



Study of Clinical Characteristics of AIDS Patients with Opportunistic Infections: Findings from Cut Mutia General Hospital

Alfi Syahri¹, Tintin Sukartini², Erna Dwi Wahyuni³, Sriyono⁴, Hakim Zulkarnain⁵, Wikan Purwihantoro Sudarmaji⁶, Domingos Soares⁷, Mawaddah Fitria⁸, Eti Rahmawati⁹

^{1,2,3,4,5,6}Faculty of Nursing, Universitas Airlangga, Surabaya, Indonesia

¹Faculty of Nursing, Institut Kesehatan Deli Husada, Deli Serdang, Indonesia

⁷Instituto Nacional de Saúde Pública, Dili, Timor-Leste

^{8,9}Cut Mutia General Hospital, Aceh, Indonesia

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CORRESPONDENCE

E-mail: alfi.syahri-2023@fkip.unair.ac.id

ABSTRACT

HIV/AIDS remains a global public health challenge, with opportunistic infections (OIs) being a major cause of morbidity and mortality. In resource-limited settings such as Aceh, Indonesia, the burden of OIs significantly impacts the management and outcomes of HIV/AIDS patients. Purpose: This study aims to describe the demographic and clinical characteristics, the prevalence of OIs, and treatment outcomes among HIV/AIDS patients treated at Cut Mutia General Hospital in Lhokseumawe, Aceh. A retrospective observational study was conducted using medical records of 55 HIV/AIDS patients treated between January 2023 and October 2024. Data included demographic profiles, clinical features, types of OIs, and treatment outcomes. Descriptive statistical analysis was performed. Many patients were male (67.3%) and aged 25–44 years (81.8%). Oral candidiasis (28.1%) and pulmonary tuberculosis (17.7%) were the most common OIs. Notably, some patients experienced multiple OIs. Most patients (76.4%) were discharged in stable condition, while 23.6% succumbed to their illnesses. This study highlights the high prevalence of OIs among HIV/AIDS patients in Lhokseumawe, emphasizing the need for early detection, improved clinical management, and integrated care services. Targeted interventions are critical to reducing mortality and improving patient outcomes in resource-constrained settings.

INTRODUCTION

Human Immunodeficiency Virus (HIV) and Acquired Immunodeficiency Syndrome (AIDS) are global public health issues that have caused millions of deaths worldwide. According to the World Health Organization (WHO), approximately 38 million people were living with HIV globally in 2019 (Buchacz et al., 2016; Harjoni, 2023; Tewachew et al., 2021). HIV attacks the immune system, making infected individuals vulnerable to various opportunistic infections (OIs), which are major causes of morbidity and mortality among AIDS patients (Buchacz et al., 2016; Fatimatuzzahra et al., 2022; Shi et al., 2011). In Indonesia, despite increased access to antiretroviral therapy (ART), the incidence of opportunistic infections remains high. According to data from the Ministry of Health of Indonesia in 2024, more than 543,100 HIV/AIDS cases have been reported nationwide, with 23,100 new cases reported in the last two years. In Aceh, the cumulative number of cases reached 1,750, with a significant increase in Lhokseumawe City, which accounted for 280 cases during the same period. This situation reflects significant challenges in HIV/AIDS prevention and management efforts in Indonesia.

Opportunistic infections present significant challenges in the clinical management of HIV/AIDS patients. Infections such as tuberculosis, pneumonia, cryptococcal meningitis, and cerebral toxoplasmosis are frequently reported in AIDS patients (Buchacz et al., 2016; Fatimatuzzahra et al., 2022; Tewachew et al., 2021). In Indonesia, delays in early diagnosis and poor adherence to ART exacerbate the situation, causing patients to present to healthcare facilities in advanced stages with complications from opportunistic infections (Harjoni, 2023; Shi et al., 2011; Tewachew et al., 2021). Therefore, studies on the clinical characteristics of opportunistic infections are necessary to improve strategies for prevention and management.

