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Quantitative Research Article

Determining The Appropriate Screening Method As A Basis For Policy Making On Tuberculosis Control In Hospitals

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Abstract

Background: In order to ascertain the maximum validity of the screening test for invention of TB case, it is important to assess the screening value in order to observe the effectiveness of the screening method for invention undetection sufferer

Objective: Finding the best TB screening technique for the family of a medical patient at Bahtera Mas Hospital was the aim of this study

Design and Methodology: The purpose of this comparative descriptive study was to evaluate the efficacy of sputum and rontgen inspection (thoraks) for diagnostic maintenance of TB lungs. The population consisted of the relatives of all TB patients with lungs who had treatment or endured it, up to 28 respondents.

Results: Sensitivity and specificity values from sputum microscopy inspection were found to be between 0% and 100%. The rontgen photo thoraks inspection yielded sensitivity and specificity values of 22% and 68%, respectively. The results showed that rontgen photo thoraks examination was more successful than sputum microscopy inspection

Conclusion and Implications: The skill and quality of health workers, particularly those in laboratories, must be continuously improved in order to detect TB cases and complete the tuberculosis disease treatment program with the best possible outcome.

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Introduction

Tuberculosis remains one of the most prevalent diseases worldwide, with an estimated 10.6 million cases and 1.3 million deaths by 2022, according to the World Health Organization (WHO). Despite efforts to combat it, TB remains a major health problem worldwide, especially in middle- and low-income countries, such as Indonesia. Treatment resistance (MDR-TB) can worsen the situation, with around 410,000 cases unresponsive to first-line treatment. Other topics include diagnostic limitations, the effectiveness of early detection, and the risk of transmission in health facilities, such as hospitals. Without effective screening strategies, the TB response will be hampered, potentially increasing the chain of transmission and increasing health-related economic growth (WHO, 2020).

Controlling tuberculosis (TB) requires an accurate and timely diagnosis, but hospitals continue to struggle to set up the best diagnostics. One of the main issues with diagnostic techniques is their inconsistent

sensitivity and specificity. For instance, the sensitivity of microscopic sputum examination (BTA) is approximately 50–60% in patients with pulmonary tuberculosis, and it is significantly lower in minors or patients with HIV (Yayan et al., 2024). Even though they are more accurate (around 90% sensitivity for pulmonary TB), newer technologies like GeneXpert MTB/RIF are not yet equally available in all hospitals, particularly in places with limited resources. An further issue is the delay in diagnosis brought on by the lengthy wait for culture findings (2–8 weeks) or the lack of quick molecular diagnostics. This could lead to an increase in nosocomial transmission, particularly in intensive care unit and inpatient settings. Furthermore, incorrect interpretation of test results such as false positives in BTA or false negatives in immunocompromised patients often results in overdiagnosis or underdiagnosis (Aslan, 2024).

Finding TB lesions can now be done practically using a chest radiographic examination. Although this test is more expensive than a sputum test, it can be useful in some situations, such as miliary and pediatric tuberculosis. While a sputum examination is nearly always negative, a radiographic examination of the chest can provide the diagnosis in both situations (World Health Organization (WHO), 2022). It is stated that tuberculosis is the greatest imitator since its radiological image frequently presents an odd image. Many times, infiltrations and tuberculomas are mistaken for bronchial cancer, metastatic carcinoma, pneumonia, or pulmonary mycosis. Increased morbidity, mortality, and the possibility of medication resistance as a result of improper care are the effects of this issue. To speed up TB identification, particularly in susceptible populations including children, HIV patients, and extrapulmonary TB cases, integrated diagnostic approaches, frequent training for healthcare professionals, and improved laboratory networks are therefore required (World Health Organization, 2015).

