

# Characteristics of Sexually Transmitted Infections in Patients with Human Immunodeficiency Virus /Acquired Immunodeficiency Syndrome at Abepura Regional Hospital: A Descriptive Study

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## ABSTRACT

**Background:** Sexually Transmitted Infections (STIs) are a public health problem that remains a global challenge, especially for people with Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome (HIV/AIDS). STI co-infection in HIV patients can worsen clinical conditions, increase the risk of complications, and increase the possibility of HIV transmission to sexual partners. The relationship between HIV and STIs is bidirectional, where STIs can increase the risk of HIV transmission through genital mucosal damage and inflammatory processes, while a decreased immune system in HIV patients can worsen the manifestations of STIs. Papua is one of the provinces with a high number of HIV/AIDS cases in Indonesia, so it is important to understand the types of STIs and the factors that contribute to the occurrence of STIs in people with HIV/AIDS. **Objective:** This study aims to determine the most common types of STIs and the characteristic factors that contribute to the incidence of STIs in HIV/AIDS patients at the VCT Clinic of Abepura Regional Hospital for the period 2022–2024. **Methods:** This study used a quantitative approach with a descriptive design. The study sample consisted of 63 medical records of HIV/AIDS patients with STIs selected using a purposive sampling technique. Data were collected through a review of medical record documents and analyzed descriptively using frequency distribution and crosstabulation. **Results:** The results showed that the most common type of STI found was syphilis with 55 cases (87.3%), followed by gonorrhea with 5 cases (7.9%) and condyloma acuminata with 3 cases (4.8%). The majority of patients were in the 17–25 years age group (39.7%), male (55.6%), had a high school education (81%), were unemployed (34.9%), single (63.5%), and had high-risk sexual behavior (84.1%). No patients were found with a history of drug use. **Conclusion:** Syphilis was the most prevalent STI among HIV/AIDS patients at the VCT Clinic at Abepura Regional Hospital. The most common characteristics among HIV/AIDS patients with STI coinfection were young age, male gender, secondary education, single status, unemployed, and high-risk sexual behavior

**Keywords:** HIV/AIDS, Sexually Transmitted Infections, Syphilis, Risky Sexual Behavior, VCT

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## 1. INTRODUCTION

Human Immunodeficiency Virus (HIV) and Acquired Immunodeficiency Syndrome (AIDS) remain global health problems, significantly impacting morbidity and mortality in various countries. HIV attacks the immune

system, specifically CD4 lymphocytes, causing decreased immunity and increasing susceptibility to various opportunistic and sexually transmitted infections (STIs) (Justiz Vaillant & Gulick, 2022). According to the World Health Organization (WHO), HIV/AIDS remains a global health problem, with the number of sufferers continuing to increase in various countries, particularly in areas with limited access to health services and sexual education [1].

In Indonesia, HIV/AIDS remains a serious public health challenge. According to a 2023 report from the Indonesian Ministry of Health, the number of reported HIV cases reached 57,299, with the highest proportion occurring in the productive age group of 25–49 years (64%), followed by the 20–24 age group (18.1%). Based on regional distribution, Papua Province has one of the highest number of HIV/AIDS cases in Indonesia and has ranked first for AIDS cases in several national reporting periods [2]. This indicates that HIV/AIDS remains a health problem that requires serious attention, especially with regard to the incidence of comorbidities such as sexually transmitted infections [3].

Sexually Transmitted Infections (STIs) are a group of diseases transmitted primarily through sexual contact, whether vaginal, anal, or oral, and can be caused by bacteria, viruses, parasites, or fungi. In addition to sexual contact, some STIs, including HIV, can also be transmitted through blood transfusions, shared needles, and procedures with non-sterile instruments, such as tattoos or body piercings [4][5]. According to the WHO, STIs remain a significant public health problem because they impact reproductive health and quality of life and increase the risk of transmission of other diseases, including HIV [6].

The relationship between HIV and STIs is reciprocal. The presence of an STI can increase a person's risk of contracting HIV due to damage to the genital mucosa, inflammation, and an increased number of HIV target cells in the genital area. Conversely, a weakened immune system in HIV-positive individuals can lead to more severe, atypical, and more difficult-to-treat STIs [5][7]. The literature shows that individuals with STIs have a higher risk of HIV transmission than those without STIs, making this co-infection a significant concern in HIV/AIDS prevention and control efforts [5][8].

