Usage of Mobile X-Rays in Active Case-Finding for Tuberculosis

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Abstract

Indonesia has the world's second-highest number of tuberculosis cases. More than 300,000 cases of tuberculosis in Indonesia have not been diagnosed or recorded, which are known as the missing cases. Undiagnosed tuberculosis patients will cause the spread of tuberculosis bacteria to other people. Active case-finding of tuberculosis needs to be carried out to find more cases of tuberculosis in the community. Purwakarta is one of the districts with the highest incidence of tuberculosis in West Java province. Maranatha Christian University, in collaboration with the Purwakarta District Health Office, carried out active case-finding activities in the Plered subdistrict, which is the subdistrict with the highest tuberculosis cases in the Purwakarta district. Active case-finding activities were carried out at the 'balai desa' (village hall). The flow of active case-finding activities consists of registration, anamnesis, physical examination, sputum sampling, and chest x-ray examination using a mobile x-ray. Active case-finding activities in the Plered subistrict were attended by 364 patients. Chest x-ray examination was carried out on 231 patients, and 21 of them were diagnosed with tuberculosis. Active case-finding tuberculosis using a combination of; anamnesis, physical examination, sputum examination, and x-rays, can be applied to facilitate public access to health services and increase the rate of finding tuberculosis cases.

Keywords: *active case-finding, mobile x-rays, tuberculosis*

Usage of Mobile X-Rays in Active Case-Finding for Tuberculosis | Paskaria et al.

129

Introduction

Tuberculosis is a major health problem in Indonesia. Indonesia has the world's second-highest number of tuberculosis cases, after India. In 2022, it is anticipated that there will be 385 tuberculosis cases per 100,000 people in Indonesia, or around 1,060,000 cases in one year. The number of tuberculosis cases recorded and reported was only 724,309, implying that more than over 300,000 were missing cases of tuberculosis (World Health Organization, 2023).

Missing cases are tuberculosis patients who have not been diagnosed or reported. A tuberculosis patient who has not been diagnosed and is not receiving treatment will spread the bacteria that cause tuberculosis to those around him, particularly to those who have frequent contact with the patient, such as family members who live in the same house and coworkers. Tuberculosis patients who do not receive treatment will have worsening health problems and illness complications, increasing their likelihood of dying from tuberculosis (Kemenkes RI, 2016).

The End of TB Strategy outlines the global commitment to combating tuberculosis. This approach aims to reduce tuberculosis mortality by 90% by 2030 compared to 2015, new tuberculosis cases by 80% in 2023 compared to 2015, and no households incurring catastrophic disease costs in 2030. Indonesia is dedicated to eliminating tuberculosis by 2030 and ending the tuberculosis epidemic by 2050. By 2030, the number of new tuberculosis cases is predicted to drop to 65 per 100,000 people. One strategy for dealing with tuberculosis in Indonesia is to make it easier to find tuberculosis cases and treat them according to standards, thereby breaking the chain of tuberculosis transmission and preventing the occurrence of tuberculosis cases resistant to anti-tuberculosis drugs (Presiden RI, 2021; Kemenkes RI, 2020).

Tuberculosis is an infectious disease caused by *Mycobacterium tuberculosis*. This bacterium mostly targets the lungs, but it can also infect lymph nodes, bones, intestines, and the lining of the brain. When a tuberculosis patient coughs, sneezes, or talks, phlegm containing *Mycobacterium tuberculosis* bacteria is discharged, which can spread the disease to others. Tuberculosis patients who receive standard therapy are no longer able to spread the disease to others (Yuen et al., 2015).

Usage of Mobile X-Rays in Active Case-Finding for Tuberculosis | Paskaria et al.

130

Tuberculosis cases can be detected in both active and passive methods. Active case detection is carried out by tracing tuberculosis patient's contacts and screening in specific locations such as correctional facilities, workplaces, and dormitories. Passive case finding involves the use of government and private healthcare facilities to diagnose tuberculosis cases in patients seeking treatment (Kemenkes RI, 2016).

Purwakarta district is one of the districts in West Java with a high incidence of tuberculosis. In 2023, 5,657 cases of drug-sensitive and 44 cases of drug-resistant patients were diagnosed, with 1,877 cases of tuberculosis in children. To increase the detection of tuberculosis cases in the Purwakarta district, the team carried out active case-finding tuberculosis cases in collaboration with the Purwakarta District Health Office.

