

Limitations of the Indonesian Pediatric Tuberculosis Scoring System in the context of child contact investigation

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Abstract

Background The Indonesian scoring system for childhood tuberculosis (TB) was developed to address the problem of overdiagnosis. The implementation of this scoring system in children who have household TB contacts has not been evaluated.

Objective To evaluate the performance of the Indonesian pediatric tuberculosis scoring system in the context of contact investigation.

Methods A cross-sectional study was conducted in the Yogyakarta municipality, between August 2010 and March 2011. Subjects were children under the age of 15 years, living in the same house with an adult who had pulmonary TB. Subjects underwent history taking, physical examinations, tuberculin skin tests (TST) and chest X-rays. Sputum smear was performed in symptomatic children. We compared outcomes of the Indonesian pediatric TB scoring system to that of rigorous clinical assessment.

Results A total of 146 eligible children of 82 source cases were recruited into the study. Sixty-eight (47%) children had positive TST tuberculin skin tests. Using the scoring system, 47% of the subjects were diagnosed to have TB disease, while only 10% were diagnosed with TB using rigorous clinical assessment. With rigorous clinical assessment, 40% of the subjects were diagnosed as having latent TB infection (LTBI), while none of the subjects were diagnosed as LTBI using the scoring system.

Conclusion The use of the Indonesian pediatric TB scoring system in children with household TB contact may lead to overdiagnosis of TB disease. [Paediatr Indones. 2011;51:332-7].

Keywords: tuberculosis, scoring system, children, household contact

Establishing tuberculosis (TB) diagnosis in children is a challenge due to the lack of a practical gold standard. A positive result by sputum microscopy, the current acceptable gold standard, has been observed in only 10-15% of children with probable TB.¹ Sputum cultures may provide better yield of positive results (30-40%).¹⁻³ Furthermore, collecting sputum in children is difficult, limiting its use for diagnosing TB in children in clinical practice. For this reason, TB diagnosis in children has been commonly based on the presence of clinical symptoms, such as failure to thrive or malnutrition, peripheral lymphadenopathy and persistent cough, combined with chest X-ray (CXR) and history of close contact with a TB patient. However, clinical symptoms and radiological features of TB in children often overlap with other childhood respiratory diseases, particularly in settings where HIV infection and malnutrition are endemic. Clinical case definitions are

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poorly validated and are likely to result in significant under- or over-diagnosis of childhood TB.^{4,5}

The difficulties in establishing TB diagnoses in children have led to development of several diagnostic approaches, such as scoring systems and diagnostic algorithms.⁶ In 2000, the Indonesian Pediatric Society introduced a Pediatric TB Scoring System to address the problem of overdiagnosis of TB in children, particularly in the private sector in the large urban settings. Variables assessed in this scoring system include contact history, typical symptoms, tuberculin skin test (TST) and CXR (Table 1). It is recommended that children with a total score of 6 or more be considered to have TB disease. This scoring was developed based on scoring systems from other countries, and not based on Indonesian data. A validation study on the Indonesian scoring system was conducted, involving 181 children from 4 hospitals in Jakarta. Their results show the sensitivity to be 47%, specificity 68%, and positive and negative predictive values to be 14% and 92%, respectively (unpublished data from the Division of Pediatric Respiriology, Cipto Mangunkusumo Hospital). These results indicate that the use of this scoring system for diagnosing childhood TB in Indonesia should be reconsidered.

Another important issue is the implementation of the Indonesian scoring system in the context of contact screening. Contact investigation is the process of conducting an epidemiological investigation to identify contacts of a tuberculosis case, to investigate the presence of infection or tuberculosis disease, and

to provide appropriate treatment. The Indonesian scoring system gives a score of 3 for a history of contact with a patient having positive sputum smear and a score of 3 for a positive TST result. Therefore, children with household contact but have no symptoms, normal CXR, and positive TST will have a total score of 6. These children may have LTBI, but based on this scoring system, these asymptomatic children will be considered to have TB disease.

This study was conducted to evaluate the performance of the Indonesian TB scoring system in children with household TB contact, in order to improve the clinical management of these children.

