IJSCIA

International Journal of Scientific Advances
ISSN: 2708-7972
Volume: 6 | Issue: 1 | Jan – Feb 2025 Available Online: www.ijscia.com
DOI: 10.51542/ijscia.v6i1.7

Clinical Profile of TB-HIV Coinfected Patients at RSUD Dr. Soetomo Surabaya in 2022

Tasya Nathania Br Ketaren[1], Manik Retno Wahyunitisari[2*], Musofa Rusli[3], Agung Dwi Wahyu Widodo[2]

[1]Medical Program, Faculty of Medicine, Universitas Airlangga Surabaya, Indonesia

[2]Microbiology, Faculty of Medicine, Universitas Airlangga,
Dr. Soetomo General Academic Hospital, Surabaya, Indonesia Indonesia

[3]Departement of Internal Medicine, Faculty of Medicine, Universitas Airlangga,
Dr. Soetomo General Academic Hospital, Surabaya,Indonesia

E-mail: tasya.nathania.br-2021@fk.unair.ac.id;
manik-r-w@fk.unair.ac.id; Musofa-r@fk.unair.ac.id

*Corresponding author details: Manik Retno Wahyunitisari; manik-r-w@fk.unair.ac.id

ABSTRACT

Background: In Indonesia, East Java ranks second in HIV cases, with 71,909 reported by March 2022. The co-infection of HIV and TB poses significant health challenges, as People Living with HIV (PLHIV) are 14-18 times more likely to contract TB, which accelerates HIV progression and increases the risk of death. In 2021, TB was the leading cause of death among PLHIV, with around 187,000 deaths worldwide. Understanding the clinical profile of TB-HIV co-infected patients is essential to improve diagnosis and treatment, particularly in RSUD Dr. Soetomo Surabaya, where this study aims to provide valuable data for reducing co-infection cases in Surabaya and Indonesia. This study is a descriptive retrospective study that uses secondary data from medical records. In this research, 154 TB patients with HIV-AIDS at Dr. Soetomo Surabaya Regional General Hospital were collected through a random sampling technique within a period of 1 year, starting from January 2022 to December 2022. The characteristics of TB-HIV patients were predominantly male, with the majority aged between 18-65 years. The distribution of CD4 risk factors showed that 53% of the patients had very low CD4 levels, followed by 35% with low CD4 levels. Analysis of physical factors such as hemoglobin, leukocyte, and platelet levels revealed that most patients had low hemoglobin levels, with normal leukocyte and platelet counts, showing significant differences between these parameters in TB-HIV patients. This study also demonstrated that the majority of confirmed TB patients with HIV at RSUD Dr. Soetomo exhibited at least one clinical sign, including cough, fever, chronic diarrhea, or weight loss.

Keywords: HIV; Dr. Soetomo Surabaya; TB-HIV.

INTRODUCTION

HIV (human immunodeficiency virus) is a virus that attacks the cells that help the body fight infection, making a person more susceptible to other illnesses and diseases (HIV & AIDS, n.d.). HIV can be transmitted by exchanging various bodily fluids from people living with HIV, such as blood, breast milk, semen, and vaginal secretions. HIV can also be passed on during pregnancy and delivery to the child. People cannot become infected through casual, everyday contact such as kissing, hugging, shaking hands, or sharing personal objects, food, or water [1]. The World Health Organization (WHO) notes that around 38.4 million people live with HIV (Human et al.) worldwide in 2021. Of that amount, the majority came from Africa, namely 25.6 million cases, followed by the Southeast Asia Region, with a total of 3.8 million cases of HIV.

The cumulative number of PLHIV found (HIV cases) reported up to March 2022 was 329,581 people. Based on data and reporting from 2010 to March 2022, it is estimated that the number of HIV cases in East Java has reached 71,909 people, which ranks second highest, followed by DKI Jakarta province as the highest ranking with 76,103 points [2].

