

Improving Tuberculosis Detection: A Comprehensive Evaluation of Contact Investigation Implementation

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ABSTRACT

Background: Tuberculosis (TB) is the leading cause of death. Indonesia is currently ranked 2nd globally, and the incidence rate increases yearly. TB is highly contagious to risk groups, especially to those who live in one house. **Purpose.** This study aims to evaluate the implementation of tuberculosis contact investigation by health workers and health cadres in Samarinda City, Indonesia. **Methods:** This study was conducted with an exploratory qualitative design to explore the implementation of Active Case Finding through contact investigation in Samarinda. As research informants, there are five managers of the tuberculosis program of the Samarinda City Health Office and Public Health Center, four Health Cadres, and ten household contacts of tuberculosis patients. **Results:** The results of the in-depth interviews identified three domains, eight themes, and 22 sub-themes. We found several obstacles in investigating the TB patient case index contacts, including a lack of resources, low awareness of household contacts, and difficulty meeting targets. **Conclusion:** Lack of resources and use of conventional instruments indicate less effective coverage of contact investigations. Low awareness of household contact for screening is due to a lack of understanding of TB, shame as a family of TB sufferers, denying the existence of TB symptoms, and not wanting others to know about their health conditions.

Keywords: Tuberculosis Detection, Evaluation, Contact Investigation.

INTRODUCTION

Tuberculosis (TB) is the second leading cause of death after COVID-19, with 1.3 million people dying from TB in 2022¹. Indonesia ranks second in the world regarding the number of TB cases². The highest prevalence of TB patients in East Kalimantan province is in Samarinda City³. The Indonesian government is working on the End TB Strategy program initiated by WHO, which aims to reduce TB cases by 80% and TB deaths by 90% by 2030^{1,4}.

TB is caused by *Mycobacterium tuberculosis*^{5,6} transmitted from one person to another through the air^{7,8}, droplets released when people cough, sneeze, or talk can transmit 10 – 20 close contacts^{9,10}. TB transmission is more common in household contacts^{11,12} with index cases due to physical proximity, frequency of meetings, length of contact, and density of house occupancy¹³.

Contact investigation as an early detection strategy for tuberculosis to speed up diagnosis and treatment^{14,15}. Aims to find out TB transmission between household contacts and close contacts¹⁶⁻¹⁸. Contact investigation includes tracing and health checks to identify those who have been infected¹¹. This process helps with early detection and efforts to prevent the spread of the disease among household contacts and close contacts^{19,20} especially if the contact participation rate can be optimized^{21,22}.

Despite efforts to control tuberculosis, the incidence rate continues to increase^{23,24}. The increase in new TB cases is due to a lack of compliance of family members to prevent transmission among their contacts. A study in South Africa found that the

incidence rate of tuberculosis among household contacts was higher than that of the general population, and it increased over time²⁵. Other factors that cause an increase in new tuberculosis cases include limited constraints and the capacity of health resources, which can cause a decrease in the quality of health services²⁶. Limitations Access to healthcare²⁷ and inadequate health infrastructure lead to low health service coverage^{28,29}. Contact investigation screening often has a limited scope, especially in urban areas where at-risk populations can be dispersed and are more challenging to reach, impacting incomplete contact identification and reduced contact tracing effectiveness³⁰. This study aims to evaluate the implementation of tuberculosis contact investigation by health workers and health cadres in Samarinda City.

