Original Article

Community Active Case Finding for Pulmonary Tuberculosis

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Background: The World Health Organization (WHO) has implemented a policy of active case findings for tuberculosis (TB) to achieve the End TB Strategy, a world free of TB, by 2035. However, early case detection in Thailand, a high TB-burden country, is not presently routinely applied.

Objective: To demonstrate a model for, and the feasibility of, active TB case detection in Thailand.

Materials and Methods: The present study was a cross-sectional study of a mobile-outreach survey conducted in Hua Hin District, Prachuap Khiri Khan Province. Adult Thai participants were assessed for TB risk factors, symptoms, and signs, and onsite chest X-rays (CXRs) were performed. Pulmonologists identified individuals with suspected active TB and referred them to hospital.

Results: The findings of 21 out of 858 participants (2.4%) were classified as highly suspicious of TB. Any one of a chronic cough, constitutional symptoms, a history of household TB contact, and an abnormality on a CXR raised the possibility of TB (odds ratio of 4.07, 4.60, 3.68, and 1.30 respectively). Anti-TB therapy was prescribed for seven individuals following hospital-based assessments (0.8% of the study population; two smear-positives and five smear-negatives). However, one quarter of the 21 screen-positive participants did not contact the local health authority for further evaluation to confirm the diagnosis.

Conclusion: The mobile-outreach TB screening, which utilized a questionnaire and CXR, proved to be practical. Including migrant employees in the screening program and enhancing public awareness may strengthen the program.

Keywords: Tuberculosis, Screening, Chest X-ray

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Tuberculosis (TB) remains one of the top 10 causes of death worldwide. In 2017, nearly ten million people were taken ill with TB, and over 1.3 million around the world died from it, predominantly in Southeast Asia and Africa[1]. The World Health Organization (WHO) realized that the substantial rise in the global TB burden should be managed strategically. Therefore, WHO has endorsed the "End TB Strategy" since 2014, with the goal of making the world TB-free by 2035[2].

The End TB Strategy has been promoted internationally. On the 2018 World TB Day, a campaign entitled "Wanted: Leaders for a TB-Free World" was launched in response to the WHO policy goal of achieving zero deaths, disease, and suffering due to TB[3]. Thailand has been identified by WHO as one of 30 high TB-burden countries[1]. More than 70,000 people were diagnosed with TB in Thailand in 2016[4]. The government subsequently established a national movement to resolve the TB situation in Thailand. Recently, three organizations-the Department of Disease Control of the Ministry of Public Health, the Ministry of Education, and the Faculty of Medicine of Siriraj Hospital-signed a Memorandum of Understanding to undertake the Academic Collaborative Project "Unite to End Tuberculosis". Its aim was to stop TB and multidrug-resistant TB, in accordance with the WHO roadmap and a National Action Plan[5].

One of the main WHO strategies to reduce the

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number of people suffering with TB is early case detection, which is based on the systematic screening of contacts and high-risk groups. This approach involves the use of one or two screening tests and a bacteriological diagnostic test. Chest radiography combined with screening questions are generally employed as a screening tool for clinical symptoms consistent with TB, such as a persistent cough, weight loss, or fever. Once individuals with a high likelihood of disease are identified, the diagnostic test (either sputum-smear microscopy or a rapid molecular test) is performed[6].

At its 2018 Annual Meeting, the Thoracic Society of Thailand agreed with the Division of Respiratory Disease and Tuberculosis, Department of Medicine, Siriraj Hospital, and Hua Hin Hospital to conduct the active TB-screening project, "ElimiNation of Drastic TB in Hua Hin to commemorate The great king Bhumibol (End-TB-TB)". It was decided that the project would be undertaken in Hua Hin District, Prachuap Khiri Khan Province. It aimed to develop a prototype for active case finding in Thailand and to commemorate King Bhumibol Adulyadej, who had supported the Anti-Tuberculosis Association of Thailand through His Royal Patronage from the time of its founding.

Objective

The main objective was to identify people having a high likelihood of active TB in a community-based population. The secondary objectives were to identify the clinical manifestations and radiological findings of the participants with positive screening tests, and to assure the performance of the screening algorithm employed to find active TB cases.

Materials and Methods

The present study was a cross-sectional survey conducted at two primary care units (one in a rural area, and the other in an urban area) and a private hospital in Hua Hin District, Prachuap Khiri Khan Province, on August 24 and 25, 2018. The present study was approved by the Human Research Protection Unit of the Siriraj Institutional Review Board (Si389/2018). Local healthcare staff invited eligible people in the target community (Thai citizens aged 18 years or more and living in Hua Hin District) to participate in a TB screening program. Excluded were pregnant women; and individuals receiving treatment for pulmonary or extrapulmonary TB, having regular medical check-ups, or having had a chest X-ray (CXR) in the preceding 12 months.

