Infection prevention and care for contacts of people with tuberculosis, Thailand

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Abstract

**Problem** Despite implementation of universal health coverage in Thailand, there remain gaps in the system for screening contacts of tuberculosis patients.

**Approach** We designed broader criteria for contact investigation and new screening practices and assessed the approach in a programme-based operational research study in 2017–2018. Clinic staff interviewed 100 index patients and asked them to give household and non-household contacts an invitation for a free screening and chest X-ray. Contact persons who attended received 250 Thai baht (about 8 United States dollars) allowance for transport.

**Local setting** Chiang Rai province, Thailand, has high rates of tuberculosis notification and a high number of people living in poverty. The coverage of contact investigation in under 5-year-olds was only 33.2% (222 screened out of 668 contacts) over 2011–2015.

**Relevant changes** Index patients identified 440 contacts in total and gave invitation cards to 227 of them. The contact investigation coverage was 81.1% (184/227) and tuberculosis detection among contacts screened was 6.0% (11/184). Of the 11 contacts with active tuberculosis, three did not have tuberculosis symptoms, three were non-household contacts and three were contacts of non-smear-positive tuberculosis patients. The contact investigation coverage of the contacts younger than 5 years was 100% (14/14) and the yield of tuberculosis detection in this age group was 21.4% (3/14).

**Lessons learnt** High coverage of contact investigation with a high yield of tuberculosis detection among contacts can be achieved by applying broader criteria for contact investigation and providing financial support for transportation.
Introduction
Tuberculosis is curable and preventable, typically at low cost, but every year approximately 10 million people worldwide fall sick with tuberculosis and more than 1 million die.\textsuperscript{1} In Thailand, an estimated 12 000 people die due to this preventable disease.

The World Health Organization (WHO) and the World Bank are using tuberculosis service coverage for monitoring global progress towards universal health coverage (UHC).\textsuperscript{2} To end the tuberculosis epidemic in a generation, the high tuberculosis burden countries should give priority investments to populations at highest risk of tuberculosis, including households and close contacts. Economic evaluations have demonstrated the cost–effectiveness of contact investigation for the prevention of tuberculosis as well as its economic benefits to society as a whole.\textsuperscript{3–5} Contact persons should have access to quality and rapid tuberculosis diagnosis, treatment and prevention services.\textsuperscript{6} Hence, contact investigation is an imperative intervention to facilitate the global End TB Strategy.

At our referral hospital in Thailand we found a low coverage of contact screening in small children, the group at highest risk of contracting tuberculosis infection and developing active tuberculosis disease. In response, we carried out a programme-based operational research study aiming to increase the contact investigation coverage and yield of tuberculosis detection in contact persons and to obtain evidence for guiding contact investigation practices.

Setting
Thailand is one of 14 countries with the highest burdens of tuberculosis, human immunodeficiency virus (HIV) and tuberculosis co-infection and multidrug-resistant tuberculosis.\textsuperscript{1} Chiang Rai, about 800 km from Bangkok, is the northernmost province of Thailand, with a provincial population of 1 287 615 and approximately 13% hill-tribe minorities. The province has been ranked as one of the poorest in Thailand. The Chiang Rai tuberculosis registry reported higher tuberculosis notifications (143 per 100 000 population), mortality (11.4%; 180 deaths among 1576 registered patients) and HIV co-infection (15.5%; 227 of 1466 patients) compared with national data in 2018. We conducted the study at Chiang Rai hospital, a referral hospital for 16 district hospitals in the province that also serves as a primary care unit and a district hospital for people living in the central district (244 311 population in 2018). Tuberculosis was detected in 4.8% (58 of 1200) contacts of smear-positive patients in Chiang Rai in 2003.\textsuperscript{7} In our setting, only 33.2% (222 of 668) contacts
younger than 5 years were screened over 2011–2015. Diagnosis and treatment of tuberculosis is free of charge for Thai people under the UHC scheme. However, diagnosis by chest X-ray for the contacts of people with tuberculosis is free only for contacts with tuberculosis symptoms.