METHOD

The design of this study is qualitative exploratory, a research instrument in the form of structured interview guidelines about the implementation of TB contact investigations and their constraint factors. Data were collected through in-depth interviews with semi-structured interviews to explore information about the implementation of tuberculosis contact investigations. The research informants were the managers of the Tuberculosis Program of the Samarinda City Health Office and Public Health Center, as many as five people, Health Cadres of as many as four people, and household contacts of tuberculosis patients as many as ten people. The interview was conducted for 45-60 minutes using tools like stationery and voice recorders. Furthermore, the recorded data is transcribed into written form, and thematic analysis is carried out. This research has received ethical approval from the

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RESULT

This research was conducted from July to August 2023 in four Public health centers in Samarinda City. The analysis of this study found five themes, namely Constraints in Implementation through contact investigation, the flow of TB management is still oriented to health facilities and other supporting facilities, health education on the prevention of TB transmission has not been maximized, the ineffectiveness of contact investigation forms to reach household contacts and close contacts. Table 1 displays the number of interview participants, which consists of stakeholders from the Samarinda City Health Office, four public health centers, health centers, and household contacts of tuberculosis patients. Table 2 displays the theme of the interview results.

Theme 1: The investigation target has not been achieved

The achievement of the contact investigation target is lower than that set by the Indonesian Ministry of Health and the East Kalimantan Provincial Health Office. Although the contact investigation of tuberculosis index cases has been carried out according to the program, it has not received maximum results.

"..... the achievement of finding new TB cases in the city of Samarinda is 77% of the provincial target of 88%" (PTB 1).

"The case findings have not reached the target given by the City Health Office. The diagnosis procedure is running according to the flow or direction from the Provincial Health Office." (PTB 5).

Theme 2: Resource limitations

Health workers work more in the Public health center building because the number of patients in the Public health center is quite large, and they must get good service. With the limited number of health workers, the opportunity to conduct home visits for TB index cases is minimal. To get a contact investigation of 10 – 20 close contacts is difficult to achieve. Similarly, the number and capacity of trained health cadres are very limited in reaching their area; on the other hand, they have busyness and work.

"... contact investigation could not reach the target of 20 people per index case due to the limitation of health workers and more service hours at the public health center building" (PTB 1).

"The cadre community conducts health cadre training" (PTB 1).

"For those actively involved, only TB cadres have been trained by the TB cadre community, while Integrated healthcare center cadres have not been involved much." (PTB 5).

"The number of cadres is not enough to reach the work area. It is necessary to think about more effective means for case tracking" (PTB 2).

Table 1. Research Informant.

Informants	Total
Manager of the Tuberculosis Control Program of the Samarinda City Health Office (PTB 1)	1
Managers of the Tuberculosis Control Program of Public Health Centers (PTB2- PTB5)	4
Tuberculosis health cadres (C6- C9)	4
Household contacts of TB patients from four Public health centers (HC10- HC19)	10
Total	19

Table 2. Themes and sub-themes of in-depth interview results.

Domain	Theme	Sub-theme
Implementation of TB contact investigation	The investigation target has not been achieved	<ul style="list-style-type: none"> • The target area for one Public health center is too large • The percentage of contact investigations has not met the target set by the Provincial Health Office • The limited capacity of health cadres
	Resource limitations	<ul style="list-style-type: none"> • Community organizations initiated cadre training • The involvement of health cadres is not optimal in contact investigations; they only wait for health workers to arrive at integrated healthcare centers.
	Difficulty finding contacts	<ul style="list-style-type: none"> • The patient's contact is not in place • TB contact participation is low, and no investigation is wanted • TB contact spread
	Contact investigation instruments are still paper-based	<ul style="list-style-type: none"> • The TB screening currently uses paper sheets. • Contact investigation paper sheets are sometimes lost, forgotten to save, or damaged.
	TB management is more oriented to health facilities	<ul style="list-style-type: none"> • The policy has been structured, but its implementation has not been maximized • More TB treatment in Public health center buildings, self-practicing doctors, clinics, and Integrated healthcare centers
Health Promotion Activities	Lack of awareness in the prevention and follow-up of health check-ups	<ul style="list-style-type: none"> • Poor understanding of household contact about tuberculosis, prevention, early detection, and treatment • Household contacts do not understand what to do if there is a health problem and follow-up if they experience TB symptoms • Lack of preventive measures for TB transmission among household contacts
	Health Education targets are less relevant to risk groups	<ul style="list-style-type: none"> • Health promotion is mostly carried out in health facilities • Health promotion targets have not been maximized in TB risk groups • Health education is carried out during Integrated healthcare center activities or meeting forums with community leaders, community organizations, and health cadres, and general invitations • Posters are pasted in the waiting rooms of Public health center and Integrated healthcare center • Leaflets are distributed during health counseling
	Outcome	<ul style="list-style-type: none"> • People are used to using Android cell phones as social media • People want to screen independently with an application but it is not yet available,