Many problems arise with the increasing incidence of HIV infection, which can weaken the body's immunity, causing other diseases or infections to enter the body of a person with HIV quickly. Besides the fact that there is no potential natural drug yet, the emergence of opportunistic diseases has added to the difficulty of treating HIV. Opportunistic infections are infections that arise due to decreased immunity.

This infection can occur due to microbes (bacteria, viruses, fungi) that come from outside the body or those that are already present in the human body but, under normal circumstances, are controlled by the immune system. National AIDS Control Organization (NACO) data reveals that tuberculosis is the most common infection in AIDS patients, followed by candidiasis, cryptosporidiosis, and others.

Tuberculosis (TB) is the most common of the many opportunistic infections. Tuberculosis (TB) is a potentially severe infectious disease that generally affects the lungs. Tuberculosis is caused by the bacteria Mycobacterium tuberculosis infection, which can spread through the lymph nodes and bloodstream to human organs. Tuberculosis is transmitted through the air [3].

HIV cases are one of the influences on the increase in TB cases worldwide, which also impacts increasing chances in society.TB is a challenge for AIDS control because it is the most common opportunistic infection in people with PLHIV. TB can increase HIV progression and the risk of death for people with HIV [4]. People living with HIV are 14-18 times more likely to get TB than people without HIV. TB is the leading Cause of death among people with HIV. In 2021, around 187,000 people will die from HIV-associated TB [5].

This study is a descriptive retrospective study that uses secondary data from medical records. In this research, 154 TB patients with HIV-AIDS at Dr. Soetomo Surabaya Regional General Hospital were collected through a random sampling technique within a period of 1 year, starting from January 2022 to December 2022. The collected subjects were then categorized based on: name distribution, age, gender, occupation, education, marital status, CD-4 levels, patient BMI, diabetes mellitus, hemoglobin, leukocyte count, platelet count, chronic diarrhea, cough, fever, and weight loss.

RESULT

The results of the research that I will discuss below are the findings from medical record retrieval data related to tuberculosis patients with ICD B20.0, specifically among HIV-AIDS patients at RSUD Dr. Soetomo Surabaya. The data was collected from January to December 2022. I employed a retrospective descriptive design with a random sampling technique, and the variables considered included name, age, gender, occupation, education, marital status, CD-4 levels, patient BMI, DM, Hemoglobin, Leukocytes, Platelets, Chronic Diarrhea, Cough, Fever, and Weight loss.

Based on the data I obtained, it was found that the number of HIV-AIDS patients at RSUD Dr. Soetomo Surabaya in 2022 was 5680 people. The results of the study will be described in the form of tables and diagrams as follows.

TABLE 1: Distribution of The Number of Patients at RSUD Dr. Soetomo Surabaya in 2022.

	Tahun 2022
Number of HIV-AIDS Patients	5680
Number of TB patients in HIV-AIDS	1673
TB patients with HIV-AIDS in the study	154

TABLE 2: Gender Distribution of Tuberculosis Patients with HIV-AIDS at RSUD Dr. Soetomo Surabaya in 2022.

Gender	N	%
Male	111	72%
Female	43	28%
Total	**154**	**100%**

TABLE 3: Age Distribution of TB Patients in HIV-AIDS at RSUD Dr. SoetomoSurabaya in 2022.

Age	N	%
<15 Years	0	0%
15- 64 Years	148	96%
≥ 65 Years	6	4%
Total	**154**	**100%**

TABLE 4: Occupational Distribution of Tuberculosis Patients with HIV-AIDS at RSUD Dr. Soetomo Surabaya in 2022.

Occupation	N	%
Working	102	66%
Not working	52	34%
Total	**154**	**100%**

TABLE 5: Distribution of Education of Tuberculosis Patients with HIV-AIDS at RSUD Dr. Soetomo Surabaya in 2022.

Education	N	%
Not attending school	5	3%
Graduated from elementary school	10	6%
Graduated from elementary School junior high school	10	6%
Graduated from senior high school	107	69%
Passed D3 / S1	22	14%
Total	**154**	**100%**

TABLE 6: Distribution of Marital Status of Tuberculosis Patients with HIV-AIDS at RSUD Dr. Soetomo Surabaya in 2022.