In order to identify the most reliable screening technique for TB case discovery, it is necessary to measure the utility of screening in order to assess how well screening techniques identify patients who have not been identified. In order to minimize a rise in TB morbidity and death rates, it is believed that accurate early case detection through suitable screening technologies can lower the number of TB cases over time. Treatment can therefore be initiated right away. In tackling TB, the right policy is needed, starting from screening patients. Therefore, data and research are needed to prove the best screening method in order to make the right policy. Based on this description, the researcher is interested in taking the title Determination of the appropriate screening method in preventing an increase in TB morbidity and mortality rates as a basis for policy making to overcome TB.

Methods

Research type, population, and sample

This study uses secondary data from diagnostic tests and is comparative descriptive in nature. Families of all pulmonary tuberculosis patients who were admitted to or had previously been admitted to Bahtera Mas Hospital in Southeast Sulawesi Province made up the study's population. where 28 inpatients were admitted during the third quarter. Patients with pulmonary TB symptoms who were admitted to or had

previously been admitted to the General Hospital of Southeast Sulawesi Province comprised the study's sample. 28 respondents made up the study's sample, which was determined by the hospital's average monthly inpatient volume. Purposive sampling was used to select the sample for this study, which requires that the sample have signs of tuberculosis and be one of the family members who interacts with the patient the most.

Data Collection and Analysis

Medical records, laboratory, radiology, and internal medicine poly at Bahtera Mas Hospital in Southeast Sulawesi Province, as well as relevant organizations in this case, the Southeast Sulawesi Provincial Health Office and publications pertaining to this study were examined in order to gather secondary data.

By examining the frequency distribution, descriptive analysis was used to determine the traits of the respondents who served as samples and variables in the research. The methodology used to examine the comparison of the independent variables under investigation is known as bivariate analysis. Sensitivity and specificity are the two ratios utilized in this diagnostic test to gauge a diagnostic method's effectiveness.

Results

Respondent Characteristics

Table 1 displays the characteristics of the respondents who were the subject of the study. The study's age group characteristics showed that respondents between the ages of 15 and 25 had the highest percentage of respondents who performed sputum examination (microscopy) and X-rays (radiology), with 13 respondents (46.4%), while respondents between the ages of 36 and 45 and 56 had the lowest percentage, with only 1 respondent (3.6%). Sputum examination and X-rays were most frequently performed by respondents with incomes between Rp 500,000 and Rp 1,000,000 (11 respondents, or 39.3%), and least frequently by respondents with incomes between Rp 1,000,000 and Rp 2,000,000 (one respondent, or 3.6%).

Seven (25.0%) and eight (28.6%) of the 28 respondents who performed X-rays (radiology) and sputum examinations (microscopy) were self-employed. and additional occupations like motorbike taxi drivers, traders, etc., as 13 respondents (46.4%) said. Among respondents who performed sputum examination (microscopy) and X-rays (radiology), those who completed college had the highest level of education (3 respondents, 10.7%), while those who did not fall into any school category had the lowest level of education (3 respondents, 3.6%).

Tabel 1. Distribution of Characteristic respondents)

Characterstic	Frequency (n)	Percentage (%)
Age groups		
15-25 years	13	46.4
26-35 years	10	35.7
36-45 years	1	3.6
46-55 years	3	10.7
➢ 56 years	1	3.6
Family Income		
< Rp.500.000	8	28.6
Rp 500.000 – Rp 1.000.000	11	39.3
Rp 1.000.000 – Rp	1	3.6
2.000.000	8	28.6
None		
Ocuupation		
None	8	28.6
Self-employed	7	25.0
others	13	46.4
Education		
None	1	3.6
Primary	3	10.7
Secondary	5	17.9
High School	16	57.1
College	3	10.7

Clinical Diagnostic

In this study, a symptom or suspect is defined as an individual who exhibits clinical indications of pulmonary tuberculosis disease, such as persistent coughing up phlegm for at least two weeks. If a respondent coughs up phlegm for two weeks or longer, they are considered suspects; if they do not cough up phlegm for two weeks or longer, they are considered non-suspects. More respondents had no symptoms than those who did, according to table 2 of the symptom/suspect disease variables from the families of the patients analyzed. Examining specimen samples taken from sputum, pleural fluid, or throat smears is known as sputum examination. If BTA germs can be detected in the sputum specimen, the respondent is considered BTA positive; if not, the respondent is considered BTA negative.