This study aims to examine the clinical characteristics and types of opportunistic infections in AIDS patients treated at Cut Mutia General Hospital. It also seeks to identify the main risk factors contributing to the occurrence of opportunistic infections (Ando, 2024; Savadogo et al., 2021; Utarini, 2017).

Various studies have shown a high prevalence of opportunistic infections among HIV/AIDS patients. Studies in China found that cytomegalovirus (CMV) retinitis often occurs in AIDS patients, and treatment with ganciclovir has proven effective (Damtie et al., 2013; Fenner et al., 2017; Opoku et al., 2018; Tewachew et al., 2021). Research in Ethiopia by Tewachew et al (2021) identified malnutrition and a history of previous opportunistic infections as significant predictors of recurrent infections. In Indonesia, research by Fatimatuzzahra et al (2022) Fatimatuzzahra et al. (2022) found that cerebral toxoplasmosis is the most common central nervous system infection, with high mortality rates among patients with other opportunistic infections (Adamu & Petros, 2010; Almaw, 2024; Harjoni, 2023; Sanyaolu et al., 2016).

Although studies on opportunistic infections in AIDS patients have been widely conducted in various countries, research on the specific characteristics of patients in Indonesia, particularly in Aceh, remains very limited (Ahmetagic et al., 2015; Harjoni, 2023; Teeka, 2023). Most existing studies focus only on prevalence without delving deeper into the types of infections and other risk factors. This gap needs to be addressed to develop evidence-based management strategies, especially in Aceh, which has unique social and cultural challenges in managing HIV/AIDS (Fatimatuzzahra et al., 2022; Mo, 2016; Shi et al., 2011).

This research offers new contributions by presenting a detailed analysis of patient characteristics and types of opportunistic infections found at Cut Mutia General Hospital. Additionally, the study focuses on the relevance of community-based support such as Peer Support Groups (PSGs), which have proven effective in assisting HIV/AIDS patients in North Aceh (Dawet & Onaiyekan, 2020; Fatimatuzzahra et al., 2022; Harjoni, 2023; Wulandari, 2023). This data is expected to serve as a reference for local health policy.

The findings from this study can provide new insights for the medical community and researchers in understanding the epidemiology of opportunistic infections in Indonesia. Practically, this research can help clinicians identify high-risk patients and implement early interventions. Furthermore, the study's results can support the development of community-based education and prevention programs to improve ART

adherence and reduce the burden of opportunistic infections (Fatimatuzzahra et al., 2022; Harjoni, 2023; Tewachew et al., 2021).

Based on the aforementioned background, the research data was collected from January 2023 to October 2024 to understand the clinical characteristics and types of opportunistic infections in AIDS patients at Cut Mutia General Hospital. The research question is: "What are the clinical characteristics and types of opportunistic infections in AIDS patients treated at Cut Mutia General Hospital?"

METHOD

This study employed a retrospective observational design to analyze secondary data from medical records of HIV/AIDS patients treated at Cut Mutia General Hospital. The study period covered January 2023 to October 2024, with a total population of 55 patients included in the analysis. The primary objective was to describe the clinical characteristics and types of opportunistic infections among these patients. The sampling method involved using the total population approach, meaning all 55 patients who met the inclusion criteria were included as the sample. This approach was chosen to ensure that the study captured comprehensive data from all available cases during the study period. The inclusion criteria specified that patients must have a confirmed diagnosis of HIV/AIDS, must have received treatment at Cut Mutia General Hospital between January 2023 and October 2024, and must have complete medical records documenting demographic and clinical details. Exclusion criteria were not applied, as all cases within the defined population met the requirements for analysis.

Data were collected from medical records, which included demographic information such as gender, age, last educational attainment, marital status, and AIDS stage. Clinical data included types of opportunistic infections diagnosed and treatment outcomes, including recovery, complications, or mortality. The statistical analysis was conducted using the IBM Statistical Package for the Social Sciences (SPSS) version 15.0 (Chicago: SPSS Inc., 2006). The data are presented in accordance with the following conventions: as a number (n) and percentage (%), or as a median and interquartile range (IQR, 25th and 75th percentile). Descriptive statistics were used to summarize the data, and no inferential or multivariate analyses were performed due to the scope and nature of the study.