Marriage Status	N	%
Unmarried	15	10%
Married	137	90%
Widower	0	0%
Widowed	1	1%
Total	**154**	**100%**

TABLE 7: Distribution of CD4 Levels of Tuberculosis Patients with HIV-AIDS at RSUD Dr. Soetomo Surabaya in 2022.

CD4	N	%
Normal (500-1500)	22	14%
Low (200-499)	57	37%
Severely Low (<200)	75	49%
Total	**154**	**100%**

TABLE 8: Distribution of Hb Levels of Tuberculosis Patients with HIV-AIDS at RSUD Dr. Soetomo Surabaya in 2022.

Hemoglobin	N	%
Low (Male)(<13,8)	77	50%
Normal (Male) (13,8 –17,2)	33	21%
High (Male) (>17,2)	1	1%
Low (Female) (<12,1)	25	16%
Normal(Female) (12,1 –15,1)	18	12%
High (Female)(>15,1)	0	0%
Total	**154**	**100%**

TABLE 9: Distribution of Leukocyte Levels of Tuberculosis Patients with HIV-AIDS at RSUD Dr. Soetomo Surabaya Year 2022.

Leukocyte	N	%
Low (<4.000)	29	19%
Normal (4.000 -11.000)	111	72%
High (>11.000)	14	9%
Total	**154**	**100%**

TABLE 10: Distribution of Platelet Level Factors of Tuberculosis Patients in HIV-AIDS at RSUD Dr. Soetomo Surabaya in 2022.

Platelet	N	%
Low (<150.000)	10	6%
Normal (150.000 - 450.000)	138	90%
High (>450.000)	6	4%
Total	**154**	**100%**

TABLE 11: Distribution of DM Risk Factors of Tuberculosis Patients in HIV-AIDS at RSUD Dr. Soetomo Surabaya in 2022.

Diabetes Mellitus	N	%
With History of DM	19	12%
Without History of DM	93	60%
Not confirmed	42	27%
Total	**154**	**100%**

TABLE 12: Distribution of BMI Risk Factors of Tuberculosis Patients in HIV-AIDS at RSUD Dr. Soetomo Surabaya in 2022.

BMI	N	%
Underweight (<18,5)	34	22%
Healthy Weight (18,5 - 24,9)	116	75%
Overweight (25 - 29,9)	4	3%
Obesity (>30)	0	0%
Total	**154**	**100%**

TABLE 13: Distribution of Clinical Manifestations of Chronic Diarrhea of Tuberculosis Patients in HIV-AIDS at RSUD Dr. Soetomo Surabaya in 2022.

Diarrhea	N	%
Positive	136	88%
Negative	18	12%
Total	**154**	**100%**

TABLE 14: Distribution of Clinical Manifestations of Cough of TuberculosisPatients in HIV-AIDS at RSUD Dr. Soetomo Surabaya in 2022.

Cough	N	%
Positive	140	91%
Negative	14	9%
Total	**154**	**100%**

TABLE 15: Distribution of Clinical Manifestations of Fever of TuberculosisPatients in HIV-AIDS at RSUD Dr. Soetomo Surabaya In 2022.

Fever	N	%
Positive	140	91%
Negative	14	9%
Total	**154**	**100%**

TABLE 16: Distribution of Clinical Manifestations of Weight Loss of TuberculosisPatients in HIV-AIDS at RSUD Dr. Soetomo Surabaya in 2022.

Weight Loss	N	%
Positive	116	75%
Negative	38	25%
Total	**154**	**100%**

DISCUSSION

This study was conducted retrospectively using secondary data in the form of medical records of tuberculosis patients with HIV-AIDS at RSUD Dr. Soetomo in 2022, which were obtained through a random sampling technique. A total of 154 cases of tuberculosis patients with HIV-AIDS were included in the study. The variables to be discussed in this study include name distribution, age, gender, occupation, education, marital status, CD-4 levels, patient BMI, DM, Hemoglobin, Leukocytes, Platelets, Chronic Diarrhea, Cough, Fever, and Weight loss.