The incidence of STIs in people with HIV/AIDS is influenced by various internal and behavioral factors, including age, gender, education level, occupation, marital status, risky sexual behavior, drug use, and other social characteristics [9][10]. Younger age groups tend to be more curious and engage in more exploratory sexual behavior, increasing the risk of STI exposure. Furthermore, unprotected sexual behavior, multiple sexual partners, and low knowledge of reproductive health are also contributing factors to the incidence of STIs [11][12].

Voluntary Counseling and Testing (VCT) clinics are a form of health service that plays a crucial role in the prevention, early detection, and management of HIV/AIDS, including the detection of sexually transmitted infections that often co-occur in HIV patients. VCT services provide counseling, examinations, and education related to risky sexual behavior and disease transmission prevention [11]. The VCT clinic at Abepura Regional Hospital, a health-care facility in Jayapura City, plays a crucial role in providing health services for HIV/AIDS patients, including the detection and treatment of STIs [13].

Based on the significant relationship between HIV/AIDS and the incidence of sexually transmitted infections, research is needed to determine the types of STIs and the characteristic factors contributing to the incidence of STIs in patients with HIV/AIDS at the VCT Clinic at Abepura Regional Hospital in 2022–2024. The results of this study are expected to form the basis for developing prevention strategies, reproductive health education, and more effective interventions for at-risk groups to reduce the incidence of STIs in patients with HIV/AIDS.

## 2. METHOD

This study used a quantitative approach with a descriptive design, which aimed to systematically describe the characteristics of a phenomenon based on data obtained without intervening on the variables studied [14]. The descriptive approach was chosen because this study focuses on describing the types of sexually transmitted infections (STIs) and the characteristic factors found in HIV/AIDS patients at the Voluntary Counseling and Testing (VCT) Clinic at Abepura Regional Hospital during the period 2022–2024.

Quantitative descriptive research was conducted by collecting numerical data from secondary data, which were then analyzed to determine the frequency distribution of each research variable. This study used a descriptive design to describe the distribution of characteristics of HIV/AIDS patients with STI coinfections based on age, gender, education level, occupation, marital status, risky sexual behavior, drug use, and the type of STI.

This research was conducted at the VCT Clinic of Abepura Regional Hospital, Jayapura City, Papua Province, which is one of the referral health service facilities for handling HIV/AIDS patients, including counseling services, examinations, treatment, and monitoring of HIV/AIDS patients.

Data collection was carried out through a review of the medical records of HIV/AIDS patients with STI co-infections in the period 2022 to 2024, while the processing and analysis process

The population in this study included all HIV/AIDS patients who experienced co-infection with sexually transmitted infections (STIs) at the VCT Clinic at Abepura Regional Hospital between 2022 and –2024.

The sample in this study was the medical record data of patients with HIV/AIDS and STIs who met the inclusion criteria during the study period, with a total sample of 63 patient medical records.

### 3. RESULTS AND DISCUSSION

Table 1. Distribution of Patients Between Internal Factors and STI Types.