Ethical approval for the study was obtained from the Ethics Committee of Cut Mutia General Hospital with approval number 016/KEPK-RSUCM/X/2024. All data were anonymized to ensure confidentiality and were handled according to ethical guidelines for research involving human subjects.

RESULT

This study analyzed a total of 55 patients diagnosed with HIV/AIDS at Cut Mutia General Hospital from January 2023 to October 2024. The findings are presented below, encompassing both demographic and clinical characteristics, as well as patient outcomes.

Table 1 Demographic and clinical characteristics of AIDS patients

Characteristics	Frequency (n)	Percentage (%)
Gender		
Male	37	67.3
Female	18	32.7
Total	55	100.0
Age		
15-24 years	3	5.5
25-44 years	45	81.8
45-59 years	7	12.7
Total	55	100.0
Educational Level		
Junior High School	6	10.9
High School	31	56.4
Diploma (D3)	8	14.5
Advanced Diploma (D4)	2	3.6
Bachelor's Degree (S1)	8	14.5
Total	55	100.0
Marital Status		
Married	24	43.6
Unmarried	29	52.7
Widowed	2	3.6
Total	55	100.0
AIDS Stage		
Stage IV	39	70.9
Stage III	12	21.8
Stage II	4	7.3
Total	55	100.0
Opportunistic Infections		
Oral Candidiasis	27	28.1
Pulmonary Tuberculosis	17	17.7
Gastroenteritis	10	10.4
Oesophageal Candidiasis	9	9.4
Syphilis	7	7.3
Pneumocystis carinii Pneumonia	6	6.3
Toxoplasmosis Encephalitis	6	6.3
Hepatitis B	3	3.1
Bronchitis	2	2.1
Lymphadenitis	2	2.1
Tuberculous Lymphadenitis	2	2.1
Miliary Tuberculosis	2	2.1
Pleural Effusion	1	1.0
Pneumonia	1	1.0
Tuberculous Gland	1	1.0
Total	96	100.0
Patient Outcomes		
Lives	42	76.4
Deaths	13	23.6
Total	55	100.0

Demographic Characteristics

The study revealed that many of the patients were male, accounting for 67.3% (n = 37), while females made up 32.7% (n = 18). The age distribution showed that most patients (81.8%, n = 45) were aged 25-44 years, followed by 12.7% (n = 7) aged 45-59 years, and 5.5% (n = 3) aged 15-24 years. Regarding education levels, the majority had completed high school (56.4%, n = 31), followed by those with diplomas (D3, 14.5%, n = 8) and bachelor's degrees (S1, 14.5%, n = 8). Patients with junior high school education (SMP) accounted for 10.9% (n = 6), and those with advanced diplomas (D4) represented 3.6% (n = 2). Marital status distribution indicated that 52.7% (n = 29) were unmarried, 43.6% (n = 24) were married, and 3.6% (n = 2) were widowed. Most patients were classified as having stage IV AIDS (70.9%, n = 39), while others were in stage III (21.8%, n = 12) or stage II (7.3%, n = 4).