Tabel 2. Distribution of respondents according to the results of sputum examination (microscopic) with symptom s of disease (suspected)

Scrining	Symtomps				Frequency (n)	Percentage (%)
	Suspect		None			
	n	%	n	%		
Sputum						
Positive	–	–	–	–	–	–
Negative	9	32.1	19	67.9	28	100
Thoraks						
TB Active	2	7.1	4	14.3	6	21.4
TB non active	7	25.0	15	53.6	22	78.6

Sensitivity specifity of Sputum

$$\text{Sensitifitas} = \frac{(0)}{(0) + (9)} 100 = 0$$

$$\text{Spesifisitas} = \frac{(19)}{(0) + (19)} 100 = 100$$

Sensitivity specifity of Rontgen

$$\text{Sensitifitas} = \frac{(2)}{(2) + (7)} 100 = 22\%$$

$$\text{Spesifisitas} = \frac{(15)}{(4) + (15)} 100 = 68\%$$

All of the respondents received negative results from the microscopic inspection of the patient's family's sputum. The examination known as "observation of thoracic X-rays" (radiology) involves examining the findings of chest X-rays (thorax). More respondents displayed symptoms of dormant TB than those with active TB, according to the findings of the observation of thoracic X-rays (radiology) from the families of the patients analyzed. According to Table 3's analysis of the microscopic sputum examination findings with suspected pulmonary tuberculosis symptoms in the patient's family, all responders had negative results, and the majority did not exhibit any suspected pulmonary tuberculosis symptoms. More responders were not suspected of having pulmonary tuberculosis, even though the analysis of the observation of thoracic X-rays (radiology) with symptoms of the disease (suspected) of the patient's family revealed X-rays displaying indicators of dormant TB.

Discussion

Although all of the respondents in this study had negative results from the sputum examination, several of them continued to exhibit clinical symptoms that could be indicative of pulmonary tuberculosis. This situation suggests the existence of false negatives, in which the patient's coughing up phlegm is not accompanied by any bacteriological results. Numerous variables could contribute to this phenomena, including low bacterial load (particularly in patients with impaired immune systems or in the early stages of infection), poor sputum sample quality, or insufficient microscopic sensitivity that only detects 50– 60% of pulmonary TB cases (Murwaningrum et al., 2017). However, the majority of asymptomatic respondents who had negative findings may be classified as true negatives, indicating that their cough symptoms were not brought on by an infection with Mycobacterium TB.

Clinically, these results support the notion that microscopic examination alone is insufficient for diagnosing tuberculosis, particularly in individuals who have severe symptoms but provide negative results. To lower the chance of misdiagnosis, WHO advises using radiological scans or molecular diagnostics (such GeneXpert)(World Health Organization (WHO), 2022). Furthermore, when making a differential diagnosis, non-infectious causes such chronic bronchitis, COPD, or other airway infections must be taken into account. This study emphasizes the value of a thorough diagnostic method that combines clinical evaluation, sophisticated laboratory testing, and routine monitoring to guarantee diagnosis accuracy and prevent incorrect treatment.

The likelihood of false positive results is one of the special features of sputum microscopic examination for the diagnosis of pulmonary tuberculosis. Because the process necessitates a sputum sample from the patient, this method virtually never results in false positives, in contrast to other diagnostic tests. This mechanism functions as a natural filter with not coughing productively or is not producing any sputum, they cannot test positive for TB using sputum microscopy(Ockhuisen et al., 2024). With a specificity score of 100%, the diagnostic test analysis results in this study demonstrated features in line with the fundamentals of sputum inspection(Castro et al., 2015). Nevertheless, a sensitivity of 0% was discovered, suggesting a significant drawback of this approach. This result is consistent with the medical literature, which claims that sputum microscopy can only identify TB cases under specific circumstances. The study's primary drawback is its limited sample size, which could limit how far the results can be applied. However, conceptually, these findings confirm the knowledge that, despite its high specificity, sputum microscopy is insufficient as a diagnostic tool when used alone without additional supporting examination modalities.