Internal Factors	Category	Syphilis	%	Gonorrhea	%	Condyloma	%	Total	%
Age	17 – 25	20	31.7	4	6.3	1	1.6	25	39.7
	26 – 35	20	31.7	0	0	1	1.6	21	33.3
	36 – 45	10	15.9	1	1.6	0	0	11	17.5
	Other	5	7.9	0	0	1	1.6	6	9.5
Gender	Man	30	47.6	5	7.9	0	0	35	55.6
	Woman	25	39.7	0	0	3	4.8	28	44.4
Education	Elementary School	3	4.8	0	0	0	0	3	4.8
	JUNIOR HIGH SCHOOL	7	11.1	1	1.6	0	0	8	12.7
	SENIOR HIGH SCHOOL	44	69.8	4	6.3	3	4.8	51	81
	D3	1	1.6	0	0	0	0	1	1.6
Work	Doesn't work	19	30.2	1	1.6	2	3.2	22	34.9
	Student	11	17.5	1	1.6	0	0	12	19
	Private sector employee	7	11.1	3	4.8	0	0	10	15.9
	Housewife	8	12.7	0	0	1	1.6	9	14.3
	Driver	8	12.7	0	0	0	0	8	12.7
	Civil Servants/Police	2	3.2	0	0	0	0	2	3.2
	Marital status	Not married yet	36	57.1	3	4.8	1	1.6	40
	Marry	16	25.4	2	3.2	1	1.6	19	30.2
	Widow	1	1.6	0	0	1	1.6	2	3.2
	Widower	2	3.2	0	0	0	0	2	3.2
Risky Sexual Behavior	Vaginal	47	74.6	5	7.9	1	1.6	53	84.1
	Vaginal & anal	8	12.7	0	0	2	3.2	10	15.9
Drug Use	No	55	87.3	5	7.9	3	4.8	63	100
	Yes	0	0	0	0	0	0	0	0

The results of the study showed that the most common sexually transmitted infection (STI) found in HIV/AIDS patients at the VCT Clinic at Abepura Regional Hospital during the 2022–2024 period was syphilis, with 55 cases (87.3%), followed by gonorrhea with 5 cases (7.9%), and condyloma acuminata with 3 cases (4.8%). These findings indicate that syphilis was the most prevalent STI in HIV/AIDS patients in this study [15].

The high incidence of syphilis in patients with HIV/AIDS can be explained by the shared transmission pathway between syphilis and HIV, namely, through risky sexual intercourse. The presence of lesions or ulcers in syphilis can increase the risk of HIV entry through damage to the genital mucosa, facilitating HIV transmission. Conversely, in HIV patients with compromised immune systems, syphilis can be more severe, and co-infection is more likely [5][7].

The results of this study align with the theory that syphilis is one of the STIs most frequently found as a co-infection in HIV/AIDS patients because of the epidemiological and biological relationship between the two diseases [5]. Furthermore, VCT services that focus on HIV and STI screening enable syphilis to be detected more frequently in patients with HIV than in other STIs [11][16].

The predominance of syphilis cases in this study also indicates that HIV transmission in the study patient group is likely still closely related to risky sexual behavior, especially unprotected sex with high-risk sexual partners.

Based on age, the study results showed that the 17–25 age group was the largest group of HIV/AIDS patients with STIs, with 25 people (39.7%), followed by the 26–35 age group with 20 individuals (31.7%). These findings indicate that HIV/AIDS with STI coinfection is more common in young and productive age groups [17][18].

Young people are biologically and psychosocially more likely to engage in risky sexual behavior. In this age group, curiosity, sexual exploration, and social influences can increase the risk of unsafe sex, potentially leading to the transmission of STIs and HIV [11][19].

The results of this study align with a report from the Indonesian Ministry of Health, which indicates that HIV cases in Indonesia are most prevalent among productive age groups, particularly young adults and those in early adulthood. Furthermore, Semwogerere et al. (2021) stated that young people are more likely to experience STIs because of their active sexual behavior, low condom use, and low-risk perception of sexually transmitted infections [9].

Thus, the young age group requires special attention in reproductive health education and HIV/AIDS prevention programs [18].

Based on gender, the research results show that the majority of HIV/AIDS sufferers with STIs are male (35 people, 55.6%), while 28 people (44.4%) are female [20].

The high proportion of men in this study may be related to the risky sexual behaviors more commonly found in men, including multiple sexual partners, low use of protective equipment, and more active sexual behavior in certain groups [9]. Furthermore, men tend to be at a higher risk of syphilis and other STIs associated with high-risk sexual behavior [21].

The results of this study align with previous research showing that men have a higher proportion of HIV cases with STI co-infections, particularly in groups with high-risk sexual behavior [11]. However, the proportion of women in this study was also quite high, indicating that HIV and STI transmission occurs in men and poses a reproductive health problem for women [22].

These findings suggest that HIV/AIDS and STI prevention efforts should target both men and women, with approaches tailored to their respective risk characteristics.