Gender Distribution of TB Patients in HIV-AIDS

The research taken in 2022, shows that the male sex is more affected by TB disease in HIV-AIDS than women. With 111 men (72%) while women get 43 people (28%) [6]. Men have a 53% higher risk of TB compared to women (risk ratio [RR] = 1.53; 95% confidence interval [CI], 1.12- 2.09). Gender roles, expectations, and prescribed norms may result in differences in access to material resources (prestige, power, nutrition), health-related behaviors (e.g., smoking and drinking), and exposure to psychosocial stressors (e.g., discrimination and violence). Current literature on the gender epidemiology of TB suggests gender differences in prevalence/notification rates, disease manifestations, disease progression, case fatality rates, response to treatment, and along the continuum of TB pathogenesis and care [7].

Statistical analysis results from other studies showed that there was a significant effect of gender on TB-HIV co-infection, in 2017 ($p<0.05$ with an OR of 20.47 and 95% CI: 4.357-96.21), which explained that males had a higher prevalence of TB-HIV co-infection and were 20 times more likely to have TB-HIV co-infection than females. Infectious diseases rarely affect men and women equally, and tuberculosis is no exception. Worldwide tuberculosis notification data for 2012 shows a male-female ratio of 1.9:1. This is not a new phenomenon, first observed at the turn of the 20th century in New York, where the male-female ratio of deaths from tuberculosis approached 2:1, and during the 1950s in rural Wales, where radiographic surveys showed a male-female disease ratio of 2.1:1. The extent of male bias varies by geographic location and year, but the overall trend is clear, and of the 20 high-burden countries for which data are available, the average male-female ratio is 1.8:1, with only Afghanistan reporting a ratio <1:1, [8].

Age Distribution of TB Patients in HIV-AIDS

Based on the results of the study at RSUD Dr. Soetomo, it was found that the age range of tuberculosis patients with HIV-AIDS was mostly in the age group of 18-65 years, namely 148 cases (96%).

This is to journal data, where most HIV cases occur in the age group >35 years with a 1.12 times risk of developing TB compared to younger ages of 15-35 years [9]. Similarly, data at Dr. Kariadi Hospital Semarang (2013), data with an age group of 15-35 years recorded the highest number of TB-HIV co-infection cases, namely 49 people (59%).

Strengthened by research by the Directorate General of P2P, from the results of frequency distribution analysis, it was found that the number of HIV / AIDS patients was highest in the age range category 30-39 years as many as 50 patients with a percentage of 40.32%. HIV infection tends to increase and is most prevalent in the productive age group, namely the age group 25-49 years and age 20-24 years [10].

Distribution of Employment of TB Patients in HIV-AIDS

This study shows that the majority of patients with confirmed TB in HIV at Dr. Soetomo Hospital have jobs or work, with a total of 102 cases (66%). The dominating patient occupation is as a private employee. While data for patients who did not work were 52 patients.

The interconnectivity of TB epidemiology with social and economic conditions has made its prevention and control a daunting task to achieve. In particular, previous studies have found that socioeconomic conditions such as malnutrition, alcohol and substance abuse, smoking, and unemployment contribute to an increased risk of TB, recurrent TB even after completion of treatment, and poor treatment adherence and outcomes. This is supported by the data of HIV/AIDS patients with Tuberculosis co-infection at Dr. Kariadi Hospital Semarang in 2014, namely, patients who worked reached a higher rate (68.5%) than those who did not work (31.5%) [11].

Patients who are not working also reflect the low level of education and socioeconomics in Indonesian society, these patients tend to have a poor level of knowledge of the importance of sanitation, and healthy lifestyle behaviors such as diligent exercise, not smoking, nutritious food, thus increasing the risk of pulmonary tuberculosis co-infection in HIV/AIDS patients.