Clinical characteristics and patient outcomes

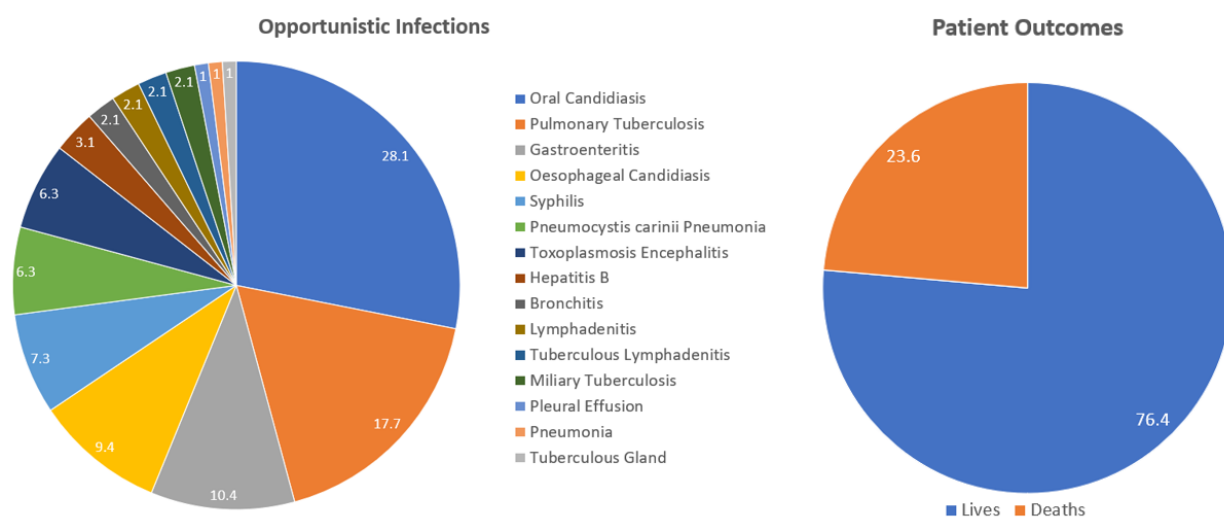


Figure 2. Clinical characteristics and patient outcomes

A total of 96 opportunistic infections were identified among the 55 patients, highlighting that some patients experienced multiple infections. The most common opportunistic infection was oral candidiasis (28.1%, n = 27), followed by pulmonary tuberculosis (17.7%, n = 17), gastroenteritis (10.4%, n = 10), and oesophageal candidiasis (9.4%, n = 9). Other notable infections included syphilis (7.3%, n = 7), *Pneumocystis carinii* pneumonia (6.3%, n = 6), and toxoplasmosis encephalitis (6.3%, n = 6). Less frequent infections included hepatitis B (3.1%, n = 3), bronchitis (2.1%, n = 2), lymphadenitis (2.1%, n = 2), and miliary tuberculosis (2.1%, n = 2). Rare cases included pleural effusion (1.0%, n = 1), pneumonia (1.0%, n = 1), and tuberculous gland (1.0%, n = 1). The treatment outcomes demonstrated that 76.4% (n = 42) of the patients were discharged in stable condition, while 23.6% (n = 13) succumbed to their illnesses during the study period. Notably, some patients were

diagnosed with more than two opportunistic infections, emphasizing the severe immunocompromised state observed in this population.

DISCUSSION

This study provides crucial insights into the demographic and clinical characteristics of HIV/AIDS patients treated at Cut Mutia General Hospital in Lhokseumawe, Aceh, particularly in understanding the burden of opportunistic infections (OIs) and treatment outcomes. These findings align with and expand on existing literature, highlighting significant challenges and opportunities for improving HIV/AIDS management in resource-limited settings.

The predominance of male patients (67.3%) in this study is consistent with global and regional trends, where men are disproportionately affected by HIV due to higher-risk behaviors such as unprotected sexual activity and injecting drug use (Harjoni, 2023; Pinheiro et al., 2018; Tewachew et al., 2021). The concentration of cases among the productive age group (25–44 years, 81.8%) underscores the socio-economic impact of HIV/AIDS, as individuals in this age range are key contributors to household and national productivity. Studies by Buchacz et al (2016) and Shi et al (2011) have similarly noted that this demographic bears the highest burden of disease, necessitating targeted prevention and intervention strategies. The finding that most patients have completed high school education (56.4%) suggests that awareness and knowledge gaps about HIV/AIDS persist even among educated populations. Research in Ethiopia by Tewachew et al (2021) identified similar patterns, where educational attainment did not always correlate with comprehensive knowledge about HIV transmission and prevention. Additionally, the high proportion of unmarried patients (52.7%) highlights vulnerabilities among single individuals, particularly related to limited social support and increased engagement in high-risk behaviors (Buchacz et al., 2016; Fatimatuzzahra et al., 2022; Tewachew et al., 2021).