Based on educational level, the research results showed that the majority of respondents had a high school education, with 51 people (81%). This indicates that the majority of HIV/AIDS patients with STIs in this study came from the secondary education group [23].

Education level is one factor that can influence a person's knowledge, attitude, and behavior regarding reproductive health. Individuals with higher levels of education generally have greater access to information, but this does not necessarily guarantee protection from risky sexual behavior if it is not accompanied by good health practices.

The results of this study indicate that, despite the majority of respondents having secondary education, the incidence of HIV/AIDS and STI co-infection remains high. This suggests that formal knowledge alone is insufficient to prevent risky sexual behavior, necessitating more specific health education related to HIV/AIDS and STIs.

Based on the work, the research results show that the majority of respondents were in the unemployed group, namely 22 people (34.9%).

Employment status can be related to a person's socioeconomic status, including access to health information, social behavior, and interaction patterns, which can influence the risk of HIV and other STIs. Unemployed individuals may experience certain social vulnerabilities that can potentially influence risky behaviors directly and indirectly.

These findings indicate that socioeconomic factors must also be considered in HIV/AIDS and STI prevention programs, especially for groups with economic vulnerability.

Based on marital status, the research results show that the majority of respondents are unmarried (40 people, 63.5%).

Unmarried status in this study is likely related to more flexible sexual relationship patterns or sexual relations outside of marriage, which have the potential to increase the risk of exposure to STIs and HIV if not accompanied by safe sexual behavior [24].

Previous research has shown that unmarried individuals are more likely to engage in sexual relations with casual partners than married individuals, resulting in a higher risk of STI and HIV transmission.

These findings indicate that education related to reproductive health and safe sexual behavior needs to be strengthened, especially among young and unmarried age groups.

Based on marital status, the research results show that the majority of respondents had risky sexual behavior, namely 53 people (84.1%).

Risky sexual behavior is a major factor in the transmission of HIV and STIs. Risky sexual behaviors include unprotected sex, multiple partners, sex with high-risk partners, and other unsafe sexual behaviors.

The results of this study support the theory that risky sexual behavior is a dominant factor in the incidence of HIV/AIDS and STIs. According to Semwogerere et al. (2021), risky sexual behavior is strongly associated with an increased incidence of sexually transmitted infections, particularly among young and sexually active age groups [9].

The high proportion of risky sexual behavior in this study indicates that HIV/AIDS prevention interventions in VCT Clinics need to focus not only on treatment but also on strengthening education on behavior change and promoting consistent condom use [25].

Based on the history of drug use, the results of the study showed that none of the respondents (100%) had a history of drug use.

These findings suggest that in this study, HIV/AIDS transmission with STI coinfection was most likely unrelated to drug use but rather predominantly through sexual transmission. This contrasts with some theories that suggest that injection drug use is a significant risk factor for HIV transmission because of shared needles.

The absence of a history of drug use in this study may indicate that the epidemiological pattern of HIV/AIDS in patients at the VCT Clinic at Abepura Regional Hospital is more dominated by sexual behavior compared to injection drug use.

#### 4. CONCLUSION

Based on the results of research on the description of sexually transmitted infections (STIs) in HIV/AIDS patients at the VCT Clinic of Abepura Regional Hospital for the period 2022–2024, it was found that the type of STI most commonly suffered by patients was syphilis, with a total of 55 cases (87.3%) of 63 patients, while the least number of cases was condyloma acuminata with 3 cases (4.8%) of 63 patients. This indicates that syphilis is the most dominant form of sexually transmitted infection as a co-infection in HIV patients in this region. The respondents most likely to have syphilis were those aged 17–25, male, with a high school education, single, and mostly unemployed. Furthermore, most respondents reported having engaged in risky vaginal intercourse, and none reported drug use as a risk factor. These findings indicate that young age, risky sexual behavior, and secondary education are dominant factors contributing to the high rate of STI coinfection, particularly syphilis, in HIV/AIDS patients. This highlights the importance of more intensive education and counseling regarding reproductive health.