Educational Distribution of TB Patients with HIV-AIDS

Grouped by education, the last education of high school graduates became the most significant case with 107 cases (69%). Followed by D3 / S1 graduates who amounted to 22 cases (14%).

The least cases were found to be 5 cases (3%) based on out-of-school education.

Unemployed people and people with low education levels have limited access to health information and lack awareness of the routes and dangers of HIV transmission. Therefore, they are at greater risk of HIV/TB co-infection, reflecting the positive correlation between poverty and TB from an alternative perspective [12].

The data obtained is in line with the research which shows that most of the subjects studied were high school graduates, namely 33 people (46.4%). Followed by academy graduates as many as 15 people. This shows that low education affects the patient's understanding of TB co-infection with HIV and its treatment [13].

Research by Karima et al. reported the opposite, that people with HIV-TB coinfection were primarily found in those with primary education (69%), followed by secondary education (55.5%), and 39% with tertiary education. The higher education level of HIV-TB coinfected sufferers can affect their behavior and understanding in receiving information about HIV-TB infection prevention.

Distribution of Marital Status of TB Patients with HIV-AIDS

This study shows that the most cases of marital status are married as many as 137 people (90%). The second rank is unmarried cases as many as 15 people (10%), and the last marital status data is widower / widow as many as 1 person (1%). This is in line with the research of Tiewsoh et al., in India reported that TB co-infection was most commonly found in the married group (73%), followed by singles (17%) and widows (4%). Similarly, a study by Zhu et al. in China showed that 76% of HIV-TB co-infected patients were married, followed by widows/widowers (16%) and singles (8%).

Meanwhile, HIV-TB co-infection was found in single patients (17,28). HIV-TB cases are higher in married individuals because transmission can occur through sexual intercourse with their partners. This suggests that heterosexual transmission was most common in this study. Another study mentioned that patients who did not have a partner received data as many as 382 people (54.6%), compared to patients who had partners with a total of 318 people (45.4%) [14].

Distribution of CD4 Risk Factors for TB Patients with HIV-AIDS

This study shows that the most CD4 Risk Factors are in the severely low range which is usually associated with AIDS (<200 cells/mm^3) as many as 75 people (49%), followed by the low range (200-499 cells/mm^3) as many as 57 people (37%), and finally the normal range (500-1500 cells/mm^3) as many as 22 people (14%). This is in accordance with research by Ibnu Sina Gresik Hospital in 2019-2020 that the highest CD4 value was obtained in the CD4 <200 cells/mm^3 category, namely 35 patients (97.22%) with an average CD4 value of 61.33 cells/mm^3. This is also supported by a study by Lee et all that most patients were in the advanced stage of HIV infection; 93% had a CD4 cell count of less than 200/mm^3.

Clinically, the CD4 lymphocyte value is used as a parameter for the onset of opportunistic inflammation in people with HIV/AIDS. A person with normal conditions has a CD4 count between 500 - 1,200 cells/mm (Kemala, 2021). If the CD4 lymphocyte cell value is less than 200 cells/mm, HIV patients have a higher risk of secondary infection, one of which is TB [15].

The number of CD4 in patients suspected of TB-HIV co-infection tends to be very low, namely most 53% with CD4 < 200 cells/mm^3. This is also in line with the research of at H. Adam Malik Medan Hospital also stated that 180 patients (80.7%) had CD4 values <200 cells/mm^3 [16].

Distribution of Risk Factors for Hemoglobin, Leukocyte, and Platelet Levels in TB Patients in HIV-AIDS.

The results of the distribution of risk factors for hemoglobin, leukocyte, and platelet levels in TB patients with HIV-AIDS at RSUD Dr. Soetomo Surabaya in the 2022 period indicate that the highest number of patients had low hemoglobin levels, normal leukocyte counts, and normal platelet counts. This finding is consistent study, which reported an average Hb level of 9.4 g/dL in HIV- Tuberculosis coinfected patients [17].