Approach
Our team comprised government tuberculosis service providers, including clinicians and nurses, and a multidisciplinary research team from a nongovernment organization based in Chiang Rai. Based on our literature review, we designed an intervention that included new criteria and practices of contact investigation than previously used in Thailand (Table 1). For example, we broadened the criteria for contact investigation to include not only smear-positive patients and household contacts but also other categories of tuberculosis and non-household contacts, according to WHO’s recommendations for contact investigation. From March 2017 to February 2018, we recruited 100 patients newly diagnosed tuberculosis to the study (64 patients with smear-positive tuberculosis, 34 patients with HIV and tuberculosis co-infection, one patient with multidrug-resistant tuberculosis and one child younger than 5 years with tuberculosis). Trained staff members interviewed the index patients about their contacts and displayed a video explaining the importance of contact investigation. The staff offered invitation cards for each index case to invite up to six contacts (four household and two non-household contacts) for a free chest X-ray (usual cost to patients 200 Thai baht, THB; about 6 United States dollars, US$) and 250 THB allowance for transportation. Invitation cards were numbered so that we could link contacts to the index patient. The cards included information about the hours and location of the hospital, and non-stigmatized information about the need for tuberculosis screening and the curability and preventability of tuberculosis. The invitation cards facilitated communication with the staff when the contact people reached the hospital and were also used as evidence to obtain the transportation fee. All of the contacts brought the cards with them to the hospital.

For each index patient we recorded the number of contacts identified, the number of invitation cards that he or she was willing to accept, the contacts who came to the clinic for screening and the outcomes of contact screening. We calculated the contact investigation coverage (percentage of contact persons receiving an invitation card who were screened for tuberculosis) and yield of tuberculosis detection (percentage of screened contacts who were diagnosed with active tuberculosis). Index patients were asked to provide a telephone number
or address for contact persons so that staff could call or visit to ask about the reasons for not going for screening.

The tuberculosis service staff were already experienced with conducting interviews about tuberculosis symptoms. We gave the staff an additional 2-day training on how to interview the patients sensitively and obtain information about household and non-household contacts who met the criteria. The staff referred all contact persons for a chest X-ray, regardless of the presence of symptoms. The radiologists interpreted the X-ray results without extra incentives.

**Relevant changes**

The index patients identified a total of 440 contact persons and gave invitation cards to 227 of them (Fig. 1). A total of 184 invited contacts came for screening, a contact investigation coverage of 81.1%. Eleven of the contacts screened (6.0%) had active tuberculosis. Of these, 3 did not have tuberculosis symptoms, 3 were non-household contacts and 3 were contacts of non-smear-positive tuberculosis patients. Among the contacts younger than 5 years we achieved 100% coverage (14/14 contacts), followed by 90.2% (37/41 contacts) among contacts older than 60 years (Table 2). The yield of active tuberculosis in children younger than 5 years was also high (21.4%; 3/14 contacts), suggesting the need to ensure 100% coverage for small children contacts. The coverage of the tuberculin skin test for contacts under 18 years was 91.7% (44/48 contacts).

The reasons index patients gave for not accepting the contact invitation cards varied, including the contact having already been screened for tuberculosis or being on tuberculosis treatment, fearing losing their job, wanting to retain confidentiality about the disease, believing that they were not infected, and having conflicts with their contacts. Some patients could not locate the non-household contacts because they only temporarily attended the same training and did not know each other personally. The reasons contacts gave for not receiving a tuberculosis screening despite receiving an invitation card were: being busy with work, unwillingness to be screened for tuberculosis, inability to travel due to age or disability, not having anyone to accompany them, perceiving no risk for tuberculosis, mental health problems, and having moved to another place.

Based on the chest X-ray cost of 200 THB and transportation allowance of 250 THB, we calculated that the cost of detecting one contact with active tuberculosis was 7527 THB (184 contacts × 450 THB ÷ 11 cases of active tuberculosis). The cost equates to
approximately US$ 254 if a transport allowance were provided to every contact, or US$ 119 if no travel expenses were provided.

In November 2018, we had an opportunity to present our study findings to the Minister of Public Health of Thailand. In addition, our team members had several discussions with the public health authorities. As a result, the National Health Security Office, which is the organization responsible for implementing UHC in Thailand, agreed to cover the cost for tuberculosis screening as of October 2019 using chest X-ray for the household tuberculosis contact cases, regardless of the presence of tuberculosis symptoms. However, the other criteria and social interventions which we applied in our study and increased tuberculosis case detection have not yet been adopted by national health policy.