The predominance of oral candidiasis (28.1%) as the most common opportunistic infection aligns with global evidence that candidiasis serves as a frequent marker of severe immunosuppression in HIV patients (Ahmetagic et al., 2015; Montúfar-Andrade et al., 2016; Savadogo et al., 2021). Pulmonary tuberculosis (17.7%) remains a critical concern in regions with a high TB burden, corroborating studies by Fatimatuzzahra et al (2022) and Buchacz et al (2016) that identify TB as both a primary cause of morbidity and mortality among HIV/AIDS patients. The co-occurrence of TB with other OIs, such as toxoplasmosis encephalitis (6.3%) and *Pneumocystis carinii* pneumonia (6.3%), highlights the severe immune dysfunction characteristic of advanced AIDS stages (Elango et al., 2022; Kawakami et al., 2018; Radisic, 2018).

The presence of multiple infections in individual patients reflects the cumulative burden of immunosuppression. At least one patient in this study experienced more than two OIs, illustrating the

complexity of clinical management. Such cases demand an integrated approach, combining antimicrobial therapies with supportive care, as recommended by global treatment guidelines (WHO, 2021). Gastroenteritis (10.4%) and oesophageal candidiasis (9.4%) were also notable contributors to morbidity, emphasizing the need for vigilant monitoring of gastrointestinal symptoms, which are often overlooked in routine care (Epplein et al., 2014; Patel, 2023; Qua et al., 2020).

The mortality rate of 23.6% observed in this study underscores the challenges of managing advanced HIV/AIDS in resource-limited settings. Similar studies in Indonesia and sub-Saharan Africa report comparable mortality rates, often linked to late presentation, co-infections, and delayed initiation of antiretroviral therapy (ART) (Dereje et al., 2019; Harjoni, 2023; Pantazis et al., 2023). The successful discharge of 76.4% of patients indicates that timely and appropriate clinical interventions can lead to positive outcomes, even in advanced cases. However, the need for early diagnosis and ART initiation remains critical to reducing mortality further.

This study contributes valuable data to the growing body of literature on HIV/AIDS management in Indonesia, particularly in Aceh. The high prevalence of opportunistic infections highlights gaps in prevention and early detection, necessitating stronger community-based health education and outreach programs. Research by Tewachew et al (2021) and Fatimatuzzahra et al (2022) supports the implementation of peer support groups and targeted education campaigns to address stigma and improve treatment adherence. The study also emphasizes the importance of integrating tuberculosis control programs with HIV care services, given the significant overlap between these conditions. WHO (2021) recommends routine TB screening for all HIV patients, a practice that could significantly reduce morbidity and mortality in settings like Aceh.

The findings underscore the need for comprehensive training of healthcare providers in managing complex cases of HIV/AIDS with multiple OIs. Strengthening diagnostic capacities, such as access to advanced imaging and laboratory tests, is essential for timely identification and treatment of infections like toxoplasmosis encephalitis and *Pneumocystis pneumonia*. Additionally, expanding ART coverage and ensuring uninterrupted drug supply chains are critical for sustaining treatment success rates. From a policy perspective, integrating HIV care into primary healthcare systems can enhance access and reduce stigma, as recommended by global health organizations (Buchacz et al., 2016; WHO, 2021). Collaborative efforts between governmental and non-governmental organizations are vital to address the multifaceted challenges posed by HIV/AIDS in resource-limited settings.

This study has several limitations. The retrospective design may limit the completeness of data, particularly in documenting patient histories and follow-ups. Additionally, the study was conducted in a single hospital, which may not represent the broader HIV/AIDS population in Aceh or Indonesia. Future

research should consider multicenter studies and longitudinal designs to provide a more comprehensive understanding of disease progression and treatment outcomes.

CONCLUSION

The findings of this study provide a detailed overview of the demographic, clinical, and treatment characteristics of HIV/AIDS patients in Cut Mutia General Hospital in Lhokseumawe, Aceh. These results highlight the urgent need for improved prevention, early diagnosis, and integrated care services to address the high burden of opportunistic infections and associated mortality. By addressing these gaps, healthcare providers and policymakers can enhance the quality of life for individuals living with HIV/AIDS and contribute to the broader goal of epidemic control.