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#### REFERENCES

- [1] WHO., “Sexually Transmitted Infections (Stis). [https://www.who.int/news-room/fact-sheets/detail/sexually-transmitted-infections-\(stis\)#:~:text=Eight Pathogens Are Linked To,And Human Papillomavirus \(HPV\)](https://www.who.int/news-room/fact-sheets/detail/sexually-transmitted-infections-(stis)#:~:text=Eight Pathogens Are Linked To,And Human Papillomavirus (HPV))”.
- [2] K. K. RI., “Laporan Eksekutif Perkembangan HIV AIDS Dan Penyakit Menular Seksual Triwulan I. Retrieved from <https://hivaid-s-pimsindonesia.or.id>,” 2023.
- [3] S. M. Yuniarsih, M. K. Umam, R. W. Martani, R. A. Vianti, and N. Hasanah, “Understanding Adolescent Risk Behaviors: Insights from a School-Based Health Student Survey,” *E3S Web Conf.*, vol. 622, p. 02011, Apr. 2025, doi: 10.1051/e3sconf/202562202011.
- [4] P. E. Pradnyani, I. G. N. E. Putra, and N. L. E. P. Astiti, “Knowledge, attitude, and behavior about sexual and reproductive health among adolescent students in Denpasar, Bali, Indonesia,” *GHMJ (Global Heal. Manag. Journal)*, vol. 3, no. 1, pp. 31–39, Feb. 2019, doi: 10.35898/ghmj-31554.
- [5] D. Masriadi, “EPIDEMIOLOGI PENYAKIT MENULAR. Depok: PT RajaGrafindo Persada,” 2017.
- [6] WHO, “Sexually Transmitted Infections (Stis). World Health Organization (WHO). [https://www.who.int/health-topics/sexually-transmitted-infections#Tab=Tab\\_1](https://www.who.int/health-topics/sexually-transmitted-infections#Tab=Tab_1)”.
- [7] P. . Justiz Vaillant, A.A., & Gulick, “HIV Disease Current Practice. (WWW Document). Elsevier,,” 2022.
- [8] S. Paul, R. Dayal, A. J. Sharma, K. Seth, S. Ramesh, and N. Saggurti, “Unpacking vulnerability to sexually transmitted infections (STIs)/human immunodeficiency virus (HIV) among adolescent girls and young women in India: A qualitative study,” *PLoS One*, vol. 20, no. 11, p. e0336593, Nov. 2025, doi: 10.1371/journal.pone.0336593.
- [9] M. Semwogerere *et al.*, “Factors associated with sexually transmitted infections among care-seeking adults in the African Cohort Study,” *BMC Public Health*, vol. 21, no. 1, p. 738, Dec. 2021, doi: 10.1186/s12889-021-10762-4.
- [10] Nirwanto K. Rahim and Erwin Purwanto, “A PLISSIT-BASED COMPREHENSIVE SEXUAL EDUCATION INTERVENTION ON ATTITUDES TOWARDS HIV TRANSMISSION PREVENTION IN ADOLESCENTS: A GENDER EQUALITY PERSPECTIVE,” *Multidiscip. Indones. Cent. J.*, vol. 2, no. 4, pp. 5800–5809, Dec. 2025, doi: 10.62567/micjo.v2i4.1746.
- [11] W. G. Refti, “Faktor Resiko yang Berhubungan dengan Kejadian Infeksi Menular Seksual (IMS) di Klinik Voluntary Counseling Test (VCT). *Jurnal Aisyah: Jurnal Ilmu Kesehatan*, 3(1), 47-60,,” 2018.
- [12] L. I. Sirait, “Perilaku Seksual Berisiko Infeksi Menular Seksual. *Jurnal Ilmiah PANNMED (Pharmacist, Analyst, Nurse, Nutrition, Midwifery, Environment, Dentist)*, 16(1), 150-154,,” 2021.
- [13] M. L. Ramdani, “Hubungan Pengetahuan, Lama Terapi dan Akses Layanan Terhadap Kepatuhan Minum Obat Pada ODHIV,” *J. Kesehat. Glob.*, vol. 7, no. 2, pp. 90–96, May 2024, doi: 10.33085/jkg.v7i2.6100.
- [14] A. dkk. Fauzi, “Metodologi Penelitian. Banyumas: CV. Pena Persada. 2022,,” 2022.