**Lessons learnt**

Applying new criteria for recruiting tuberculosis patients, tuberculosis contacts and tuberculosis screening contributed to higher coverage and a higher yield of detecting latent tuberculosis infection and active tuberculosis among the contacts of tuberculosis patients (Box 1). Despite the incentives offered, some contacts could not access tuberculosis screening due to challenges such as poverty, stigma and health-system responses. If Thailand is to end the tuberculosis epidemic by 2035, the government and society must invest in contact investigation by addressing those challenges. The health system should improve health workers’ communication and interview skills as these skills will improve the coverage of contacts and the yield of tuberculosis detection. Some tuberculosis patients migrate for work to the capital city, Bangkok, but move to their hometown when they are sick. In this case, their contacts are in Bangkok and contact investigation should be performed by the local health service. Tuberculosis public health networks must be established and coordinated for contact investigation.

Several studies, including our previous study, have reported that stigma against tuberculosis threatens contact investigation and the effort to end tuberculosis because index patients keep their illness confidential and conceal information about their contacts. As a result, contacts at high risk of tuberculosis such as children younger than 5 years do not benefit from tuberculosis prevention and care. Campaigns to reduce tuberculosis stigma in the general population are urgently needed. We are now implementing a programme to reduce stigma against tuberculosis by means of education and communication strategies. To sustain the high contact investigation coverage and high yield of tuberculosis case detection...
achieved in this study, we are now engaging with multisectoral partners and civil society to support travel expenses for socioeconomically disadvantaged patients and their contacts.

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Competing interests:
None declared.

References


Box 1. Summary of the main lessons learnt

- Applying new criteria for recruiting tuberculosis patients and contacts and for tuberculosis screening contributed to higher coverage and a higher yield of detecting latent infection and active tuberculosis among patients’ contacts.

- Providing contacts with invitation cards and transport costs enhanced their access to tuberculosis screening, prevention and treatment.

- Tuberculosis contacts living with physical and mental disability and in extreme poverty require additional interventions to assist them in accessing tuberculosis screening and care.
Table 1. Comparison of previous and current criteria and practices of contact investigation and the justifications for change in Chiang Rai province, Thailand

<table>
<thead>
<tr>
<th>Process</th>
<th>Previous practice</th>
<th>Practice in this study</th>
<th>Justification for change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recruiting tuberculosis index patients</td>
<td>Emphasized smear-positive tuberculosis patients</td>
<td>Included smear-positive tuberculosis patients, multidrug-resistant tuberculosis patients, all types of tuberculosis in children younger than 5 years, and all types of tuberculosis in people with human immunodeficiency virus infection</td>
<td>WHO’s recommendations for contact investigation⁹</td>
</tr>
<tr>
<td>Recruiting tuberculosis contact persons</td>
<td>Emphasized household contacts. The staff simply instructed tuberculosis patients to bring everyone in their house to visit the tuberculosis clinic for screening</td>
<td>Included household contacts and non-household contacts. The staff carefully interviewed tuberculosis patients to obtain a list of contacts (age, sex and relation with tuberculosis patient). A contact was defined as a person who always stayed closely and spent time with a tuberculosis patient 4–8 hours a day during the previous 3 months, including contacts living in the same house or living outside the house but regularly visiting the patient at home and other social gatherings (e.g. work, school)</td>
<td>Studies have shown that the transmission of tuberculosis to contacts occurred outside the house, such as at schools and workplaces⁹,¹⁰</td>
</tr>
<tr>
<td>Method of screening for active tuberculosis disease</td>
<td>Tuberculosis symptom screening. Contacts with symptoms were eligible for tuberculosis screening by chest radiography. Diagnosis for latent tuberculosis infection. Contacts younger than 18 years were given a tuberculin skin test</td>
<td>Interview for tuberculosis symptoms. Regardless of the tuberculosis symptoms, all contacts are eligible for tuberculosis screening by chest radiography</td>
<td>Tuberculosis prevalence surveys in Thailand and South East Asia showed that 50% of smear-positive tuberculosis patients and 65% of culture-confirmed tuberculosis patients did not report having tuberculosis symptoms¹¹</td>
</tr>
<tr>
<td>Applying social interventions</td>
<td>Health-care staff verbally instructed the tuberculosis patients to bring every household member for a screening for tuberculosis</td>
<td>Health-care staff offered an invitation card to the tuberculosis patient to give to his or her contacts. There was one card for each contact. Each card had a unique identifier which allowed staff to follow-up with the index patients when their contacts did not attend for screening. The invitation cards included non-stigmatized information about the need for tuberculosis screening, the curability and preventability of tuberculosis, the free service with a 250 Thai baht travel allowance (about US$ 8) and clinic service hours (Monday to Friday from 09.00 to 15.00 hours). The contact persons presented the cards when they came for screening. The staff called or visited the index patients’ home to ask why contacts did not visit the hospital. Staff could only investigate non-attendance for patients who gave consent for home visits to their houses and their contacts</td>
<td>A study in South Africa showed that invitation cards increased tuberculosis screening among household and non-household contacts, with a high yield of tuberculosis detection.¹² In our setting, tuberculosis patients are poor and cannot afford transport costs to the hospital. Financial assistance for attendance improved tuberculosis treatment outcomes¹³</td>
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</tbody>
</table>