Theme 3: Difficulty finding contacts

A challenging obstacle is meeting close contacts for various reasons, including close contacts not at home, in designated locations, where they work or other businesses, or even changing domicile. Some close contacts also stated that they did not want to be examined for fear of being detected as TB suspects, embarrassed to be said to be part of the TB family, and even angry that they did not want to be considered infected with TB. Here are some statements from informants about the difficulty of meeting close contacts in the same house.

"I find it very difficult to reach close contacts and household contacts because of the mobility of people who work, do business, or move houses" (PTB 3).

"Sometimes the address doesn't match, and the phone number is inactive" (C6).

"Some TB contacts do not want to be screened for fear of detection. Some are embarrassed or avoid thinking that none have any symptoms" (PTB 1).

"I was sometimes even treated unkindly by the family of my TB housemates. Some of them closed the door when I came, maybe feel embarrassed and did not want to be visited" (C7).

"I am tired of asking about their health condition because they always refuse to be checked" (C8).

"Many suspects and close contacts or housemates are reluctant to check themselves" (C9).

Theme 4: Contact investigation instruments are still paper-based

Contact investigation sheet for TB screening. This screening sheet is filled by health workers or trained health cadres, but its use is less effective because it is easily lost and damaged and tends to be late in reporting.

"contact investigation instruments in the form of a written format used are health workers." (PTB 2).

"In the form of a written fill format" (PTB 3).

"The instrument of finding new cases with contact investigation has not been effective in finding new cases of TB" (PTB 5).

"ACF with the contact investigation method is ineffective in getting the target" (PTB 1).

"Sometimes I forget to put the contact investigation sheet, or the paper is damaged" (C8).

"I report it the next day during the working hours of the Public Health Center if I am not busy" (C7).

Theme 5: TB management is more oriented in health facilities

The tuberculosis control program has various policies, but most are still management-oriented, as well as other supporting facilities such as the Integrated Healthcare Center, independent practice doctors, clinics, school health centers, and social networks. Early detection in risk groups has not been maximized

"TB screening is carried out by Public health center officers, practicing doctors, clinics, and cadres" (PTB4)

"I did screening on patients who came to the Public health center and follow-up examinations" (PTB3)

"Public health center officers conduct screening by filling out a paper checklist during visits to the Integrated Healthcare Center Elderly or screening activities in the community" (C5).

Theme 6: Lack of awareness in the prevention and follow-up of health check-ups

New cases of TB will continue to increase due to transmission that is difficult to control. Public awareness, especially for patients in risk groups, is not compliant in preventing transmission. Many of them throw phlegm in any place, do not wear masks, and do not cover their mouths and noses when coughing or sneezing. Some feel that they do not need to undergo follow-up examinations even though they have experienced TB-like symptoms.

"On average, the patients I asked said there are no special rules at home to prevent TB transmission." (PTB5).

"They spit in any place even though they are TB" (C7).

"I don't understand how to know if a person has TB." (HC13).

"I don't wear a mask at home, and it's uncomfortable" (HC14).

"It is better that the Health promotion menu is integrated with the application, and it would be better if it follows the user's condition because not all TB contacts are suspects, but most of them are at risk, so prevention and early detection are needed" (PTB1).

