, Tanzania.

RESULTS

Characteristics of adult participants

A total of 179 eligible adults presented to the health facilities for TB treatment and consented to be interviewed. The patients had received TB treatment for an average of 2.7 months (standard deviation [SD] 2.2). Of the 141 (78.8%) patients with at least one pediatric household contact, 126 (89.3%) were new patients; 48 (34.0%) were living with HIV, 89 (63.1%) were HIV-negative, and 4 (2.8%) did not know their HIV status (Table 1). Their symptoms

TABLE 1 Clinical characteristics of adult smear-positive TB patients with pediatric contacts, March–April 2016 ($n = 141$)

	<i>n</i>	%
Patient type		
New	126	90.7
Relapse	6	4.3
Failure	3	2.2
Treatment after LTFU	2	1.4
Transfer in	1	0.7
Other	1	0.7
TB symptoms in adult TB patients		
Cough	134	95.7
Fever	102	74.5
Night sweats	111	79.9
Weight loss	107	79.3
HIV status of adult patients		
Positive	48	34.0
Negative	89	63.1
Declined to answer/unknown	4	2.8

TB = tuberculosis; LTFU = loss to follow-up; HIV = human immunodeficiency virus.

at the time of diagnosis included cough (95.7%), fever (74.5%), night sweats (79.9%), and weight loss (79.3%).

The 141 adult participants had 396 children living in the same household. Detailed information on TB was available for 346 (87.4%) of the children. Of these, 166 (48.0%) were girls, 179 (51.7%) were boys, and one (0.03%) child's sex was not reported. Of these children, 100 (28.9%) were aged ≤ 5 years; 84 (24.3%) were aged 0–4 years, 150 (43.4%) were aged 5–10 years, and 112 (32.4%) were aged 11–15 years. Fifteen of the adult participants (10.6%) reported that children in their home had been sick; 12 (80%) reported a child with a cough, 9 (60%) reported fever, 5 (33%) reported night sweats, and 6 (40%) reported weight loss.

TB screening, HIV testing, and receiving IPT

Of the 320 children with detailed information about HIV status and use of IPT, 167 (52.2%) were boys and 152 (47.5%) were girls. One child's (0.03%) sex was not reported. Of the 37 (10.7%) children assessed for TB, 5 (13.5%) were diagnosed with TB and received treatment, 22 (59.5%) received IPT, and 10 (27.0%) received neither IPT nor TB treatment. Of the 22 children who received IPT, 12 met national eligibility criteria (younger than 5 years regardless of HIV status or aged 5–14 years and living with HIV, excluding TB). A total of 320 (92.5%) participants reported the children's HIV testing status: 55 (17.2%) children had been tested for HIV, and one (1.8%) was HIV-infected (Figure 2).

A higher percentage of females, children aged 0–4 years and children with adult contacts on TB treatment for longer periods were screened for TB. A higher percentage of males and children aged 0–4 years were tested for HIV. A higher percentage of females were on IPT (Table 2).

HCW practices in child contact management

We interviewed 41 HCWs: 25 (61%) clinicians (clinical officers and medical officers) and 16 (39%) nurses. They had worked an average of 6 years in the current TB clinic and 7 years in the field of TB. Thirty-three participants (80%) reported receiving training in TB and directly observed therapy (DOT), and 26 (63%) reported they had received training in pediatric TB. Of these 26 participants, 18 (69%) had received training since 2015 after the Tanzania National TB and Leprosy Programme (NTLP) updated national pediatric guidelines that cover contact tracing.

FIGURE 2 Outcomes of children ($n = 396$) who are contacts of adult patients with smear-positive TB in Tanzania. TB = tuberculosis; IPT = isoniazid preventive therapy; HIV = human immunodeficiency virus.

All HCWs reported that they routinely ask adult patients with TB about children with whom they are in contact, especially in the home. HCWs reported that 40% of adult patients bring their children into healthcare facilities, a much higher estimate than the 9% reported by interviewed adult patients with TB. When asked to describe the process of contact tracing, HCWs primarily described reminding their patients about the signs and symptoms of TB and asking patients to bring their children to be checked for TB.

Most HCWs noted that in their experience, most caregivers do not refuse TB screening for their children. HCWs identified

stigma and fear of TB diagnosis as reasons why some caregivers refuse TB screening for their children. HCWs reported a lack of community resources for home-based contact tracing.

None of the 10 facilities used a TB contact tracing or IPT register. When asked about ways to improve pediatric contact tracing, HCWs suggested several strategies, including training health providers and staff who provide services other than TB and sensitizing community members (Table 3).

DISCUSSION

Our evaluation found that of 346 child contacts, only 37 (10.7%) children were clinically assessed for TB, 5 (13.5%) were diagnosed with TB and 22 started on IPT (59.0%). Of 320 children whose caregivers responded to whether their children had been tested for HIV, 55 (17.2%) had been tested and one (1.8%) was HIV-positive. Forty-one HCWs reported passive CCM without the use of contact or IPT registers.

