

RISK FACTORS AND DIAGNOSIS OF PULMONARY TUBERCULOSIS

Darmini¹, Widya Hary Cahyati^{2*}

¹ Poltekkes Kemenkes Semarang, Indonesia

² Department of Public Health Science, Semarang State University, Indonesia

*Corresponding Author: widyahary27@mail.unnes.ac.id

Abstract. Tuberculosis (TB) is a direct infectious disease caused by TB germs, namely mycobacterium tuberculosis (MTB). Although caused by the bacterium *Mycobacterium tuberculosis*, the risk factors underlying the development of TB are complex and multifactorial. The diagnosis of TB needs a supporting examination for the next treatment process. The purpose of this study was to discuss the risk factors for tuberculosis, namely biological factors, behavioral factors, and TB diagnosis. This type of research is a literature review taken from various references in journal articles. This literature review was compiled using sources obtained through journal databases such as Google Scholar, Proquest, Scindirect, and several other references using the keywords risk factors, diagnosis, and pulmonary tuberculosis. From the search results it is known that risk factors are variables associated with an increased risk of a particular disease or infection. Based on the results of a review of articles on tuberculosis risk factors including biological risk factors, namely a weak immune system, including lack of nutrients, changing conditions such as HIV/AIDS, cancer, hypertension, use of immunosuppressive drugs, Covid-19 and long duration of diabetes mellitus (DM). Behavioral risk factors are genetic factors and exogenous factors, namely gender, older age, place of residence, use of illegal drugs, alcoholism, smoking, lifestyle, obesity, distance from home to TB diagnostic facilities, poverty level, population density, domicile in rural areas, suboptimal adherence to medication, alcohol consumption, incarceration, hospital admissions, poor pill-taking behavior, low levels of educational attainment, and missed clinic appointments were reported among treatment-aborted and drug-resistant patients. Diagnosis of tuberculosis based on TB symptoms includes smear microscopy, additional tests such as Xpert/RIF, and urine tests (lipoarabinomannan (LAM), NF- α and VEGF, IGRA (an immunological method which includes T-SPOT and QuantiFERON-TB), chest X-ray and chest CT scan.

Keywords: [Pulmonary tuberculosis, risk factors, diagnosis]

INTRODUCTION

Tuberculosis (TB) is a direct infectious disease caused by TB germs, namely *Mycobacterium tuberculosis* (MTB) (Bui et al., 2018). Most TB germs attack the lungs, but can also affect other organs. Indonesia is a country that is included in the top 3 of 32 countries in the world with a large TB burden, with an estimated 824,000 new TB cases each year. Inadequate TB management and ineffective activities to ensure TB patients can complete treatment will have an impact on increasing cases of Drug Resistant TB (RO TB) (Shanmuganathan & Subramaniam, 2015).

Every year WHO estimates that 24,000 new cases of RO-TB appear in Indonesia. Supporting examinations for tuberculosis referrals are if the initial diagnosis uses a microscopic examination of Acid-resistant Bacteria (AFB), a referral is made for TCM examination to determine resistance to Rifampicin. Referrals are made according to the flow set by the local Health Office. If the results of the bacteriological examination are negative, a radiological examination can be referred to an advanced referral facility for the enforcement of clinically diagnosed adult pulmonary TB (Sadikin Budi G, 2022). Based on the Global TB Report 2022, the incidence of tuberculosis is also the highest, with 4.8 out of 10.6 million (45%) global incidents. The highest number of tuberculosis death is 0.76 out of 1.38 million (5%) of global deaths. While treatment coverage is only 62%.

Tuberculosis can be caused by a family history of being infected with TB. If one family member is exposed to TB disease, other family members will likely be infected. TB transmission within the family occurs due to frequent direct contact with TB sufferers who live in the same house. In addition, the behavioral factors of TB sufferers can influence the occurrence of TB incidents. The behavior of TB sufferers who often throw sputum carelessly can cause people around them to be infected because TB bacteria are present in the patient's sputum. TB sufferers who do not apply cough etiquette and PHBS at their place of residence can provide opportunities for TB bacteria to easily infect other people. Another factor that can cause a person to be exposed to TB disease is smoking behavior. If someone has a smoking habit then that person is more susceptible to contracting TB bacteria. The condition of the home environment can be another factor in the incidence of TB. Houses that do not have good lighting and lack of sunlight are factors that can make TB bacteria survive in the home environment so the incidence

of TB increases. In addition, even a house that does not have adequate windows can make TB bacteria last longer in the house. This factor in the environmental conditions of the house can be even more dangerous if you are in shabby and densely populated housing. This occupancy density factor can increase the incidence of TB because the denser the occupancy, the greater the person's indirect contact with sufferer B in the area where they live(Paneo & Nursasi, 2019).