REFERENCES

- Adamu, H., & Petros, B. (2010). Intestinal Protozoan Infections Among HIV Positive Persons With and Without Antiretroviral Treatment (ART) in Selected ART Centers in Adama, Afar and Dire-Dawa, Ethiopia. *Ethiopian Journal of Health Development*, 23(2). <https://doi.org/10.4314/ejhd.v23i2.53230>
- Ahmetagic, S., Porobic-Jahic, H., Piljic, D., Custovic, A., Sabitović, D., & Zepic, D. (2015). Clinical and Epidemiological Characteristics of HIV Infection/Aids in Hospitalized Patients. *Materia Socio Medica*, 27(1), 27. <https://doi.org/10.5455/msm.2014.27.27-30>
- Almaw, A. (2024). Prevalence of Opportunistic Intestinal Coccidian Parasites and Associated Factors in HIV/AIDS Patients Attending Anti-retroviral Therapy (ART) Clinic at Debre Tabor Comprehensive Specialized Hospital, Northwest Ethiopia: A Cross-sectional Study. *Health Science Reports*, 7(9). <https://doi.org/10.1002/hsr2.70056>
- Ando, K. (2024). Impact of HIV Status on Prognosis of Malignancies Among People Living With HIV in Japan. *Cancer*. <https://doi.org/10.1002/cncr.35351>
- Buchacz, K., Lau, B., Jing, Y., Bosch, R. J., Abraham, A. G., Gill, M. J., Silverberg, M. J., Goedert, J. J., Sterling, T. R., Althoff, K. N., Martin, J. N., Burkholder, G. A., Gandhi, N. R., Samji, H., Patel, P., Rachlis, A., Thorne, J. E., Napravnik, S., Henry, K., ... Brooks, J. T. (2016). Incidence of AIDS-Defining Opportunistic Infections in a Multicohort Analysis of HIV-infected Persons in the United States and Canada, 2000–2010. *The Journal of Infectious Diseases*, 214(6), 862–872. <https://doi.org/10.1093/infdis/jiw085>
- Damtie, D., Yismaw, G., Woldeyohannes, D., & Anagaw, B. (2013). Common Opportunistic Infections and Their CD4 Cell Correlates Among HIV-infected Patients Attending at Antiretroviral Therapy Clinic of Gondar University Hospital, Northwest Ethiopia. *BMC Research Notes*, 6(1). <https://doi.org/10.1186/1756-0500-6-534>
- Dawet, A., & Onaiyekan, O. E. (2020). Prevalence of Malaria and Some Opportunistic Infections in Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome (HIV/AIDS) Patients With CD4 Below 200 in Faith Alive Hospital, Jos, Plateau State, Nigeria. *International Journal of Virology and Aids*, 7(1). <https://doi.org/10.23937/2469-567x/1510058>
- Dereje, N., Moges, K., Nigatu, Y., & Holland, R. (2019). Prevalence And Predictors Of Opportunistic Infections Among HIV Positive Adults On Antiretroviral Therapy (On-ART) Versus Pre-ART In