Methods

Maranatha Christian University, in collaboration with the Purwakarta District Health Office, carried out active case-finding activities in the Plered subdistrict, which is the subdistrict with the highest tuberculosis cases in Purwakarta district. The Health Service chose three villages in Plered District to be the locations for this activity, namely Citeko Kaler Village, Sindang Sari Village, and Cibogo Girang Village. These three villages were chosen because of the high incidence of tuberculosis in these villages. The three village heads have a good understanding of health and are able to collaborate with the Community Health Center, this supports the successful implementation of active case-finding activities. Active case-finding activities were carried out at the '*balai desa*' (village hall). The flow of active case-finding activities is as follows:

First Table: Registration

The medical staff seated at the First Table are familiar with the residents in the village as they are tuberculosis cadres. The name, age, address, and population registration number of the patient were noted by the officer. To ensure that the data is complete, patients were required to bring a photocopy of their family card. Information about patients suspected of having tuberculosis would be sent to the Ministry of Health of the Republic of Indonesia's tuberculosis information system. The First Table activities are displayed in Figure 1 below.

Fig. 1. Registration table

Second Table: anamnesis

The nurses of the Public Health Center stood by at the Second Table and were supported by students from Maranatha Christian University's medical doctor profession program. The patient was questioned by the officer about their medical history, contact history with other patients who have tuberculosis, and any symptoms or complaints they may be having. Responses from patients were recorded using a Google Form. Figure 2 below shows the activities held at the Second Table.

Fig. 2. Anamnesis

Third Table: physical examination

The officers at Third Table were Public Health Center's nurses, who were assisted by students from the medical professional program at the Faculty of Medicine, Maranatha Christian University. The officer carried out a physical examination of the patient, namely body temperature, blood pressure, examination of the lymph nodes in the neck, signs of anemia, examination of lung sounds, measurement of body weight and height to determine the patient's nutritional status. The activities at the Third Table can be seen in Figure 3 below.

Fig. 3. Physical examination

Fourth Table: confirm the results of the history and physical examination.

The officer at Fourth Table was a service lecturer from the Faculty of Medicine, Maranatha Christian University. The doctor re-checked the results of the patient's history and physical examination, then the doctor determined whether the patient needs further examination to confirm the case of tuberculosis or not. The activities at the Fourth Table can be seen in Figure 4 below.

Fifth Table: sputum sampling

The officer at the Fifth Table was a Public Health Center laboratory officer. Patients who were suspected of having tuberculosis based on the results of the history and physical examination were asked to expel their sputum and then be examined using a Rapid Molecular Test. The activities at the Fifth Table can be seen in Figure 5 below.

Usage of Mobile X-Rays in Active Case-Finding for Tuberculosis | Paskaria et al.

133

Fig. 4. Physical examination by doctor

Fig. 5. Sputum sampling

Sixth Table: chest x-ray examination

The officer at the Sixth Table was a mobile x-ray officer who collaborates with the service team. Patients suspected of having tuberculosis underwent a chest x-ray examination on a bus as shown in Figure 6 below.

Fig. 6. Mobile rontgen

Results and Discussions

Results

Active case-finding activities in three villages in Plered subdistrict were attended by 364 patients. An overview of patient characteristics can be seen in Table 1.

Table 1. Description of active case-finding patient characteristics in Plered district

Characteristics	Frequency	Percentage (%)
Sex		
- Male	127	35
- Female	237	65
Age		
- Younger than 5 y.o	63	17.3
- 5-12 y.o	60	16.5
- Older than 12 y.o	241	66.2
Residencies		
- Cibogo Girang Village	103	28.3
- Citeko Kaler Village	159	43.7
- Sindang Sari Village	102	28

Table 1 shows that the majority of patients who came to active case-finding activities were female and aged more than 12 years. Since active case finding arrangements run from morning till afternoon, most males were unable to participate since they are employed and in their working hours. In addition to requesting to be inspected, many women arrived with their toddler children. Thoracic x-ray facilities help diagnose tuberculosis cases in toddlers, because

Usage of Mobile X-Rays in Active Case-Finding for Tuberculosis | Paskaria et al.

135

toddlers cannot produce phlegm for Rapid Molecular examination. X-ray officers had difficulty carrying out examinations on toddler patients who are less than two years old. Most patients at this age feel afraid and cry when they are about to be examined, so an x-ray examination cannot be carried out.

The results of the chest x-ray were read by a radiology specialist after the active case-finding activities were completed. The results of the chest x-ray examination can be seen in Figure 7 below.
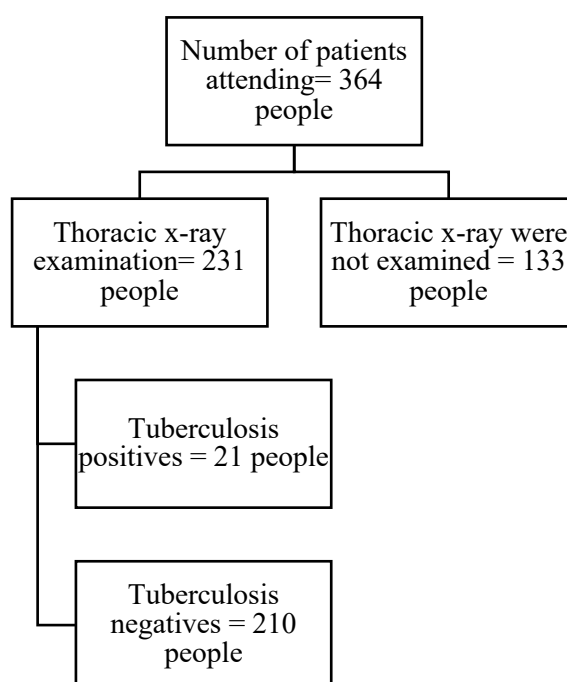
Fig. 7. Thorax x-ray's result