Some people also still think that coughing for months is an ordinary cough. Even if you look closely, coughing for a long time is one of the symptoms of tuberculosis. In general, people will only have their disease checked when it is severe, there is a lack of adequate facilities and limited expert doctors so the lack of public knowledge about tuberculosis is too late it can threaten public health(Aini & Rahmania Hatta, 2017).

Based on the background above, researchers are interested in conducting research with the title "Risk factors and diagnosis of pulmonary tuberculosis". This study aimed to determine the risk factors for tuberculosis and the diagnosis of pulmonary tuberculosis. The benefit of this research is to be able to add insight to readers, especially about the risk factors and diagnosis of pulmonary tuberculosis.

METHODS

This study was compiled using a literature review design. Researchers analyzed and synthesized the results of previous studies regarding risk factors and diagnosis of pulmonary tuberculosis. This type of research is a literature review of various references in journal articles. This literature review was compiled using sources obtained through journal databases such as Google Scholar, Pubmed, Proquest, ScienceDirect, and several other references using the keywords risk factors, diagnosis, and pulmonary tuberculosis. The type of research used by researchers is a survey and case study (case report). The inclusion criteria in this study were international and national articles, namely English and Indonesian. Research articles conducted on adult tuberculosis patients included preventive, promotive, and curative measures and a case study/case report research design. Exclusion criteria were other than tuberculosis. Journal Analysis The research articles obtained totaled 22 articles which were then analyzed and synthesized in a tabular format containing the title, author, year, methodology, and results.

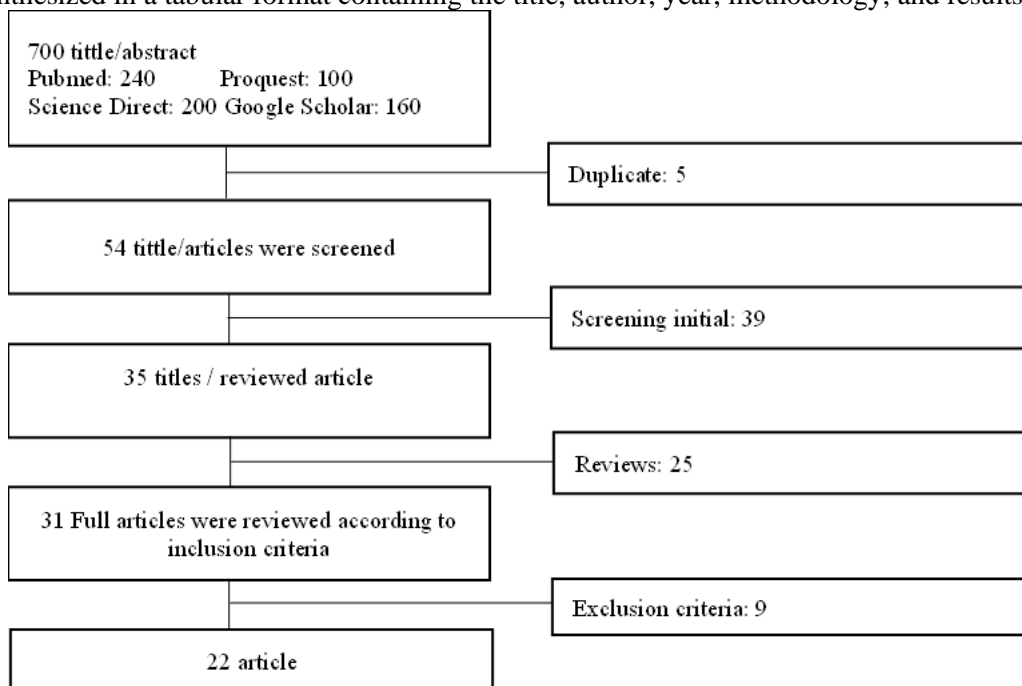


Figure 1. Chart of Research Article Selection Process

RESULTS AND DISCUSSION

Risk factors and diagnosis of tuberculosis based on the results of an analysis of 22 articles found that tuberculosis is an infectious disease, has various symptoms, and may be accompanied by other diseases. A summary of the analysis can be seen in the following table:

Table 1. Review of the Journal

No	Title	Author/Year	Design	Results
1	Risk Factors for Tuberculosis	Melia F & Eyis H, 2019	Case-control	The main cause of pulmonary tuberculosis is the bacterium <i>Mycobacterium tuberculosis</i> , apart from being caused by various causal or multifactorial risk factors that increase a person's risk of suffering from pulmonary tuberculosis such as statistical results OR value of 6.429 (95% CI 1.517-27.244) means that knowledge is a risk factor for tuberculosis. The factors that affect the level of knowledge are age, smoking, and occupancy density. Knowledge is very important for the formation of one's actions with good knowledge and can also create good behavior. Residential density is a factor that causes pulmonary tuberculosis, dense occupancy or the large number of occupants that are not balanced with the building area is said to be unhealthy, because it can cause a lack of oxygen (O ₂) consumption, and <i>Mycobacterium tuberculosis</i> germs spread quickly if there is a patient with pulmonary tuberculosis. houses with a high enough density, then the transmission of disease through the air.
2	Prevalence and associated factors of tuberculosis and diabetes mellitus comorbidity: A systematic review	(Workneh et al., 2017)	Systematic review	Factors associated with TBDM comorbidities include gender, older age, urban residence, drug use, alcoholism, smoking, sedentary lifestyle, obesity, HIV co-infection, hypertension, long duration of pre-existing DM, and poor glycemic control. poor, being a PTB patient, and having a family history of DM.
3	Alcohol consumption as a risk factor for tuberculosis: a meta-analysis and disease burden	(Sameer Imtiaz, 2017)	Meta analysis	Alcohol use, alcohol dosage, and alcohol-related problems were examined as risk factors for tuberculosis through meta-analyses of cohort studies and case-control studies. All three classifications are associated with an increased risk of tuberculosis. Because problems were associated with higher consumption, a dose-response meta-analysis suggested a higher disease burden of tuberculosis at the highest levels of alcohol consumption. Alcohol consumption is a major contributor to the burden of tuberculosis, with the most severe impact estimated for the African Region.
4	Occupational Risk Factors for Tuberculosis Among Healthcare Workers in KwaZulu-Natal, South Africa	(Tudor et al., 2016)	Case-control study	Of the 307 selected subjects, 145 (47%) health workers answered the questionnaire; 54 (37%) tuberculosis cases, and 91 (63%) controls. Cases occurred more frequently among clinical staff 46% (n = 25) and support staff 35% (n = 19). Thirty-two (26% [32/125]) health workers were known to be infected with human immunodeficiency virus (HIV), including 45% (21/54) of the cases. Healthcare workers living with HIV (odds ratio [OR], 6.35; 95% confidence interval [CI], 3.54–11.37) and those who had spent time working in areas with patients (OR, 2.24; 95% CI, 1.40-3.59) had a greater chance of developing tuberculosis, after controlling for work, number of working wards, and occupancy density.
5	Development and Validation of the Tuberculosis Risk Score for Smokers (TBRSS)	(Tengku Khalid et al., 2022)	Case control study	Seven variables were selected to be included in the risk score. The selected cut points were 16 (out of 43), with a sensitivity and specificity of 91% and 78%, respectively. The scale-level content validity index was 0.83, while the advance validity index scores for each element ranged between 0.85 and 1.00. TBRSS can be considered as a screening tool that has been validated for use in screening for the risk of TB disease among smokers, potentially