Theme 7: Health Education Targets Disproportionate to Risk Groups

The results of in-depth interviews found that health workers' health education to improve knowledge, attitudes, and measures to prevent TB transmission was less relevant to the target. Health Education focuses more on patients coming to the Public health center. Health education in the community is carried out during visits to the Integrated Healthcare Center or special community meetings, and those present are community leaders, community organizations, and health cadres, while risk groups are rarely present at conferences.

"Health education is provided for the community when there is a TB program coordination meeting, special counseling sessions, and Integrated Healthcare Center." (PTB5).

"We do education information and communication on patients and their families during visits to the Public Health Center" (PTB3).

"We conducted counseling about TB at meeting forums in the community, but it was not relevant because those who came were community leaders such as cadres, RTs, and religious leaders. Meanwhile, risk groups are reluctant to come and may feel embarrassed". (PTB4).

"Our health counseling media such as posters and leaflets have been pasted in the waiting room of the Public health center and distributed to visitors and at the Integrated Healthcare Center" (PTB5).

Theme 8: Self-screening desire with the app

The results of in-depth interviews with several informants revealed the desire for TB household contacts to be able to conduct self-screening with the application. They feel they are more flexible and used to Android cell phones because they can use them anytime. Resources are more efficient and effective in finding new cases if notification of tuberculosis suspects is forwarded to the nearest health care or Public health center. Coordinating the contact investigation team will allow faster follow-up on diagnostic examinations.

"People are already using Android phones, more suitable for Android-based applications." (PTB1).

"In my opinion, self-screening will be more effective so that it is diagnosed earlier." (PTB3).

"I am happy if the community that conducts self-screening is more efficient for cadres." (C6).

Sometimes household contacts are offended if asked about TB complaints". (C7).

"If there is an application specifically for families, we can immediately recommend installing the application when treating for the first time and immediately screening the family." (PTB5).

"In my opinion, the application development should be directed to the TB transmission risk group, which is connected to health cadres or health workers so that follow-up coordination is faster if health cadres or health workers pick up at the suspect's house" (PTB1).

DISCUSSION

Implementation of active case finding (ACF) discovery through contact investigation is an essential element of TB control strategies and Effective methods to control the spread of infectious diseases^{31,32}. With systematic and organized measures, this strategy helps detect and manage cases early and prevent further transmission in the community. ACF has proven to be very cost-effective for regions with a high prevalence of tuberculosis³³.

The National Strategy for Tuberculosis Control in Indonesia 2020-2024 has set a target of 90% of case findings by the end of 2024, and at the East Kalimantan provincial level of 88%, we found that the achievement of contact investigation was 77% lower than the target. A study in Vietnam stated that contact investigations and preventive measures were successfully implemented in these resource-constrained cities through systematically structured programs and resource capacity building³⁴. Research in Lusaka, Zambia, states that ACF carried out by health facilities is more effective than that done by the community. This is related to the better capacity of health workers, but the high workload causes the target to be less affordable than the maximum³⁵.

We found that limited health resources are one of the causes of the suboptimal implementation of tuberculosis contact investigations. The number of patients receiving treatment at the Public health center is significant and must be served, while activities outside the building for contact investigation have a large enough area not to reach all close contacts of TB patients. Health cadres have tried to help carry out early detection, but with the limited number of trained health cadres, it is ineffective in reaching all TB patient contacts. The training of health cadres is not explicitly provided by the Health Office but is initiated by community organizations that care about tuberculosis.

Health cadres are essential in strengthening health systems with limited health resources³⁶. Contact investigations are carried out jointly or by health workers and cadres and can also involve drug-swallowing supervisors (PMOs) from patient index data (index cases) at the public health center. The involvement of cadres in the TB control program is one of the efforts to empower the community³⁷. The community-based TB program is one of the most efficient activities for TB treatment³⁸. The discovery of new TB cases through contact tracing increased from 6% to 10% involving Health cadres, and referrals made by Health cadres rose from 4% to 8%. Health cadres can influence household contact screening and referral for TB identification³⁹.