Taha's study showed that anemia will aggravate immune deficiency and increase the risk of tuberculosis. Research [18] states that hemoglobin levels below 10 g/dL increase the likelihood of tuberculosis threefold. Leukopenia is frequently linked to disease progression in HIV patients. A decrease in the absolute number of CD4+ T lymphocytes is one of the earliest immunologic abnormalities in HIV infection and serves as a crucial indicator of the risk of developing opportunistic infections [19].

Distribution of DM Risk Factors for TB Patients with HIV-AIDS

Based on the results of the study at Dr. Soetomo Hospital, there were 19 patients (12%) with DM risk factors, 93 patients (60%) without DM, and 42 patients (27%) without complete information in their medical records. Diabetic patients have a three times greater risk of contracting TB compared to non-diabetic individuals (CY Jeon, 2008). This is corroborated by the fact that diabetes is generally diagnosed before TB develops [20].

According to studies conducted in different parts of the world, the prevalence of DM ranges from 0.1 to 44.5% in TB patients, as reviewed in [21], In sub-Saharan Africa, including Ethiopia, the combined prevalence of DM in TB patients was reported to be 9.0%. HIV-positive TB patients were found to be 5 times more likely to be DM positive (aOR 5.14, 95% CI 2.00-13.25, p = 0.001), compared to HIV- negative patients [22].

Distribution of BMI Risk Factors for TB Patients with HIV-AIDS

Malnutrition, is typically defined as a body mass index (BMI) of <18.5 kg/m2, Among patients with HIV, TB disease often presents during malnutrition and even worsens it [11]. Among HIV-infected adults with CD4 counts ≥200 cells/µl living in high TB prevalence areas, low BMI and decreased BMI were independently and significantly associated with greater risk of developing TB. These results suggest that malnutrition contributes to HIV-associated TB, and that subjects with BMI < 17 kg/m2 or 1-year BMI decline ≥0.5 kg/m2 have a high risk of developing HIV-associated TB [23]. This is different from this study, which found that 34 patients had low BMI, which is 22%, 116 patients had normal BMI, which is 75%, and 4 patients were Overweight.

Distribution of Clinical Manifestations of Cough, Fever, Chronic Diarrhea, and Weight Loss in TB Patients with HIV-AIDS

This study shows that the majority of patients with confirmed TB in HIV at Dr Soetomo Hospital have at least one of the above clinical signs. Based on medical records that have been studied, there are 140 patients (91%) who are recorded as having a chronic cough, 140 patients (91%) are recorded as having a fever. There are 136 patients (88%) experiencing chronic diarrhea, and 116 patients (75%) are recorded as experiencing weight loss. This is in line with the data in the systematic review that 78.9% of HIV- associated TB had at least one of cough, fever, night sweats, and weight loss, and thus WHO recommends TB screening based on those symptoms [24].

Clinical evaluation for TB begins if the subject complains of fever, cough, or weight loss for ≥2 weeks. Research by Sharma, et all states that weight loss is very common in TB-HIV patients. This condition is called slim disease. This weight loss is thought to be related to chronic diarrhea due to HIV enteropathy. Fever, weight loss were the predominant symptoms, followed by cough, oral lesions and diarrhea. The clinical profile reported in the present study was similar to that reported in Lucknow [25].

CONCLUSIONS

HIV (Human Immunodeficiency Virus) weakens the immune system, making individuals more susceptible to infections, including tuberculosis (TB), the most common opportunistic infection among people living with HIV (PLHIV). As of 2021, approximately 38.4 million people globally were living with HIV, with the highest prevalence in Africa and Southeast Asia The number of tuberculosis patients with HIV-AIDS at RSUD Dr. Soetomo Surabaya in the 2022 period was 1673 cases with random sampling of 154 TB patients with HIV- AIDS in the study. Characteristics of tuberculosis patients with HIV-AIDS at Dr. Soetomo Hospital in the 2022 period were mostly male, with the highest age range of 18- 65 years. The level of education is high school / equivalent with the average patient being a worker and married.