Discussions

Active case-finding can increase the detection of tuberculosis cases in the community. Some people have difficulties accessing health care facilities due to faraway locations and limited transportation options. Health professionals should be more proactive in detecting tuberculosis cases in the community by employing a pick-up strategy. Active case-finding necessitates the involvement of tuberculosis cadres, community, and religious leaders. Tuberculosis cadres are commoners who have been given training by health professionals at community health centers. Cadres assist activities in the detection and monitoring of treatment of tuberculosis cases in the community. In this activity, cadres collect data and invite people to come to the village hall to

Usage of Mobile X-Rays in Active Case-Finding for Tuberculosis | Paskaria et al.

136

take part in tuberculosis screening. The village head provides support by providing a place for activities and encouraging the community to take part in these activities.

The Directorate General of Disease Prevention and Control, Ministry of Health of the Republic of Indonesia, issued government regulation number HK.02.02/III.1/936/2021 concerning changes to the flow of diagnosis and treatment of tuberculosis in Indonesia. All patients who have typical symptoms of tuberculosis (suspected tuberculosis) are required to undergo a sputum examination using a Rapid Molecular Test tool. This tool can detect the presence of *Mycobacterium tuberculosis* and can determine whether the bacteria are still sensitive or resistant to one of the anti-tuberculosis drugs, namely Rifampicin (Sahiratmadja et al., 2020; Susilawati et al., 2018). Rapid Molecular Test tools have high sensitivity for diagnosing tuberculosis cases, but there are several obstacles in this examination that occur in the field. Patients suspected of having tuberculosis are often unable to produce a sputum sample properly, because what they examined is saliva, not phlegm (sputum). Not all health care facilities have Rapid Molecular Test equipment, so patient sputum samples need to be referred to other health care facilities. Pediatric patients have difficulty expelling phlegm so Rapid Molecular examinations cannot be carried out. Pediatric tuberculosis confirmed by growth of Mycobacterium tuberculosis at best in 40% cases, so the World Health Organization has assigned high priority to the development of non-sputum diagnostic tools for tuberculosis (Gjøen et al., 2017).

The majority of pulmonary tuberculosis patients are patients with negative smear examination results (30-60%) (Campos et al., 2016). Since pulmonary tuberculosis affects the lung parenchyma, bacteria cannot be found in a patient's sputum if the tuberculosis-affected lung parenchyma is located distant from the major airways. The Rapid Molecular Test examination has a sensitivity of 89% and a specificity of 97%. Even though Rapid Molecular Test is the gold standard examination for diagnosing tuberculosis, inadequate sputum samples can reduce the sensitivity of Rapid Molecular Test to less than 70%, resulting in false negatives (Jafari et al., 2018).

Research in Uganda shows that chest x-rays are a good tuberculosis screening tool and can increase the number of tuberculosis cases detected in the community. Chest x-rays have a sensitivity of 93% and a specificity of 97% in detecting tuberculosis cases (Nalunjogi et al., 2021). Chest x-ray is an examination recommended by the World Health Organization because

of its high sensitivity, can be used in the general public, and is relatively cheap (Catanzano, 2020).

The limitation of this activity evaluation is that the service team did not track the follow-up of patients diagnosed with tuberculosis, this takes approximately 6 months. An implementation research in Lima, Peru found that the major implementation barriers of community-based tuberculosis active case-finding when patients diagnosed with tuberculosis went to initiate treatment. The local physicians were rejected tuberculosis patients who are diagnosed clinically using x-rays, because Rapid Molecular Test was viewed as a 'gold standard' with perfect sensitivity. Similar challenges were observed in India (Newtonraj et al., 2019; Yuen et al., 2021).

Conclusion

Active case-finding for tuberculosis cases needs to continue to be carried out in collaboration with various parties or stakeholders, namely health workers, tuberculosis cadres, community leaders and religious leaders. Tuberculosis case finding needs to be carried out using a combination of; anamnesis of symptoms and history of the patient's illness, physical examination, and use of TCM supporting examination facilities and x-rays. The use of mobile x-rays is an innovation that can be applied to facilitate public access to health services and increase the rate of finding tuberculosis cases. The implementation of continuous active case finding for tuberculosis, followed by adequate and standard treatment can support the achievement of eliminating tuberculosis by 2030.

Acknowledgements

Usage of Mobile X-Rays in Active Case-Finding for Tuberculosis | Paskaria et al.

138

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