Except for the present study site at the private hospital, mobile clinics with an onsite X-ray service were established. Each participant was required to sign an informed consent form. The authors then administered a screening questionnaire on the symptoms and risk factors for TB, including chronic cough, fever, anorexia, weight loss, cigarette smoking, HIV, diabetes mellitus, and household contact with a TB sufferer in the preceding year. Volunteer pulmonologists performed relevant physical examinations and reviewed onsite, digital, and posteroanterior-view CXR on a one-by-one basis. Each pulmonologist gathered information and subsequently determined the likelihood of active TB. Those participants with results that were highly indicative of TB were referred to Hua Hin Hospital, a secondary care hospital in Prachuap Khiri Khan Province, to confirm their diagnoses via sputum-smear microscopy.

The present study was funded by the Thoracic Society of Thailand under Royal Patronage. Hua Hin Hospital provided further medical evaluations, which were covered by the Universal Health-Care Coverage Scheme.

The sample size in this community study was based on the facilities available at each site. Nine hundred ninety-nine participants to commemorate King Rama IX were enrolled in the initial survey conducted by the local health authorities.

The two-sample t-test was used to compare means. As to categorical variables, Fisher's exact test or the chi-square test was used to assess the associations between the positive screening tests and the variables. All tests with a p-value of less than 0.05 were considered statistically significant. PASW Statistics for Windows, version 18.0 (SPSS Inc., Chicago, IL, USA) was used for the analyses.

Results

Eight hundred fifty-eight out of the 887 participants completed the screening protocol and consisted of 494 from rural area, 315 from urban area, and 49 from private hospital. Of those, the majority were female (61.8%), and the average age was 52.5±14.4 years. Table 1 details the characteristics of the participants and their symptoms, risk factors, physical findings, and radiological abnormalities, all grouped by positive and negative screening results. The screen-positive participants were likely to be male; have a chronic cough, constitutional symptoms, or a history of household TB contact; have adventitious lung sounds; and have abnormal CXR.

Table 1. Characteristics of participants in the survey study

Characteristics	Total screening (n=858) n (%)	Screening result, n (%)		Odds ratio (95% CI)	p-value
		Positive (n=21)	Negative (n=837)		
Age (years), Mean±SD	52.5±14.4	56.1±10.2	52.4±14.5	-	0.127
Female	530 (61.8)	6 (28.6)	524 (62.6)	0.24 (0.09 to 0.62)	0.002*
Chronic cough	118 (13.8)	8 (38.1)	110 (13.1)	4.07 (1.65 to 10.04)	0.004*
Constitutional symptoms	73 (8.5)	6 (28.6)	67 (8.0)	4.60 (1.73 to 12.24)	0.006*
Smoking	165 (19.2)	5 (23.8)	160 (19.1)	1.32 (0.48 to 3.66)	0.577
HIV	2 (0.2)	0 (0.0)	2 (0.2)	-	1.000
Diabetes mellitus	159 (18.5)	5 (23.8)	154 (18.4)	1.39 (0.5 to 3.84)	0.568
Household TB contact	54 (6.3)	4 (19.0)	50 (6.0)	3.68 (1.19 to 11.33)	0.039*
Superficial lymphadenopathy	9 (1.0)	0 (0.0)	9 (1.1)	-	1.000
Oral candidiasis	8 (0.9)	0 (0.0)	8 (1.0)	-	1.000
Pruritic papular eruption	2 (0.2)	0 (0.0)	2 (0.2)	-	1.000
Adventitious lung sounds	7 (0.8)	2 (10.5)	5 (0.6)	18.87 (3.42 to 104.20)	0.010*
Abnormal CXR	90 (10.5)	21 (100)	69 (8.3)	1.30 (1.16 to 1.46)	<0.001*

HIV=human immunodeficiency virus; TB=tuberculosis; CXR=chest X-ray; SD=standard deviation; CI=confidence interval

* p<0.05 is statistically significant

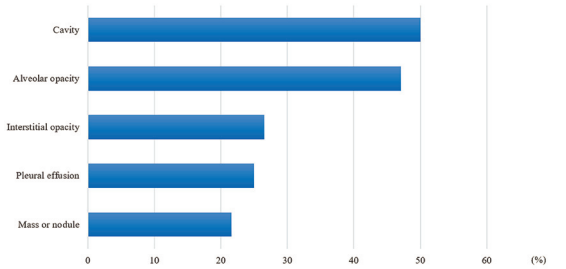

Figure 1. Percentage of positive screening in 21 cases, by radiological finding.