- 6 Indoor Air Pollution and (Blount et al., Susceptibility to Tuberculosis 2021)
Infection in Urban Vietnamese Children
- 7 Clinical Manifestation and (Shanmuganathan Case study Risk Factors of Tuberculosis & Subramaniam, Infection in Malaysia: Case 2015)
Study of a Community Clinic
- 8 Drivers of Tuberculosis (Mathema et al., Case study Transmission 2017)
- 9 Use of Geographically (Bui et al., 2018) Case study Weighted Poisson Regression to examine the effect of distance on Tuberculosis incidence: A case study in Nam Dinh, Vietnam
10. Membranous nephropathy in a (Morimoto et al., Case report patient with pulmonary 2022)
tuberculosis infection and lung adenocarcinoma: a case report
- 11 A Rare Case of Latent (Leonso et al., Case report Tuberculosis Reactivation 2022)
Secondary to a COVID-19 Infection.
- increasing the detection of TB disease in the community.
- Children had a 2.56-fold increased chance of developing latent tuberculosis for each household member who smoked (95% confidence interval, 1.27-5.16). The highest chance occurs in children who are exposed to indoor smokers and children aged <5 years who are exposed to smokers in the household. Each residential floor above street-level pollution decreased the chance of latent tuberculosis by 36% (adjusted odds ratio, 0.64; 95% confidence interval, 0.42–0.96). Motorcycles parked inside children's homes and cooking with gasoline as opposed to electricity increased the likelihood of latent tuberculosis, whereas kitchen ventilation reduced the effect, but these findings were not statistically significant.
- Patients in the age group between 41 to 50 years have the highest incidence of infection. Smoking appears to be the most important risk factor for infection, followed by substance abuse, HIV+ infection, and diabetes mellitus. and diabetes mellitus. Conclusion: People with diseases such as diabetes mellitus and HIV which are high-risk factors for TB should be screened for TB so that early detection and intervention can be carried out. Educational programs should be carried out to create awareness among the at-risk groups.
- The factors that promote transmission of tuberculosis in the community depend on the existing tuberculosis burden; the way individuals live, work, and interact (eg, congregate environments); and the capacity of health and public health systems to identify and effectively treat individuals with the infectious form of tuberculosis.
- The distance between the house and the TB diagnostic facility has a significant negative effect on reported TB incidence after adjusting for household poverty level, population density, and urban domicile. This is because communities that are further away from TB diagnostic facilities have less or no access to these services, thus hindering case detection. While TB units are located in urban areas, fewer TB cases are detected in urban communities implying that TB cases are detected in rural communities surrounding urban communities.
- To find out the secondary causes of membranous nephropathy (MN), perform a computed tomography (CT) scan of the thorax and abdomen, the appearance of ground-glass opacity in the middle lobe of the right lung, and enlarged paraaortic lymph nodes. A positive T-SPOT test indicates possible latent tuberculosis infection, as it is asymptomatic. A follow-up chest CT scan showed persistent ground-glass opacity, suggesting a non-infectious cause.
- Case of reactivation of latent tuberculosis 3 months after successful inpatient treatment of COVID-19. A 74-year-old woman from the Philippines presented with a new left lung infiltrate with worsening shortness of breath and fatigue. This case demonstrates that immunosuppression due to COVID-19 and its treatment can promote the development of active TB infection from latent infection. It is important to be aware of this potential increased risk during and after COVID-19 treatment.