Our findings are similar to other evaluations that have found suboptimal contact tracing and screening for TB in children in high-burden, low- and middle-income countries. In a systematic review of 17 TB CCM studies, pediatric contact screening rates varied between 2.7% and 100%.¹⁰ Studies have shown limited success in pediatric contact tracing for TB: in Kenya, only 1% of pediatric contacts were screened;¹¹ in Viet Nam, 5.5% of pediatric contacts aged <5 years were screened;¹² in Malawi, 9% of pediatric contacts were screened;¹³ and in Zambia, 19% of pediatric contacts were screened.¹⁴ One study in Ethiopia showed no recording and reporting of IPT.¹⁵ In Malawi, only 7.7% of all registered adults with a TB-positive sputum smear had brought their children to the clinic.¹⁶ However, one study in Gambia showed a higher rate of screening and an IPT uptake rate of 89.4% using a home-based IPT delivery program.¹⁷ When implemented, IPT can be highly effective; one study in Uganda showed that 99% of children receiving IPT did not develop TB.¹⁸

The Tanzania NTLP Guidelines recommend contact tracing for family members, with a focus on children aged <5 years.¹⁹ Our finding that children aged 0–4 years had higher odds of being screened for TB and tested for HIV may reflect national policy and the perception that they have the highest risk of TB. It is also possible that older children were in school, and thus it was more

TABLE 2 Rates of TB screening, HIV testing, and initiating IPT by characteristics of child contacts

	Screened for TB ($n = 346$)* n/N (%)	Tested for HIV ($n = 320$)† n/N (%)	Received IPT ($n = 346$)‡ n/N (%)
Sex			
Female	22/166 (13.3)	20/152 (13.2)	15/166 (9.0)
Male	14/179 (7.8)	35/167 (21.0)	7/179 (3.9)
Age, years			
0–4	17/84 (20.2)	21/79 (26.6)	
5–10	12/150 (8.0)	19/138 (13.8)	
11–14	8/112 (7.1)	15/103 (14.6)	
Time adult contact on TB treatment, days			
<60	10/154 (6.5)	26/146 (17.8)	9/154 (5.8)
60–<120	10/78 (12.8)	13/72 (18.1)	6/78 (7.7)
≥120	17/98 (17.4)	16/91 (17.6)	7/98 (7.1)

*1 child missing information on sex, 16 adults with missing contact time to treatment.

†1 child missing information on sex, 11 adults with missing contact time to treatment.

‡1 child missing information on sex, 16 adults with missing contact time to treatment.

TB = tuberculosis; HIV = human immunodeficiency virus; IPT = isoniazid preventive therapy.

TABLE 3 Summary of healthcare worker perspectives on screening pediatric contacts

Process of pediatric contact screening

'When registering them one by one, also in the morning when we give them health education, we do ask them if they have children and tell them they should bring them so that we screen them. For patients who have TB and are taking medicine here, more than 50% bring their children. After telling them that TB is spread by air and it can be possible to infect those children at homes, so it is possible for those children to have TB symptoms and that they should bring them for examination, they bring them the next day.'

Ways to improve pediatric contact screening

'Provide regular training to doctors about pediatric TB on how to diagnose these children'

'Have special programs for children and provide training to all service providers who deal with children, for example at the Outpatient Department and at the children's clinic ward.'

'The provision of health education, especially at the village level will help, though it is difficult to reach these villages. But all in all, whenever possible, they have to be educated. Even at schools this education is very important.'

TB = tuberculosis.

difficult for them to be evaluated. Because children of adults who had received long-term treatment for TB were more likely to be screened for TB, it is possible that more children would eventually receive this service later in the adult's TB treatment period. However, identifying TB in child contacts earlier would ensure maximum health benefits for child contacts.

HCWs identified lack of resources for community-based CCM, including a lack of community HCWs. In addition, caregivers estimated a higher rate of contact tracing compared to the rate reported by adult TB patients. Given that HCWs reported passive reminders to caregivers to bring children to the clinic for assessment while the patients reported actual presentation of the child to the clinic, it is likely that the adult TB patient report was more accurate. Strategies that HCWs suggested to increase CCM included training facility staff and educating the community. This finding supports another study's results, which show the need for pediatric TB training among HCWs in Tanzania.²⁰ Another study found that HCWs who had attended a national childhood TB training course were three times as likely as untrained HCWs to have ever prescribed IPT to a child.²¹ A systematic review on pediatric contact tracing identified prioritizing processes and tracking tools as essential components of a successful contact tracing strategy.¹⁰ A study in Cape Town, South Africa, found that the maintenance of an IPT register improved the identification of child TB contacts.²² In our evaluation, none of the participating facilities used registers for TB contact tracing or IPT, which may have contributed to the suboptimal TB screening practices and low rates of IPT.