The findings of diagnostic tests indicate that sputum microscopic examination has a contrasting image in terms of its detection capabilities, with a sensitivity of 0% and a specificity of 100%. When the test is positive, this complete specificity means that the patient is unquestionably TB-infected. Zero sensitivity, however, validates the method's primary flaw, which is its incapacity to identify actual positive situations.This problem happens because a relatively high number of bacteria roughly 10,000 to 100,000

bacilli per milliliter of sputum are needed for the direct smear method of conventional microscopic analysis to be considered positive. Many TB patients, particularly those who are in the early stages or have immunocompromised conditions, frequently have a germ load below this detection threshold in routine clinical practice, which leads to false negative results(Susilawati & Larasati, 2019).

This screening method is still commonly utilized in many healthcare facilities since it offers a number of benefits, including a rather quick process and low cost(Ockhuisen et al., 2024). Its reliance on operator skill and sample quality, however, is a significant drawback. Results are frequently erroneous because of inadequate sampling methods or differences in how laboratory staff interpret the data. The clinical consequences of these discoveries are significant. Sputum microscopy results should not be the only foundation for diagnosis by clinicians or other health professionals, particularly when dealing with patients who exhibit severe symptoms that raise a high suspicion of tuberculosis. To confirm the diagnosis, these patients need to be evaluated further using additional supportive tests such radiological examinations or GeneXpert molecular assays (Sumual et al., 2017).

Some significant conclusions about the use of x-rays in the diagnosis of tuberculosis were drawn from the results of the thoracic radiological examination in this study. 78.6% of responders had no indications of disease activity, whereas 21.4% had radiological characteristics compatible with active TB. This implies that although thoracic radiology is a valuable diagnostic technique, there are still some restrictions on its capacity to identify active tuberculosis. Subsequent examination of the diagnostic test revealed a 68% specificity and 22% sensitivity (Jimmy et al., 2022). Less than 25% of real active TB cases can be detected by the test, according to the poor sensitivity score (WHO, 2016). This might be caused by a number of things, such as an early stage of the disease, unusual lesion features, or difficulties interpreting radiological images. However, the 68% specificity suggests that thoracic radiography can effectively rule out the diagnosis of tuberculosis in people who are not afflicted (Sorsa, 2020).

This result supports the body of research suggesting that radiographic examination alone should not be the only method used to diagnose tuberculosis. On x-rays, certain illnesses like pneumonia, pulmonary fibrosis, or even artifacts from the examination process can appear to be TB. On the other hand, certain types of tuberculosis, particularly in people with impaired immune systems, may exhibit unusual symptoms that are challenging to detect using standard radiography. The significance of a thorough diagnostic strategy is the clinical meaning of these findings. Although thoracic radiography is still a useful first screening method, its findings should always be compared to patient risk factors, clinical findings, and microbiological investigation. Other supporting tests, like molecular tests or thoracic CT scans, should be taken into consideration to confirm the diagnosis in instances with high clinical suspicion but unsupporting radiological results (Campbell et al., 2022).