Ninety individuals had positive CXR findings, comprised of alveolar opacity (17), interstitial opacity (34), cavity (4), a mass or nodule (37), pleural effusion (4), and mediastinal lymphadenopathy (6). No miliary opacities were noted in the survey study.

Twenty-one participants were diagnosed with suspected active TB. A chronic cough was the most frequently reported symptom among these participants. All had at least one lesion on their CXRs; however, mediastinal lymphadenopathy was not found. Figure 1 illustrates the proportion of TB suspicious cases by radiological abnormality.

The community health workers at the mobile clinics issued referral forms for confirmatory evaluations to all individuals with positive TB-screening test results. However, only 16 out of the 21 cases (76.2%) subsequently went to Hua Hin Hospital to have a sputum examination. Anti-TB therapies were initiated for seven out of those 16 participants (43.8% of the positive group, or 0.8% of the study population), comprising two smear-positive and five smear-negative participants. One index case, which was based on an abnormal chest radiograph without any patient-reported symptoms, had completed pulmonary TB treatment several years earlier. The opacity seen in the patient's right middle lung zone was similar to the end-of-treatment CXR. Another four TB-suspicious cases had negative results in the sputum-smear microscopy. Since those patients were at high risk of developing active disease, close clinical follow-up appointments were scheduled. The remaining two cases received alternative diagnoses after reassessment at the hospital.

Discussion

Pulmonary TB remains one of the major health problems worldwide. The challenges to stopping TB are not only the need for innovative technology for laboratory testing and novel high-quality drugs, but also the early detection of active cases and their prompt referral to health care providers. In Thailand, patient-reported symptoms mostly initiate the screening process. A passive case finding pathway, such as is found in Thailand, often results in delayed diagnoses and increases the risk of TB transmission, especially in high TB-burden countries. The present

study demonstrated the patient characteristics of a high likelihood of active TB and the feasibility of a mobile-outreach screening algorithm to improve the provider-initiated strategy.

The present study showed that a chronic cough, constitutional symptoms, and a history of household TB contact raised the possibility of a positive screening test. However, any abnormality suggestive of active TB in chest radiography was more sensitive than symptom screening in the identification of individuals at high risk of TB disease. These results are consistent with the accuracies and yields of screening approaches previously published by WHO. A pooled sensitivity of 77% for any TB symptom was increased to 90% if there was also any radiological abnormality. Although a CXR appeared to be the most sensitive screening tool, the isolated presence of a chronic cough was more specific for active TB than a CXR clue alone, with pooled specificities of 95% versus 75%, respectively[6]. Symptom screening still plays a pivotal role in TB case-finding.

In remote areas, people seldom visit a hospital for mild symptoms such as a cough, low-grade fever, or loss of appetite. Both the under-recognition of symptoms and the difficulty accessing health care services lead to delayed diagnoses[6]. This has been the main barrier to conducting active screening, even at primary healthcare units. In the case of the present study, our local healthcare staff had to provide shuttle bus services to transport participants to the mobile clinics.

The healthcare policy for migrants was another matter of concern[6]. There were many migrant employees in the Hua Hin District. Those without legal protection rarely had health check-ups or TB screenings and were at particular risk of disease transmission. Unfortunately, the authors did not have sufficient resources to include this fringe group in the study population. In addition to case detection, a referral system is an essential step towards ensuring that high-risk individuals receive appropriate evaluation and care. Unfortunately, one quarter of the positive-screening participants in the present study did not seek further assessment in accordance with the advice of our healthcare staff. This may reflect the barriers to accessing appropriate facilities in our healthcare system.

The present study had two other limitations. Firstly, radiologists were not available to review the CXR that had been interpreted by the on-site pulmonologists. In addition, the authors could not follow up the clinical outcomes of all participants, especially the subsequent-TB incidence of the negative-screening group.

Conclusion

There was a high level of undetected TB cases in Hua Hin District. Employing screening questions and chest radiographs, the mobile outreach program proved to be a feasible measure to identify people at risk of active TB in both urban and rural settings. The two outstanding challenges are how to enhance people's awareness of the need to be evaluated for TB and how to engage migrant workers in an official screening program.

What is already known on this topic?

The patient-initiated pathway results in delayed diagnosis of TB. Screening questions combined with chest radiography are effective as a screening approach. Mobile clinics facilitate community surveys, especially in rural areas.

What this study adds?

This study confirms the usefulness of provider-initiated approaches for TB screening in Thailand via a mobile-outreach survey. Self-questionnaires are feasible and yield clues of TB suspicions. Awareness of the benefits of undergoing a TB evaluation needs to be promoted at all levels of society. How to integrate migrant workers and high-risk populations into a screening program is still challenging.

Conflicts of interest

The authors declare no conflict of interest.

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