The results of the distribution of CD4 risk factors for TB patients with HIV-AIDS at Dr. Soetomo Surabaya Hospital in the 2022 period showed that very low levels were the highest as many as 82 patients (53%), followed by low CD4 levels with 54 patients (35%). Distribution of physical factors of hemoglobin, leukocyte, and platelet levels of TB patients with HIV-AIDS at RSUD Dr. Soetomo Surabaya in the 2022 period showed that the highest data of patients were low hemoglobin levels, normal leukocytes, and normal platelets, there was a significant difference in the number of leukocytes, platelets and hemoglobin between HIV TB patients. Based on the results of the study of Tuberculosis patients in HIV-AIDS at Dr. Soetomo Hospital, it was found that there were DM risk factors in 19 patients (12%) and there were no DM in 93 patients (60%) and there was no complete information in the medical record as many as 42 patients (27%).

ACKNOWLEDGMENT

The authors wish to acknowledge Langley Conway and other contributors for developing and maintaining the IJSCIA files which have been used the preparation of this template.

REFERENCES

[1] J. Bruchfeld, M. Correia-Neves, and G. Kallenius, “Tuberculosis and HIV coinfection,” Cold Spring Harb. Perspect. Med., vol. 5, no. 7, 2015, doi: 10.1101/cshperspect.a017871.

[2] M. Mikanović et al., “Pseudoaneurysm as an Etiological Cause of Hemoptysis in Extensive Tuberculosis,” Thorac. Res. Pract., vol. 24, no. 2, 2023, doi: 10.5152/ThoracResPract.2023.22012.

[3] Y. L. Lew, A. F. Tan, S. T. Yerkovich, T. W. Yeo, A. B. Chang, and C. P. Lowbridge, “Pulmonary function outcomes after tuberculosis treatment in children: a systematic review and meta-analysis,” Arch. Dis. Child., vol. 109, no. 3, 2023, doi: 10.1136/archdischild-2023-326151.

[4] J. Gao, P. Zheng, and H. Fu, “Prevalence of TB/HIV Co-Infection in Countries Except China: A Systematic Review and Meta-Analysis,” PLoS ONE, vol. 8, no. 5. 2013, doi: 10.1371/journal.pone.0064915.

[5] L. C. K. Bell and M. Noursadeghi, “Pathogenesis of HIV-1 and mycobacterium tuberculosis co-infection,” Nature Reviews Microbiology, vol. 16, no. 2. 2018, doi: 10.1038/nrmicro.2017.128.

[6] E. Ahmadpour et al., “Cryptosporidiosis in HIV-positive patients and related risk factors: A systematic review and meta-analysis,” Parasite, vol. 27. 2020, doi: 10.1051/parasite/2020025.

[7] J. Fettig, M. Swaminathan, C. S. Murrill, and J. E. Kaplan, “Global epidemiology of HIV,” Infectious Disease Clinics of North America, vol. 28, no. 3. 2014, doi: 10.1016/j.idc.2014.05.001.

[8] A. Basavaraju, "Toxoplasmosis in HIV infection: An overview," in Tropical Parasitology, 2016, vol. 6, no. 2, doi: 10.4103/2229-5070.190817.

[9] K. Frasca and J. Cohn, "Integration of HIV and tuberculosis in the community," J. Int. Assoc. Provid. AIDS Care, vol. 13, no. 6, 2014, doi: 10.1177/2325957413488183.

[10] G. Maartens, C. Celum, and S. R. Lewin, "HIV infection: Epidemiology, pathogenesis, treatment, and prevention," in The Lancet, 2014, vol. 384, no. 9939, doi: 10.1016/S0140-6736(14)60164-1.

[11] L. Lawson et al., "Clinical presentation of adults with pulmonary tuberculosis with and without HIV infection in Nigeria," Scand. J. Infect. Dis., vol. 40, no. 1, 2008, doi: 10.1080/00365540701509899.