There is a difference between the results of sputum examination and X-ray observations, as evidenced by the diagnostic test results, which show that the sensitivity of sputum examination is 0% while that of thoracic photos is 22%. All respondents gave negative results from sputum examination, but X-ray examination revealed that some respondents had signs of active TB symptoms. The suspicion of early pulmonary TB disease can be reinforced by radiological characteristics. Clinical symptoms typically follow radiological abnormalities of the lung caused by the TB process (Central Tuberculosis Division India, 2016). However, because many other lung diseases have characteristics similar to those of tuberculosis, a conclusive diagnosis of pulmonary tuberculosis cannot be made solely based on radiographic evidence. In order to diagnose pulmonary tuberculosis disease in all 28 respondents who were sampled for this study, microscopic examination (sputum examination) and radiographic examination (thoracic X-ray) were performed. To ascertain the sensitivity and specificity values of each tuberculosis examination method, a diagnostic test was conducted based on the examination results (Murwaningrum et al., 2017).

The necessity of providing radiologists and general practitioners with ongoing training to enhance the caliber of radiological interpretation is also highlighted by this study. The accuracy of TB diagnosis by radiological examination can be increased with the use of a standardized scoring system and comprehensive evaluation of clinical variables (Susilawati & Larasati, 2019). Therefore, even with its drawbacks, thoracic radiology is still a crucial part of the pulmonary tuberculosis diagnostic algorithm and need to be applied sparingly and in conjunction with clinical evaluation.

Because sputum testing and thoracic radiology have fundamentally different properties, they have varying sensitivity when it comes to diagnosing pulmonary tuberculosis. Because it takes between 10,000 and 100,000 bacilli per milliliter of sputum to provide a positive result, the direct smear method of sputum testing has limited sensitivity and frequently misses patients with a low germ load or in the early stages of infection. Bacilli (BTA) in sputum continue to be the gold standard of diagnosis because, unlike radiography, which is merely suggestive, it offers precise microbiological confirmation (Aslan, 2024). As a result, the two procedures work in tandem: radiography aids in early screening and complication assessment, whereas sputum analysis (particularly using molecular techniques).

Statistically, sputum microscopy and thoracic radiology, two screening techniques for the diagnosis of pulmonary tuberculosis, demonstrated greater specificity values than sensitivity, making them appropriate for usage in Southeast Sulawesi Province, which has a low prevalence of TB (13.72%). Even in individuals with symptoms, sputum microscopic examination cannot detect positive cases because of its 0% sensitivity, which makes it useless as a screening method even though it has 100% specificity. However, even though the radiological image is not specific for tuberculosis, thoracic radiography is better at identifying lung abnormalities early on, with a sensitivity of 22% and a specificity of 68%. High specificity techniques are given priority in low incidence settings like Southeast Sulawesi in order to prevent

Over diagnosis, while ideally a combination of the two tests.

Research findings and reliable data should serve as the foundation for any policies that are implemented in a medical facility. The findings of this study provide a solid foundation for hospital policymakers as they decide how to screen for tuberculosis patients. According to the study's findings, radiological analysis of thoracic X-rays is the most effective technique available. Diagnostic service quality remains a problem. Due to the BLK's limited ability to supervise and provide rapid feedback, many laboratories have yet to implement the cross-check on a regular basis, which limits the external quality assurance system. As Southeast Sulawesi's community referral hospital, Bahteramas Hospital has to improve

The ability and quality of health workers, particularly laboratory personnel, to detect TB cases must be improved in order to maximize the success of the TB disease control program. This is because the best screening approach for TB prevention is radiological evaluation of thoracic X-rays. A program to standardize laboratory personnel competencies or health analyst competency standards is necessary to improve laboratory staff. Competency standards are declarations that specify the knowledge and abilities that must be applied when working in compliance with industry (workplace) standards.

Conclusions

The sensitivity and specificity of the sputum microscopic examination results in this study are 0% and 100%, respectively, and the sensitivity and specificity of the radiological examination of thoracic X-rays are 22% and 68%, respectively, according to the findings of previous research. The study's findings indicated that radiological analysis of thoracic X-rays was superior to microscopic analysis of sputum. Standardizing the proficiency of health analyzers is one way that Bahteramas Hospital may increase the caliber of its laboratory staff.

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