This evaluation has several limitations. Because we included a limited number of clinics, our results cannot be generalized to other regions or healthcare facilities. However, we chose areas of Tanzania with a high TB burden. Another limitation was that the data from adult TB patients were self-reported as contact tracing registers were not available. Adult TB patients may have underreported pediatric contacts because of a reluctance to report the possibility of transmitting TB to a family member. Finally, HCWs were asked to share their clinical perspectives and practices, but their clinical practices were not directly observed.

We identified substantial gaps in the implementation of TB screening, IPT use, and HIV testing among child contacts of adults with smear-positive TB in Tanzania. Systematic efforts, including introducing job aids and reporting tools, providing HCW training, and addressing stigma in the community may improve implementation of contact screening and scale-up of IPT for eligible children. Proposed interventions have included educational videos, decentralized screening, and parallel preventive therapy for children while parents are receiving TB treatment.²³ Family-centered care with community outreach has also been shown to improve

outcomes in children.²⁴ Prioritizing the use of Xpert® MTB/RIF (Cepheid, Sunnyvale, CA, USA), which is a more sensitive diagnostic test in children, could also help identify children with TB.

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Contexte : Dix structures de santé en Tanzanie (mars–avril 2016).

Objectif : Evaluer la mise en œuvre du dépistage des contacts pédiatriques d'adultes atteints de tuberculose (TB) maladie.

Schéma : Grâce à une approche à méthodes mixtes, nous avons soumis à un questionnaire des patients TB adultes ayant un frottis de crachats positif et extrait des données de leurs cartes de patients afin d'évaluer la mise en œuvre de la prise en charge des contacts d'enfants (CCM). Nous avons également réalisé des entretiens approfondis avec des travailleurs de santé (HCW) pour solliciter leurs opinions sur les pratiques cliniques et les difficultés rencontrées en matière de CCM.

Résultats : Un total de 141 patients TB adultes à frottis positif ont désigné 396 enfants vivant dans leurs foyers, avec des informations

détaillées pour 346 patients (87,4%). Seulement 37 (10,7%) enfants ont eu un examen clinique à la recherche de TB, 5 (13,5%) ont eu un diagnostic de TB et 22 ont démarré le traitement préventif à l'isoniazide (TPI) (59,0%). Sur 320 enfants dont les responsables savaient si ces enfants avaient eu un test virus de l'immunodéficience humaine (VIH), 55 (17,2%) avaient été testés et un (1,8%) était VIH positif ; 41 HCW ont décrit une CCM passive sans utilisation de registres de contact ou de TPI.

Conclusion : Nous avons identifié des failles dans la mise en œuvre du dépistage de la TB, de la fourniture du TPI et du test VIH pour les contacts pédiatriques des adultes atteints de TB à frottis positif. Des efforts systématiques, notamment davantage de formation des HCW et d'éducation de la communauté pourraient améliorer la mise en œuvre.

Marco de referencia: Diez establecimientos de atención de salud escogidos en Tanzania (marzo y abril del 2016).

Objetivo: Evaluar la ejecución de la investigación de los contactos pediátricos de pacientes adultos con enfermedad tuberculosa.

Método: Con un enfoque de métodos mixtos, se entregó un cuestionario a pacientes adultos con tuberculosis (TB) y baciloscopia positiva del esputo y se extrajeron datos de la tarjeta de atención de los pacientes con el objeto de evaluar la gestión de los contactos pediátricos (CCM). Se realizaron además entrevistas exhaustivas a los profesionales de salud (HCW), a fin de describir las prácticas clínicas y las dificultades en la gestión de los contactos pediátricos.

Resultados: Los 141 adultos con TB y baciloscopia positiva refirieron 396 niños que vivían en sus domicilios y existía información detallada sobre 346 de ellos (87,4%). Solo se realizó la investigación clínica de

la TB en 37 niños (10,7%) y en cinco se diagnosticó TB (13,5%) y 22 iniciaron el tratamiento preventivo con isoniazida (TPI) (59,0%). De los 320 niños cuyos cuidadores informaron si el niño había recibido la prueba del virus de la inmunodeficiencia humana (VIH), en 55 se había practicado la prueba (17,2%) y uno era positivo frente al VIH (1,8%). Cuarenta y un HCW refirieron la práctica de una CCM pasiva, sin utilización de los registros de contactos ni del TPI.

Conclusión: El estudio puso de manifiesto deficiencias en la ejecución de la detección sistemática de la TB, la provisión del TPI y la prueba del VIH en los contactos pediátricos de adultos con TB y baciloscopia positiva del esputo. La adopción de medidas sistemáticas como una mejor capacitación de los HCW y la educación de la comunidad podría mejorar la investigación de los contactos pediátricos.