[12] L. Boonyagars, C. Sangketchon, and K. Pholtawornkulchai, "Presentation, Clinical Characteristics, and Treatment Outcomes among Tuberculous Meningitis Patients with and Without HIV Infection at Vajira Hospital, Thailand: A Retrospective Cohort Study," J. Int. Assoc. Provid. AIDS Care, vol. 20, 2021, doi: 10.1177/23259582211045551.

[13] S. K. Sharma, A. Mohan, and T. Kadhiravan, "HIV-TB co-infection: Epidemiology, diagnosis & management," Indian Journal of Medical Research, vol. 121, no. 4. 2005.

[14] H. Getahun et al., "Development of a standardized screening rule for tuberculosis in people living with HIV in resource-constrained settings: Individual participant data meta-analysis of observational studies," PLoS Med., vol. 8, no. 1, 2011, doi: 10.1371/journal.pmed.1000391.

[15] A. Pozniak, "Clinical manifestations and complications of pulmonary tuberculosis," UpToDate. 2022.

[16] M. Taha, A. Deribew, F. Tessema, S. Assegid, L. Duchateau, and R. Colebunders, "Risk Factors of Active Tuberculosis in People Living with HIV/AIDS in Southwest Ethiopia: A Case Control Study," Ethiop. J. Health Sci., vol. 21, no. 2, 2011, doi: 10.4314/ejhs.v21i2.69053.

[17] S. K. Sharma, T. Kadhiravan, A. Banga, T. Goyal, I. Bhatia, and P. K. Saha, "Spectrum of clinical disease in a series of 135 hospitalised HIV-infected patients from north India," BMC Infect. Dis., vol. 4, 2004, doi: 10.1186/1471-2334-4-52.

[18] W. H. Cahyati and N. Muna, "Determinan Kejadian Tuberkulosis pada Orang dengan HIV/AIDS," HIGEIA (Journal Public Heal. Res. Dev., vol. 3, no. 2, 2019.

[19] C. Nzou, R. A. Kambarami, F. E. Onyango, C. E. Ndhlovu, and V. Chikwasha, "Clinical predictors of low CD4 count among HIV-infected pulmonary tuberculosis clients: A health facility-based survey," South African Med. J., vol. 100, no. 9, 2010, doi: 10.7196/samj.3800.

[20] D. A. Zamy, B. W. Lestari, and Y. Hartantri, "Gambaran Hasil Terapi TB Paru pada Pasien TB-HIV di RSUP dr.Hasan Sadikin Bandung Tahun 2012-2014," eJournal Kedokt. Indones., vol. 3, no. 3, 2016, doi: 10.23886/ejki.3.5649.

[21] M. Raviglione et al., "Scaling up interventions to achieve global tuberculosis control: Progress and new developments," The Lancet, vol. 379, no. 9829. 2012, doi: 10.1016/S0140-6736(12)60727-2.

[22] U. Q. Karima, M. K. Sudaryo, and N. M. Kiptiyah, "Prediktor Kejadian TB pada ODHA di Salah Satu RS Pemerintah Bogor, Tahun 2014-2016," J. Epidemiol. Kesehat. Indones., vol. 1, no. 2, 2017, doi: 10.7454/epidkes.v1i2.1585.

[23] G. Hagan and N. Nathani, "Clinical review: Tuberculosis on the intensive care unit," Critical Care, vol. 17, no. 5. 2013, doi: 10.1186/cc12760.

[24] D. Loewenstein, L. van Balveren, A. Lemson, N. Hanemaaijer, W. Hoefsloot, and J. van Ingen, "Monotherapy: Key cause of macrolide-resistant Mycobacterium avium complex disease," Respir. Med., vol. 217, 2023, doi: 10.1016/j.rmed.2023.107366.

[25] M. Rolo, B. González-Blanco, C. A. Reyes, N. Rosillo, and P. López-Roa, "Epidemiology and factors associated with Extra-pulmonary tuberculosis in a Low-prevalence area," J. Clin. Tuberc. Other Mycobact. Dis., vol. 32, 2023, doi: 10.1016/j.jctube.2023.100377.