- 12 Unrecognized and delayed to (Daulay et al., Case report
diagnose of adolescent 2018)
tuberculosis case in a boarding
school in West Java, Indonesia
Tuberculosis was diagnosed based on a positive genXpert result, detected as sensitive to rifampicin Mycobacterium tuberculosis although sputum smears of acid-fast bacilli and culture gave negative results. Chest radiograph obtained that worsened, initially showing pulmonary infiltrates, later revealing bronchogenic spread. Lymph node enlargement in neck TB as evidenced by fine needle aspiration biopsy. Anti-TB drugs were started, and after treatment, there was a clinical improvement.
- 13 From Peruvian mummies to (Zmak et al., 2019) Case study
living humans: First case of
pulmonary tuberculosis
caused by Mycobacterium
pinnipedii
This study describes the first known case of human pulmonary TB caused by M. pinniped in a 79-year-old female patient with rheumatoid arthritis and chronic respiratory disease.
- 14 The first report of co-existence (Fang et al., 2021) Case report dan
of pulmonary tuberculosis and literature review
lung malignancy in a kidney
transplant recipient: a case
report and literature review.
Chest CT scan revealed two pulmonary lesions in the right upper lobe and lower lobe respectively. 18F-fluorodeoxyglucose positron-emission tomography (FDG-PET) CT found increased FDG uptake in both lung consolidation lesions. CT-guided percutaneous transthoracic needle biopsy revealed lung adenocarcinoma and tuberculosis.
- 15 A case report of (Yin et al., 2022) Case report
dermatomyositis with the
missed diagnosis of non-small
cell lung cancer and
concurrence of pulmonary
tuberculosis.
Thoracic computed tomography (CT) shows scattered inflammatory nodules over both upper lobes of the lung with sputum smears negative for lung cancer and pulmonary tuberculosis (TB). A good clinical response to oral prednisone was obtained, except for retrosternal pain in the previous two months. The man was diagnosed with pulmonary TB based on the rapid detection of TB mycobacteria.
- 16 Recurrent tuberculosis among (Naidoo et al., Case series
HIV-coinfected patients: A 2018)
case series from KwaZulu-
Natal. *Infection and Drug
Resistance*
Recognized behavioral and biological risk factors such as alcohol abuse, incarceration, hospital admission, poor pill-taking behavior, low levels of educational attainment, and missed clinical appointments are present among patients who fail treatment and become resistant.
17. Expressions of miR-29a, Li et al. 2020 Studi korelasi
TNF- α and Vascular
Endothelial Growth Factor in
Peripheral Blood of
Pulmonary Tuberculosis
Patients and Their Clinical
Significance.
NF- α and VEGF are highly expressed in pulmonary tuberculosis patients, closely correlated with the patient's disease progression, and are expected to become targets for the diagnosis and treatment of pulmonary tuberculosis in the future
18. Sarcoidosis during treatment (Cho et al., 2021) Case report
of pulmonary tuberculosis: a
rare case report and review of
the literature.
Chest computed tomography scan reveals miliary nodules and ground-glass opacities, which are consistent with tuberculosis. To fully examine the etiology, we performed routine laboratory tests and metagenomic sequencing, which showed the presence of Mycobacterium tuberculosis and Tropheryma whipplei.
19. Acute hypercalcemia and (Wada et al., 2019) Case report
hypervitaminosis D associated
with pulmonary tuberculosis
in an elderly patient: A case
report and review of the
literature
Chest CT revealed multiple enlarged lymph nodes, without cystic or necrotic changes, in the mediastinum and both philia and postinfectious changes consistent with sequelae of tuberculosis infection in the left upper lobe. Chest radiographic evidence accompanied by compatible clinical features and non-caseating granuloma on biopsy.
20. A case of pulmonary (Ohata et al., 2019) Case report
tuberculosis diagnosed in a
patient with manifestations of
haemophagocytic
lymphohistiocytosis.
Computed tomography
21. Case report: Coronavirus (Gadelha Farias et Case report
disease and pulmonary al., 2020)
Patients in the age group between 41 to 50 years have the highest incidence of infection. Smoking appears

tuberculosis in patients with human immunodeficiency virus: Report of two cases

to be the most important risk factor for infection, followed by substance abuse, HIV+ infection, and diabetes mellitus. Conclusion: People with diseases such as diabetes mellitus and HIV which are high-risk factors for TB should be screened for TB so that early detection and intervention can be carried out. Educational programs should be carried out to create awareness among the at-risk groups.

22 A case of pulmonary tuberculosis masquerading as lung carcinoma (Kok Tong et al., Case report n.d 2019.)

The factors that promote transmission of tuberculosis in the community depend on the existing tuberculosis burden; the way individuals live, work, and interact (eg, congregate environments); and the capacity of health and public health systems to identify and effectively treat individuals with the infectious form of tuberculosis.

TB is a disease caused by the bacterium *Mycobacterium tuberculosis*. TB disease is very easily transmitted, originating from saliva splashes (droplets) from TB sufferers who are coughing or sneezing. TB bacterial infection can attack almost all parts of the body including the lungs and tissues or organs outside the lungs. The number of positive cases identified after the screening, the outcome of TB cases, and the number required for screening to make a diagnosis of TB cases are encouraging. Active case finding in the form of screening as done in this study is needed to end TB globally. The implementation of such programs must be encouraged and promoted to reduce the scourge of TB and its comorbidities (Ekeke et al., 2020).