One of the most challenging obstacles health workers and health cadres face is meeting contacts with TB patients. Although the address of the case index is precise, it is not easy to find people who have been in contact with the patient. Some obstacles are close contact, not being at home because they work, doing other business activities, and even moving domicile. Close contacts cannot be found at the designated location, and they cannot even be contacted with their mobile phone number. Some close contacts also stated that they did not want to be examined for fear of being detected as TB suspects, embarrassed to be said to be part of the TB family, and even angry that they did not want to be considered infected with TB.

A study in Kenya showed that a contact investigation funded by Global Fund reached 96.40% of households from 26,307 TB patients (index cases) and could find new instances of as much as 10%³⁹. Likewise, research in Kashmir, India, that applied a household-based intervention model for discovering active cases among household contacts of pulmonary TB cases index mentions that this method is effective for contact tracing⁴⁰. However, research in Vietnam illustrates that the obstacles to the implementation of contact investigations are due to low participation in household contacts, leading to non-compliance in participation in contact investigations. This is influenced by low knowledge about the risk of tuberculosis transmission attitudes and practices in disease detection and prevention⁴¹.

Contact investigation using conventional methods, namely screening carried out by health workers and trained health cadres using the contact investigation sheet form, is no longer effective. Screening sheets are at risk of being easily lost or forgetting to save documents, easily damaged, and tend to be late in reporting, especially since the screening requires meeting with household contacts. It is time to use various information technologies to reach close contacts of TB patients so that early detection of transmission is faster and more accurate reporting.

WHO provides recommendations on the screening principles contained in the Operational Handbook on Tuberculosis, which, among other things, should reach people most at risk of TB disease, including high-risk groups and communities with a high prevalence of TB⁴². The working mechanism of contact investigation has been regulated in the Technical Instructions for Contact Investigation of TB Patients for Health Workers and Health Cadres³⁷. The case index was obtained from patients who visited the public health center and were confirmed positive for TB. Health workers/cadres reconfirmed the contacts recorded for TB.16 K form and collected contact data at home for the index case of at least 20 contacts to be investigated³⁷. Furthermore, health cadres report to the Public health center.

A study in Ghana on the efficiency of symptom-based screening tools (Symptom-based screening tool) to detect Mycobacterium tuberculosis in the community is said to be quite effective but complicated and capital-intensive; therefore, it is necessary to consider a more efficient method⁴³. Research conducted in Myanmar states that the mobile application system based on the social and pathological characteristics of TB has the potential as a TB screening tool to identify missing TB cases and to reduce TB morbidity and mortality⁴⁴. Other research also mentions fashion applications, such as Universal Health Coverage (UHC), which has become an effective tool to increase the coverage of home visits⁴⁵.

The tuberculosis control program has various policies, but most are still management-oriented in Public health centers and other supporting facilities such as Integrated Healthcare Centers, self-practicing doctors, clinics, school health centers, and social networks. The results of self-screening indicating suspected tuberculosis were followed by TCM and X-rays to confirm the diagnosis. Treatment is scheduled immediately to make the healing rate more precise and fast. Contact investigation is carried out through activities with health cadres and health cadres during Integrated healthcare center activities, elderly Integrated healthcare center, or special meetings with the community. Meanwhile, home visits are not optimally carried out due to various factors, so contact investigation has not maximized the risk group.

The operational handbook on tuberculosis about Systematic Screening for Tuberculosis Disease mentions that TB screening is aimed at people who are at high risk of being exposed to or developing TB disease and screening them by assessing symptoms, using tests, examinations, or other procedures to identify those who may have TB, following up with diagnostic tests and additional clinical assessments to make a definitive diagnosis⁴². Discovery of cases among close contacts through home

visits or Contact Investigation. The discovery of active cases, especially among close contacts of TB patients, is considered a systematic, efficient, and effective strategy to track new TB cases, actively identify TB contacts, and screen for TB symptoms³⁷ in the risk group of tuberculosis transmission, especially people who are in close contact with tuberculosis patients such as those who live in the same house or often meet with TB patients^{34,46}.