Table 2. **Coverage of contact investigation and yield of tuberculosis detection in contacts classified by age in Chiang Rai province, Thailand, 2017–2018**

<table>
<thead>
<tr>
<th>Age of contacts, years</th>
<th>No. of contacts receiving invitation card</th>
<th>No. (%) of contacts screened for tuberculosis</th>
<th>No. (%) of screened contacts diagnosed with active tuberculosis</th>
<th>Tuberculosis patients exposed to contacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;5</td>
<td>14</td>
<td>14 (100.0)</td>
<td>3 (21.4)</td>
<td>3 smear-positive patients</td>
</tr>
<tr>
<td>5–18</td>
<td>43</td>
<td>34 (79.1)</td>
<td>0 (0.0)</td>
<td>No contact found with active tuberculosis</td>
</tr>
<tr>
<td>19–60</td>
<td>126</td>
<td>99 (78.6)</td>
<td>3 (3.0)</td>
<td>1 smear-positive patient, 1 patient co-infected with tuberculosis and HIV, 1 child with tuberculosis (4 years)</td>
</tr>
<tr>
<td>&gt;60</td>
<td>41</td>
<td>37 (90.2)</td>
<td>5 (13.5)</td>
<td>4 smear-positive patients, 1 patient co-infected with tuberculosis and HIV</td>
</tr>
<tr>
<td>Unknown</td>
<td>3</td>
<td>3 (0.0)</td>
<td>0 (0.0)</td>
<td>Unknown</td>
</tr>
<tr>
<td>Total</td>
<td>227</td>
<td>184 (81.1)</td>
<td>11 (16.0)</td>
<td>8 smear-positive patients, 2 patients co-infected with tuberculosis and HIV, 1 child with tuberculosis (4 years)</td>
</tr>
</tbody>
</table>

HIV: human immunodeficiency virus.
Fig. 1. **Contact investigation in children and adult contacts presenting results of screening by tuberculosis skin test and chest X-ray in Chiang Rai province, Thailand**

100 people with tuberculosis (64 acid-fast bacillus-positive, 34 tuberculosis/HIV co-infection, 1 multidrug resistant-tuberculosis, 1 child < 5 years)

440 contact persons

242 household contact persons

158 persons (65.3%) received invitation

133 persons (84.2%) screened for tuberculosis

33 persons aged ≤ 18 years

2 with active tuberculosis; 12 with positive tuberculin skin test

100 persons aged > 18 years

6 with active tuberculosis

198 non-household contact persons

84 persons (34.7%) did not receive invitation

25 persons (15.8%) did not come for screening

158 persons (65.3%) received invitation

51 persons (73.9%) screened for tuberculosis

15 persons aged ≤ 18 years

1 with active tuberculosis; 6 with positive tuberculin skin test

36 persons aged > 18 years

2 with active tuberculosis

69 persons (34.8%) received invitation

18 persons (26.1%) did not come for screening

129 persons (65.2%) did not receive invitation

Notes: Active tuberculosis indicates contact persons with or without tuberculosis symptoms diagnosed as tuberculosis based on result of chest X-ray read by a radiologist and confirmed by a paediatrician or a pulmonologist.