Methods

This cross-sectional study was conducted in Yogyakarta between August 2010 and April 2011. The source cases were new cases of pulmonary TB (either positive or negative sputum smears) between January 2010 and April 2011, who were identified from all Primary Health Centres, some private hospitals and lung clinics in the Yogyakarta municipality, including the lung clinic at Sardjito Hospital, a teaching hospital of Gadjah Mada University, Yogyakarta. Children less than 15 years of age who lived in the same house as the source cases were recruited to the study. Those receiving past or present TB treatment were excluded. Written informed consent was obtained from parents or guardians.

Table 1. The Indonesian Pediatric TB Scoring System

Variable	0	1	2	3
Household contact	Unknown		Contact with smear negative TB patient or unknown sputum smear result	Contact with smear positive TB patient
TST	Negative			Positive (> 10 mm, or in immunocompromised children > 5 mm)
Nutritional state		BW/age < 80%	Severe malnutrition (BW/age < 60%)	
Fever of unknown origin ≥ 2 weeks		Present		
Cough ≥ 3 weeks		Present		
Lymph node (cervical, axillary, inguinal) enlargement		Multiple, non- tender, diameter ≥ 1cm		
Joint swelling (knee, phalanges)		Present		
Chest X ray	Normal	Suggestive of TB		

The demographic and clinical data of eligible children was collected by questionnaire. Physical examination, TST and CXR were performed to eligible children. Children with TB symptoms underwent induced sputum collection for Acid Fast Bacilli (AFB) smear and culture. Suggestive TB symptoms included non-remitting and chronic cough which did not improve with antibiotics, prolonged fever of unknown origin, weight loss or lack of weight gain in the preceding 3 months or weight loss of more than 10% (minimum 1 kg) over any time interval despite at least 2 weeks of confirmed adequate nutrition, fatigue (unexplained perceived decrease in playfulness/activity since the onset of coughing as reported by parents/caregiver), hemoptysis (blood in the sputum, not hematemesis or nose bleed), and night sweats (regular sweating requiring a dry set of nightclothes).

TST was performed by a trained nurse by intradermal, volar injection of 0.1 ml of 2 TU (tuberculin units) of tuberculin purified protein derivate (PPD) RT 23. TST result was measured at 72 hours and considered positive if the induration was ≥ 10 mm, regardless of BCG vaccination, or ≥ 5 mm in severely malnourished or immunocompromised subjects. CXR was performed in Sardjito Hospital in antero-posterior and lateral views. Results were independently assessed by one radiologist and one pediatrician blinded to clinical information and each other's findings. In case of disagreement, consensus will be made by a second pediatrician. Induced sputum was done by trained research nurses. After fasting 2-3 hours, subjects were pretreated with 200 ug salbutamol via nebulizer, followed by 5 ml of 6% sterile saline for 15 minutes. Chest percussion was performed over the anterior and posterior chest walls. Sputum was obtained by suctioning through the nasopharynx with a sterile mucus extractor. Specimens were transported directly to the laboratory for processing.

Outcomes of this investigation were assessed using both the Indonesian scoring system and rigorous clinical assessment. In rigorous clinical assessment, children were diagnosed with TB disease if there was at least one TB symptom and at least one from the following: bacteriological or radiologic confirmation or definite extrapulmonary TB.

We used Epidata for data entry and STATA software, release 10 (StataCorp, College Station, Texas, USA) for all descriptive analyses.

Results

A total of 146 eligible children from 82 source cases were recruited during the study period. Most (72%) of the source cases had positive sputum smears. Subjects' characteristics are presented in **Table 2**.

Subjects' total scores are presented in **Figure 1**. Sixty-eight (47%) children had a total score of 6 or more. After further analysis of symptoms, we

Table 2. Subjects' characteristics

Characteristic	n = 146
Mean age, years (SD)	7.1 (4.7)
Females, n (%)	85 (58)
BCG vaccinated, n (%)	141 (96)
BCG scar, n (%)	116 (79)

found that most (82%) of these children (with score ≥ 6) were asymptomatic and had LTBI, 16% had TB disease, and only 2% had no evidence of TB infection or disease (**Figure 2**).