- Addis Ababa, Ethiopia: A Comparative Cross-Sectional Study. *HIV/AIDS - Research and Palliative Care*, Volume 11, 229–237. <https://doi.org/10.2147/HIV.S218213>
- Elango, K., Mudgal, M., Murthi, S., Yella, P. R., Nagrecha, S., Srinivasan, V., Sekar, V., Koshy, M., Ramalingam, S., & Gunasekaran, K. (2022). Trends in the Epidemiology and Outcomes of Pneumocystis Pneumonia Among Human Immunodeficiency Virus (HIV) Hospitalizations. *International Journal of Environmental Research and Public Health*. <https://doi.org/10.3390/ijerph19052768>
- Epplein, M., Bostick, R. M., Mu, L., Ogino, S., Braithwaite, D., & Kanetsky, P. A. (2014). Challenges and Opportunities in International Molecular Cancer Prevention Research: An ASPO Molecular Epidemiology and the Environment and International Cancer Prevention Interest Groups Report. *Cancer Epidemiology, Biomarkers & Prevention*, 23(11), 2613–2617. <https://doi.org/10.1158/1055-9965.EPI-14-0848>
- Fatimatu Zahra, D. S. L., Ganiem, A. R., Cahyani, A., Gunadharma, S., & Dian, S. (2022). Prevalence of Opportunistic Infection in Central Nervous System Among Patients With HIV/AIDS at Dr. Hasan Sadikin General Hospital Bandung, Indonesia. *Althea Medical Journal*, 9(2), 100–105. <https://doi.org/10.15850/amj.v9n2.2298>
- Fenner, L., Atkinson, A., Boule, A., Fox, M. P., Prozesky, H., Zürcher, K., Ballif, M., Furrer, H., Zwahlen, M., Davies, M., & Egger, M. (2017). HIV Viral Load as an Independent Risk Factor for Tuberculosis in South Africa: Collaborative Analysis of Cohort Studies. *Journal of the International Aids Society*, 20(1). <https://doi.org/10.7448/ias.20.1.21327>
- Harjoni. (2023). Pemberian Mitigasi Dan Pemberdayaan ODHA Di Aceh Melalui Kelompok Dukungan Sebaya (KDS) Seudara. *Sambara Jurnal Pengabdian Kepada Masyarakat*, 1(2), 83–89. <https://doi.org/10.58540/sambarapkm.v1i2.256>
- Kawakami, M., Tominaga, M., Yano, C., Okamoto, M., Nakamura, M., Sakazaki, Y., Naito, Y., Kawayama, T., & Hoshino, T. (2018). Correlation of CT Findings and Clinical Characteristics of Pneumocystis Pneumonia in Patients With Acquired Immunodeficiency Syndrome. *Biology and Medicine*. <https://doi.org/10.4172/0974-8369.1000447>
- Mo, I. (2016). Disparities in the Magnitude of Human Immunodeficiency Virus-Related Opportunistic Infections Between High and Low/Middle-Income Countries: Is Highly Active Antiretroviral Therapy Changing the Trend? *Annals of Medical and Health Sciences Research*, 6(1), 4. <https://doi.org/10.4103/2141-9248.180234>
- Montúfar-Andrade, F. E., Villa-Franco, J. P., Montúfar-Pantoja, M. C., Cadavid-Usuga, J. C., Monsalve, M. A., Zuluaga, M., Díaz, L., Vega, J., Vélez, J. D., Zuleta-Tobón, J. J., Zuleta-Tobón, J. J., & Madrid, C. (2016). Pulmonary compromise in inpatients with human immunodeficiency virus infection at Pablo Tobón Uribe Hospital, Medellín, Colombia | Compromiso pulmonar en pacientes hospitalizados con infección por el virus de inmunodeficiencia humana en el Hospital Pablo . *Infectio*, 20(4), 211–217. <https://doi.org/10.1016/j.infect.2015.10.004>
- Opoku, Y. K., Boampong, J. N., Ayi, I., Kwakye-Nuako, G., Obiri-Yeboah, D., Koranteng, H., Ghartey-Kwansah, G., & Asare, K. K. (2018). Socio-Behavioral Risk Factors Associated With Cryptosporidiosis in HIV/AIDS Patients Visiting the HIV Referral Clinic at Cape Coast Teaching Hospital, Ghana. *The Open Aids Journal*, 12(1), 106–116. <https://doi.org/10.2174/1874613601812010106>
- Pantazis, N., Pappas, V., Papastamopoulos, V., Metallidis, S., Antoniadou, A., Adamis, G., Psychgiou, M., Chini, M., Sambatakou, H., Chrysos, G., Sipsas, N. V., Gogos, C., Barbunakis, E., Panagopoulos, P., Κατσαπού, O., & Touloumi, G. (2023). Low Pre-Art CD4 Count Is Associated