- [15] N. A. L. Nurjanah, “The Correlation Between Reproductive Health Literacy and the Prevention of Sexually  
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- Transmitted Infections (STIs) in the School Environment,” *J. Kesehat. Budi Luhur J. Ilmu-Ilmu Kesehat. Masyarakat, Keperawatan, dan Kebidanan*, vol. 19, no. 1, pp. 227–234, Feb. 2026, doi: 10.62817/jkbl.v19i1.489.
- [16] K. Ayano, T. T. Desta, M. K. Takele, E. Amsalu, and D. J. Birri, “Knowledge, attitude, practice, and risky behaviours related to sexually transmitted infections among preparatory school students in western Addis Ababa, Ethiopia,” *Discov. Public Heal.*, vol. 22, no. 1, p. 139, Apr. 2025, doi: 10.1186/s12982-025-00522-9.
- [17] C. Mutie, J. Gachohi, K. Kithuci, and G. Mbuthia, “Behavior Change Communication Strategies on Human Immunodeficiency Virus /Acquired Immunodeficiency Syndrome Risk Reduction for Long-Distance Truckers in Kenya,” *J. Int. Assoc. Provid. AIDS Care*, vol. 24, Aug. 2025, doi: 10.1177/23259582251377224.
- [18] C. M. Bryer, G. S. Stang, A. B. Collins, L. N. Haygood, T. Blu Wakpa, and J. Proulx, “Promoting Healthy Aging Through Mindfulness and Yoga: A Systematic Review of Interventions for People Living with HIV Who Use Drugs or Who Have a History of Substance Use,” *Int. J. Environ. Res. Public Health*, vol. 22, no. 11, p. 1685, Nov. 2025, doi: 10.3390/ijerph22111685.
- [19] R. D. L. N. Karisma, “Classification Cyber Harassment on Twitter using Multinomial Naïve Bayes,” *MATICS J. Ilmu Komput. dan Teknol. Inf. (Journal Comput. Sci. Inf. Technol.)*, vol. 17, no. 2, pp. 52–62, Sep. 2025, doi: 10.18860/mat.v17i2.29866.
- [20] hosna faridi, farideh khalajabadi Farahani, M. Lamyian, F. Ahmadi, and A. Montazeri, “The Socio-Cultural Contexts of Women’s Sexual and Reproductive Health Literacy in Iran: A Qualitative Study,” May 16, 2025, doi: 10.21203/rs.3.rs-6234753/v1.
- [21] V. Afriyatin, O. W. K. Handayani, and S. Indarjo, “Description of Internet-based Information on Sexual and Reproductive Health and rights (SRHR) in High Schools,” *Public Heal. Perspect. J.*, vol. 9, no. 2, pp. 93–108, Dec. 2025, doi: 10.15294/phpj.v9i2.29852.
- [22] R. Hoffmann, L. Andriano, E. Striessnig, T. Rüttenauer, M. Borderon, and K. Grace, “Climate change and population: Demographic perspectives on the 21st century’s defining challenge,” *Vienna Yearb. Popul. Res.*, vol. 22, Dec. 2024, doi: 10.1553/p-nfjc-z82h.
- [23] E. Tilici, G. Epure, C. Cosma, and I. C. Epure, “Adolescent pregnancy in Romania: A retrospective hospital-based study complemented by a literature review on socio-medical determinants,” *Rom. Med. J.*, vol. 72, no. 3, pp. 329–334, Sep. 2025, doi: 10.37897/RMJ.2025.3.18.
- [24] R. Dwi Wulandari, “Antenatal care visits performance among unmarried women in Indonesia: Does unintended pregnancy matter? A cross-sectional study,” *f1000research*, 2025, doi: 10.12688/f1000research.24693.1.
- [25] S. Fatharani, Andriyanti, Ernawati, and Atika, “FACTORS AFFECTING PREGNANT WOMEN’S KNOWLEDGE LEVEL OF PREECLAMPSIA SCREENING,” *Indones. Midwifery Heal. Sci. J.*, vol. 9, no. 3, pp. 323–332, Jul. 2025, doi: 10.20473/imhsj.v9i3.2025.323-332.