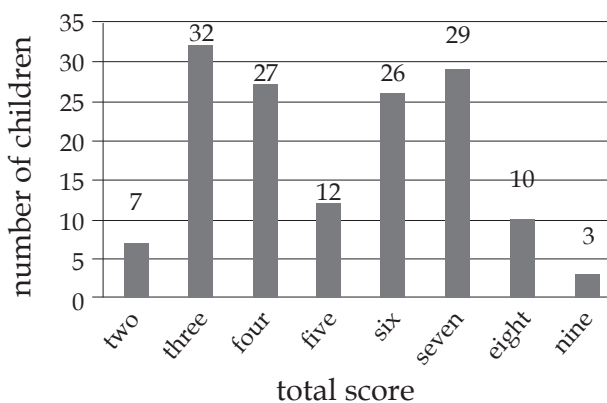


Figure 1. Total scores (all subjects)

Figure 3 shows the comparison of outcomes/diagnoses using the Indonesian scoring system versus rigorous clinical assessment in children with household TB contact. There was an obvious discrepancy in determining the presence of TB disease, as 47% of children were diagnosed to have TB disease with the scoring system, while only 10% were diagnosed to have TB disease by rigorous clinical assessment. Furthermore, none of the children were diagnosed as LTBI with the scoring system, compared to 40% by rigorous clinical assessment.

Sixty-eight (47%) of the subjects had a positive TST. Of these, 56 (82%) had no symptoms and were

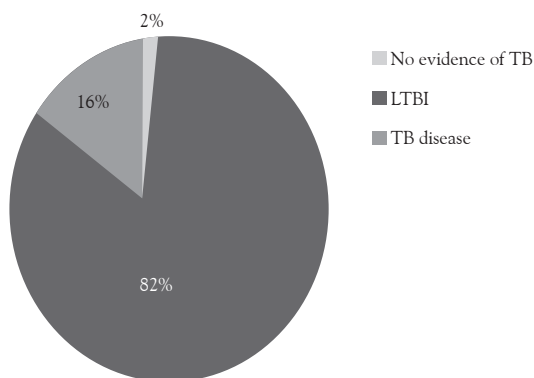


Figure 2. Diagnosis (by rigorous clinical assessment) of children with scores of > 6

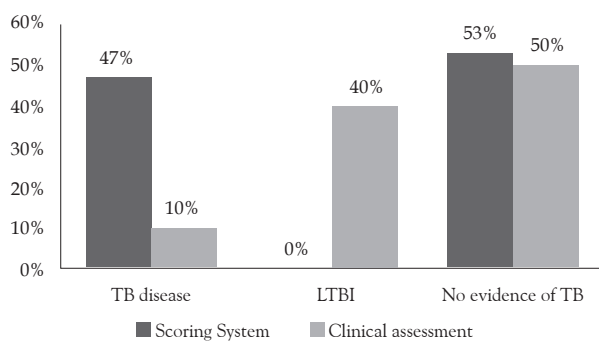


Figure 3. Comparison of diagnoses between the scoring system and rigorous clinical assessment in subjects with household TB contact

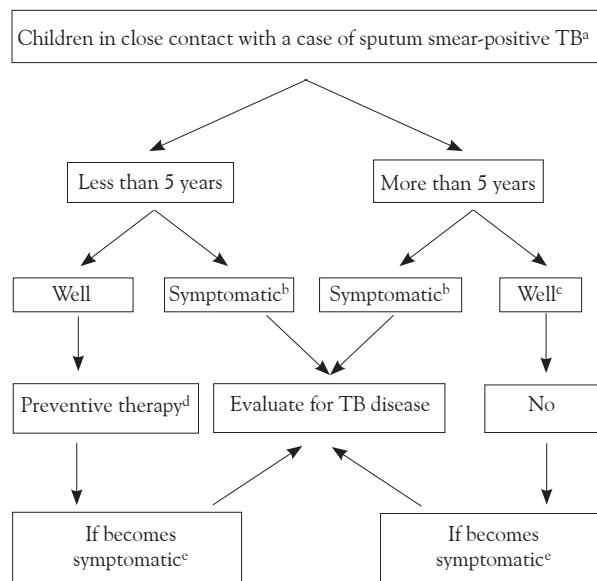
diagnosed as having LTBI. The overall outcome of all subjects in our investigation is presented in Table 3.