One of the factors that continues to increase new TB cases is public awareness, especially among risk groups that do not comply with preventing transmission. This study found a phenomenon among many sufferers who throw phlegm anywhere, do not wear a mask, and do not cover their mouth and nose when coughing or sneezing. Some feel that they do not need to undergo follow-up examinations even though they have experienced TB-like symptoms.

A study on Public Awareness of Tuberculosis in Southeast China showed that rural communities with low education showed low levels of awareness about TB prevention⁴⁷. Before conducting a contact investigation, the field team should conduct an awareness session with family members of the index case and the community about disease prevention, symptoms, diagnosis, and treatment¹³. Knowledge and awareness of transmission prevention can be increased through health education interventions⁴⁸, including prevention measures such as good ventilation, wearing masks, and avoiding close contact with active TB patients⁴⁹. Raising awareness through health education is essential to combat TB⁵⁰ and strengthen household TB contact screening¹¹.

Health education, one of the health promotion efforts to increase knowledge, attitudes, and measures to prevent TB transmission, is less relevant to the transmission risk group target. Health education that is carried out only to patients who go to the Public health center and the general public does not increase knowledge and awareness of close contacts of TB index cases.

Health promotion activities need to be carried out to increase knowledge, attitudes, and behaviors in the prevention of tuberculosis transmission and tuberculosis management⁴. Therefore, strengthening capacity in education programs and health promotion campaigns is urgently needed⁵¹. Health education to risk groups will also increase screening awareness to prevent diagnosis delays⁵². In some studies, health education for risk groups can increase willingness and behavior to get TB prophylactic therapy⁵³.

It is time for Android-based self-screening to be implemented to facilitate access to information, screening, follow-up, and health education. We found that some informants expressed a desire for TB household contacts to be able to self-screen with the app. They feel that they are more flexible and used to Android cell phones because they can use them anytime. Resources are more efficient and effective in finding new cases if notification of tuberculosis suspects is forwarded to the nearest health care or Public health center. Coordinating the contact investigation team will allow faster follow-up on diagnostic examinations.

Android-based TB early detection applications can effectively improve TB identification and control in the community. With symptom reporting, contact tracing, education, and integration with health services, this application can help people detect TB early and get timely treatment. Some studies on using mobile phones increased the productivity of health cadres for data collection and reporting, while others used mobile technology for patient-to-provider communication, patient education, health care coordination, monitoring, and evaluation⁵⁴. Mobile apps are also beneficial for transferring knowledge, sharing information, and receiving training using user interfaces with features such as social media⁵⁵.

App development mobile health (mHealth) demonstrated the app's effectiveness against substantial compliance, and its integration with

healthcare improved the detection of active TB cases⁵⁶. The benefits for users are pretty good⁵⁷. Android-based apps can help identify TB cases more efficiently and accurately, especially in areas with limited health resources. They facilitate early detection by providing users with a simple symptom screening checklist and guiding them through collecting sputum samples for follow-up examination. Android-based apps can be designed to cater to the risk group of tuberculosis transmission with customized interfaces and features⁵⁸. Reduce the need for in-person consultations, save time and resources, and provide educational materials and health information to promote awareness and understanding of TB symptoms and prevention methods⁵⁹.

CONCLUSION

A contact investigation for implementing active case findings in Samarinda has not reached the maximum target for detecting tuberculosis transmission between household contacts and close contacts. Some of the constraints found were limited resources, difficulty in meeting contacts of the TB case index, contact investigation instruments that have not used the application, and low participation of TB contacts for screening. Low awareness of household contact is due to a lack of understanding of TB, shame as a family of TB sufferers, denying the existence of TB symptoms, and not wanting others to know about their health conditions. It is recommended that health education, especially for risk groups, is needed and that screening methods are changed by using applications independently.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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