One of the risk factors for tuberculosis is a biological risk factor. The most visible biological risk factor for pulmonary TB is a weak immune system. It is caused by a variety of factors, including nutritional deficiencies, changing conditions such as HIV/AIDS, diabetes, and cancer, and the use of immunosuppressive drugs. Malnutrition, in particular, is an important risk factor, as it can lead to a weakened immune system and increased susceptibility to TB infection. In addition, individuals who have a state of change in TB sufferers are caused by the effect of this condition on the immune system. For example, people living with HIV/AIDS have a higher risk of being infected with TB than those who are not infected with HIV (negative). In addition to HIV being a risk factor because immune factors are due to Covid-19, this is as stated by (Leonso et al., 2022), the development of infection due to Covid-19 and its treatment can encourage the development of active TB infection from latent infection. During and after Covid-19 treatment to ensure early diagnosis and prompt management and to reduce transmission. People with diseases such as diabetes mellitus and HIV which are high risk factors for TB should be screened for TB so that early detection and intervention can be made. Educational programs should be carried out to create awareness among at-risk groups (Shanmuganathan & Subramaniam, 2015).

Behavior is the result of all kinds of experience and human interaction with the environment which is manifested in the form of knowledge, attitudes, and actions. Factors that influence human behavior are divided into 2 types, namely genetic factors (type of race, gender, physical characteristics, personality, innate talent, and knowledge) and exogenous factors (environment, age, occupation, religion, socio-economic, and culture). Risk factors for TB are related to human behavior according to (Workneh et al., 2017) those associated with TBDM co-morbidities including gender, older age, urban residence, use of illegal drugs, alcoholism, smoking, lifestyle, obesity, HIV co-infection, hypertension, long duration of pre-existing DM, poor glycemic control, being a PTB patient, and family history of DM. This was also conveyed by (Bui et al., 2018) distance to a TB diagnostic facility had a significant negative effect on reported TB incidence after adjusting for household poverty rates, population density, and urban domicile. This is likely because communities located farther from TB diagnostic facilities lack or do not have access to these services, thus hindering case detection. While TB units are located in urban areas, fewer TB cases are detected in urban communities implying that TB cases are detected in rural communities surrounding urban communities. Suboptimal treatment adherence is also a key factor driving drug resistance in this subset of patients. Despite receiving enhanced counseling support under clinical trial conditions, patients remained non-compliant. In agreement with previous reports, known behavioral and biological risk factors such as alcohol abuse, incarceration, hospital admissions, poor pill-taking behavior, low levels of educational attainment, and missed clinical appointments were

shown among patients who failed treatment and acquired resistance in this study (Naidoo et al., 2018). The presence of granulomas in the lung tissue according to William Braine, as well as from John Hartnell and John Torrington, led to speculation that tuberculosis may be the main cause of death among Franklin's expedition members (Forst & Brown, 2017). The factors that promote transmission of tuberculosis in the community depend on the existing tuberculosis burden; the way individuals live, work, and interact (eg, congregate environments); and the capacity of health and public health systems to identify and effectively treat individuals with infectious forms of tuberculosis (Mathema et al., 2017).

The risk factors underlying the development of pulmonary TB are complex and multifactorial. Biological factors and behavioral factors play a role in increasing individual susceptibility to TB disease. Understanding these risk factors is important for building effective TB prevention and care strategies, especially in high-risk populations. By addressing these risk factors, we can reduce the burden of pulmonary tuberculosis and improve the health and well-being of individuals and communities around the world.

Diagnosis is the determination of the health condition that is being experienced by a person as a basis for making medical decisions for prognosis and treatment. The diagnosis of TB is to explain the clinical signs and symptoms experienced by the patient and differentiate it from other conditions. The diagnosis of TB includes the diagnosis of pulmonary TB in adults which must first be established by microscopic examination of the bacteria *Mycobacterium tuberculosis*, rapid molecular TB tests, and culture. The diagnosis of TB is not justified based on a chest X-ray alone. Chest X-ray does not always give a specific picture of pulmonary TB, so it can lead to overdiagnosis or underdiagnosis, and it is not justified to diagnose TB by serological examination (Ministry of Health RI, 2016). Diagnosis is a physical examination, and tests, such as blood tests, imaging tests, and biopsies, may be used to help make the diagnosis. Misdiagnosis of tuberculosis, delays, and inappropriate management, delays in the diagnosis of TB from the first complaint of anemia until the start of anti-TB drugs. The general anemia of TB is largely due to the suppression of erythropoiesis by inflammatory mediators but is mostly benign. Nutritional deficiencies can deepen the severity of anemia (Daulay et al., 2018).