With Increased Risk of Clinical Progression or Death Even After Reaching 500 CD4 Cells/ML on ART. *Plos One*. <https://doi.org/10.1371/journal.pone.0283648>

- Patel, C. (2023). An Unusual Discovery of Multi-Opportunistic Organisms in Gastrointestinal Biopsies of a Patient With Acquired Immunodeficiency Syndrome and Infectious Colitis. *Cureus*. <https://doi.org/10.7759/cureus.50124>
- Pinheiro, M. V. C., Ho, Y.-L., Nicodemo, A. C., & Duarte-Neto, A. N. (2018). The Diagnosis of Multiple Opportunistic Infections in Advanced Stage AIDS: When Ockham S Razor Doesn T Cut It. *Autopsy and Case Reports*, 8(2). <https://doi.org/10.4322/acr.2018.028>
- Qua, K., Papp, K. K., Junk, D. J., Webb Hooper, M., & Berger, N. A. (2020). Youth Enjoy Science Program at the Case Comprehensive Cancer Center: Increasing Engagement and Opportunity for Underrepresented Minority Students. *Ethnicity & Disease*, 30(1), 15–24. <https://doi.org/10.18865/ed.30.1.15>
- Radisic, M. (2018). Extrapulmonary Pneumocystis Jirovecii Presenting as Fever and Lymphadenopathies. Case Report and Literature Review. *Journal of Infectious Diseases & Travel Medicine*. <https://doi.org/10.23880/jidtm-16000113>
- Sanyaolu, A., Oyibo, W. A., Iriemenam, N. C., & Badaru, O. S. (2016). Sero-Prevalence Study of Parasitic Infections Among HIV Positive and Negative Patients in Lagos, Nigeria. *African Journal of Clinical and Experimental Microbiology*, 17(2), 88. <https://doi.org/10.4314/ajcem.v17i2.3>
- Savadogo, M., Diallo, I., & Sondo, K. A. (2021). Opportunistic Infections Diagnosed in Patients Infected With the Human Immunodeficiency Virus (Hiv) at the Service of Infectious Diseases of Uhc (University Hospital Center) Yalgado Ouédraogo, Burkina Faso. *Pijr*, 1–2. <https://doi.org/10.36106/paripex/7006220>
- Shi, Y., Lu, H., He, T., Yang, Y. L., Liu, L., Zhang, R., Zheng, Y., Shen, Y., Zhang, Y., & Zhang, Z. (2011). Prevalence and Clinical Management of Cytomegalovirus Retinitis in AIDS Patients in Shanghai, China. *BMC Infectious Diseases*, 11(1). <https://doi.org/10.1186/1471-2334-11-326>
- Teeka, J. S. (2023). *Factors Associated With Opportunistic Infections Among HIV/AIDS Patients Attending Comprehensive Care Clinic at Mbagathi District Hospital*. <https://doi.org/10.21203/rs.3.rs-3262226/v1>
- Tewachew, A. S., Negash, W., Mekuria, A. D., & Amare, Y. E. (2021). Determinants of Opportunistic Infections Among HIV-Positive Patients on HAART in Debre Berhan Referral Hospital, North Shoa Zone, Ethiopia, 2020: A Case–Control Study. *Hiv/Aids - Research and Palliative Care*. <https://doi.org/10.2147/hiv.s298661>
- Utarini, G. A. E. (2017). Predictors of Improved Nutritional Status Among HIV/AIDS Patients Who Received Antiretroviral Therapy (ART) at Sanglah General Hospital Denpasar. *Public Health and Preventive Medicine Archive*, 5(2), 147–151. <https://doi.org/10.53638/phpma.2017.v5.i2.p14>
- WHO. (2021). *Key Facts HIV/AIDS*. www.who.int/news-room/fact-sheets/detail/hiv-aids
- Wulandari, A. (2023). Risk Factors and Adverse Drug Reactions in HIV/AIDS Patients at Undata Regional Hospital in Palu City, Indonesia. *Sciences of Pharmacy*, 2(4), 45–53. <https://doi.org/10.58920/sciphar02040045>