Table 3. Outcomes of rigorous clinical assessment

Diagnosis	n (%)
TB disease	15 (10)
LTBI	58 (40)
No evidence of TB infection or disease	73 (50)

Discussion

We observed that almost half of children living in the same house as an adult with pulmonary TB had TB score of 6 or more. However, only a small proportion of these children had TB disease, as confirmed by microbiological examination or clinical and/or radiological features. Most of them were asymptomatic and had LTBI. This finding indicates that the use of the Indonesian scoring system for children with TB



Notes:

- ^a Also consider if the mother or primary caregiver has sputum smear-negative pulmonary TB
- ^b Symptomatic: if TB is suspected, refer to local guidelines on diagnosis of childhood TB
- ^c Unless the child is HIV-infected (in this case, INH 10 mg/kg daily for 6 months is indicated)
- ^d INH 10 mg/kg daily for 6 months

Figure 4. Suggested approach for children in contact with TB cases when chest radiograph and TST are not readily available¹⁰

household contact may lead to overdiagnosis of TB disease. Close contact with an infectious case of TB, particularly with an immediate household member, may lead to TB infection in young children, identified by a positive TST result. Therefore, a history of household contact and positive TST are in a causal pathway, and should not be weighted simultaneously in the TB scoring system.

TST has been widely used to identify persons infected with *M. tuberculosis*.⁷ The triad of known contact with an adult index case, positive TST, and suggestive signs on chest radiograph has been recommended by the International Standard for TB Care, but its accuracy is reduced in endemic areas. Since transmission in endemic areas is not restricted to the household, the diagnostic values of both documented household exposure and a positive TST are limited.⁸

The requirement of TST for diagnosing TB in children in Indonesia is also problematic, since the test is not readily available in most health centers, particularly in rural areas. With regard to contact investigation, as long as TST and CXR remain as mandatory tests for screening children with household contact, the program coverage and the use of isoniazid (INH) preventive therapy in resource-limited settings cannot be expected to improve.

The current WHO guideline advocates symptom-based screening in resource-limited settings (Figure 4). This approach applies to household contacts of smear-positive pulmonary TB cases, but screening should also be available for contacts of smear-negative pulmonary TB cases. This guideline recommends that clinical assessment alone is sufficient to decide whether the contact is well or asymptomatic. TST or CXR are not required in routine assessment of exposed contacts. Asymptomatic contacts do not require additional tests to exclude active TB. Further investigation and follow-up depend on national policy and practice. WHO recommends INH 10 mg/kg daily for 6 months for healthy contacts aged less than 5 years, and bimonthly follow-up until treatment is completed. If TB is suspected at the initial assessment or at subsequent follow-up, further investigation should be performed to establish or exclude the TB diagnosis. Referral to a district or tertiary hospital may be necessary when there are uncertainties about the diagnosis. Contacts with TB disease should be registered and treated according to TB guidelines.⁹

We also observed that almost 50% of children with TB household contact were latently infected, with only 10% having the disease. Similarly, previous TB contact studies reported the proportion of children with LTBI to be higher than that with TB disease. Among children aged less than 15 years, the proportion of LTBI ranged from 25% to 69%, whereas TB disease ranged from 1% to 10%.¹⁰⁻¹⁷ The discrepancy between the studies is due to different tuberculin solutions used for TST and different definitions of positive TST as an indicator of TB infection. Salazar-Vergara and colleagues in the Philippines in 2003 used the standardized, recommended dose of 0.1 ml of 2 TU of PPD RT 23 with Tween 80 (Statens Serum Institute, Copenhagen, Denmark). Using a low cutoff point for positive TST (more than 5 mm induration),

the LTBI proportion of as high as 69% may be an overestimation of the infection rate among contacts.¹⁵ In studies which defined TB infection as positive TST of ≥ 10 mm induration, the proportion of children with TB contact aged less than 5 years who were infected ranged from 7.8% to 33.8%.^{11,14,16,18-23} A meta-analysis by Morrison and colleagues revealed the pooled yield of TB disease among children aged less than 15 years in household TB contact in developing countries to be 7.0% (95% CI 6.0 to 8.0), whereas the proportion of LTBI was higher at 40.4% (95% CI 38.7 to 42.2%).²⁴ These results, however, are also subject to substantial heterogeneity.

In conclusion, contact investigation of TB in children is of great value, not only to identify infected or diseased children, but also for TB control in the community as a whole. However, using the Indonesian scoring system for this purpose leads to overdiagnosis. A symptom-based screening recommended by WHO provides a simple approach for contact investigation in children. Implementation of this approach may be warranted.

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