The current technological development that can detect TB quickly and accurately is the GeneXpert examination. GeneXpert MTB/RIF is a test tool that uses a cartridge based on the Nucleic Acid Amplification Test (NAAT) to automatically detect TB cases and rifampicin resistance. This tool is suitable for endemic countries and can be done even if the sputum sample is only 1 ml (Ibrahim & Hakeem, 2013). GeneXpert examination is important because patients with drug-resistant TB require fast second-line treatment to prevent morbidity, mortality, and dissemination of MDR-TB and extensive drug-resistant tuberculosis (XDRTB) (Evans, 2011). Diagnosis of TB without testing for drug resistance can lead to poor treatment outcomes, increased suffering, increased costs, and further spread of drug-resistant strains of anti-TB (WHO, 2013).

In low-resource TB endemic countries, such as smear microscopy, with additional tests such as the Xpert MTB/RIF test and urine lipoarabinomannan (LAM), these tests cannot differentiate between MTBC and NTM. TB culture and speciation are based in specialist centers and referral laboratories and are not easily accessible to the general public (Twabi et al., 2021). Definitive diagnosis of TB and lung cancer Because most individuals present with atypical and non-specific symptoms and radiological findings between TB and lung cancer are very similar, challenges remain in the diagnosis of the coexistence of tuberculosis and lung cancer. In this case, the presence of a cavitated lesion on the chest CT image indicates a possible TB infection (Fang et al., 2021). NF- α and VEGF are highly expressed in pulmonary tuberculosis patients, closely correlated with the patient's disease progression, and are expected to become targets for the diagnosis and treatment of pulmonary tuberculosis in the future (Li et al., 2020). IGRA is an immunological method that includes T-SPOT and QuantiFERON-TB Gold. It is an effective method for the differential diagnosis of NTM-PD and PTB. Although several NTM species that share the RD1Mtb region, such as *Mycobacterium kansasii* and *Mycobacterium szulgai*, can cause positive IGRA results, these strains are not the dominant species of NTM infection in our region; therefore, this method can still distinguish the majority of NTM-PD cases from PTB. Patients with recurrent pulmonary TB had an increased frequency of hemoptysis, 2) Cavitation, infiltration, and -2 mm nodules were the most common radiographic findings in recurrent pulmonary TB participants, 3) in patients aged >45 years, hemoptysis, and fibrosis were independently associated with PTB recurrent, 4) there was a significant reduction in lung function as observed by a higher mixed pattern of restriction and obstruction in recurrent PTB participants (Nagu et al., 2021). Secondary pulmonary tuberculosis,

cavernous lesions, exudate, fibrosis, and calcification were observed in the apicoposterior segment of the left upper lobe and the dorsal segment of the left lower lobe, indicating the possibility of pulmonary tuberculosis. Lesions caused by tuberculosis COVID-19. In clinical practice, the latter tends to be covered by tubercular lesions.

CONCLUSION

Biological risk factors are a weak immune system. These risk factors include nutritional deficiencies, changing circumstances such as HIV/AIDS, diabetes and cancer, hypertension, and the use of immunosuppressive drugs, due to Covid-19 and its treatment can encourage the development of active TB infection from latent infection. Long-duration of diabetes mellitus (DM) with previous poor glycemic control is also a high-risk factor for TB. Behavioral risk factors are the result of all kinds of experiences and interactions between humans and their environment which are manifested in the form of knowledge, attitudes, and actions. Factors that influence human behavior are divided into 2 types, namely genetic factors and exogenous factors, namely gender, older age, place of residence, use of illegal drugs, alcoholism, smoking, lifestyle, obesity, distance from home to a TB diagnostic facility, poverty rates, household, population density, and rural domicile, suboptimal adherence to alcohol abuse treatment, incarceration, hospital admissions, poor pill-taking behavior, low educational attainment rates, and missed clinic appointments were among the patient's treatment failure and drug resistance. Diagnosis of TB based on TB symptoms includes smear microscopy, additional tests such as Xpert/RIF, and urine tests (lipoarabinomannan (LAM), NF- α and VEGF, IGRA (an immunological method which includes T-SPOT and QuantiFERON-TB), chest X-ray and chest CT scan. It is written in one paragraph without numbering. Answering the research objectives.

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