

Original Article

Prevalence, co-occurrence patterns, and factors associated with multiple sexually transmitted infections among men living with HIV in Indonesia: A cross-sectional study in Surakarta

Labitta P. Aquaira^{1*}, Elsita Lisnawati¹, Endra Y. Ellistasari¹, Nugrohoaji Dharmawan¹ and Adniana Nareswari¹

¹Department of Dermatology and Venereology, Faculty of Medicine, Universitas Sebelas Maret, Surakarta, Indonesia

*Corresponding author: labitta.pachira.a@gmail.com

Abstract

Men living with human immunodeficiency virus (HIV) may experience a substantial burden of sexually transmitted infections (STIs), including concurrent infections. The aim of this study was to determine the prevalence and co-occurrence patterns of multiple STIs and identify factors associated with their occurrence among male patients living with HIV. A retrospective cross-sectional study was conducted using medical records of 70 male patients living with HIV who were diagnosed with at least one active STI at Dr. Moewardi Regional General Hospital, Surakarta, Indonesia, between January 2019 and December 2023. Demographic characteristics, sexual orientation, number of sexual partners, and STI diagnoses were analyzed using bivariate analysis and multivariable binary logistic regression. Multiple STIs were identified in 18.6% of participants. Condyloma acuminata was the most frequently documented single STI (50.0%), while condyloma acuminata with syphilis was the predominant multiple-STI combination (14.3%). In the bivariate analysis, sexual orientation ($p=0.005$) and number of sexual partners ($p=0.003$) were significantly associated with multiple STIs, whereas age and education level were not. After adjustment, having more than one sexual partner remained significantly associated with multiple STIs (OR=6.93; 95%CI: 1.20–39.95; $p=0.030$), while sexual orientation was not significantly associated in the overall multivariable model ($p=0.165$). These findings support comprehensive STI screening and careful assessment of sexual behavior among men living with HIV, particularly those reporting multiple sexual partners.

Keywords: Sexually transmitted disease, HIV infection, men who have sex with men, condyloma acuminata, risk factors

Introduction

Sexually transmitted infections (STIs) remain an important global public health concern and disproportionately affect populations at increased risk of human immunodeficiency virus (HIV) infection [1-3]. HIV and other STIs share common routes of transmission and frequently occur within the same sexual networks. Moreover, the relationship between HIV and STIs is bidirectional: the presence of certain STIs may facilitate HIV transmission through mucosal disruption and local inflammation, whereas HIV-associated immune dysfunction may increase susceptibility to persistent or recurrent infections caused by sexually transmitted pathogens [1-3]. Consequently, people living with HIV may experience a substantial burden of both



individual and concurrent STIs, emphasizing the importance of comprehensive sexual health assessment in this population.

Men living with HIV, particularly men who have sex with men (MSM), represent an important population for STI prevention and control. Previous studies have documented substantial burdens of syphilis, gonorrhea, chlamydia, human papillomavirus-related disease, and other STIs among MSM and people living with HIV [4-8]. Behavioral factors, including multiple sexual partnerships and patterns of sexual exposure, may further increase the probability of acquiring more than one STI [6-8]. The occurrence of multiple STIs in the same individual is particularly relevant because it may indicate repeated or overlapping exposure to sexually transmitted pathogens and may complicate clinical management. Identifying patterns of STI co-occurrence and the characteristics associated with multiple infections could therefore help inform more comprehensive screening and targeted prevention strategies.

Despite the clinical importance of STI co-infections, evidence regarding the distribution and determinants of multiple STIs among men living with HIV in Indonesia remains limited [9]. Most available studies have focused primarily on individual infections or selected high-risk populations, leaving limited information regarding which STIs commonly occur together and which demographic or behavioral characteristics are associated with multiple infections. Local epidemiological data are particularly important because STI patterns may vary according to population characteristics, sexual networks, healthcare-seeking behavior, and regional epidemiology. Therefore, the aim of this study was to determine the prevalence and co-occurrence patterns of multiple STIs and identify factors associated with their occurrence among male patients living with HIV in Indonesia. The findings are expected to provide evidence to support more targeted STI screening, early detection, and prevention strategies for men living with HIV.

Methods

Study design and setting

A retrospective cross-sectional study was conducted using medical records of male patients living with HIV who attended the Dermatology and Venereology Clinic of Dr. Moewardi Regional General Hospital, Surakarta, Indonesia, between January 2019 and December 2023. The study was designed to describe the distribution and co-occurrence of STIs and to identify demographic and behavioral factors associated with the occurrence of multiple STIs among male patients living with HIV.

Study population and eligibility criteria

The study population comprised male patients living with HIV who were diagnosed with at least one active STI during the study period. Patients were eligible for inclusion if they were male, aged ≥ 18 years, had confirmed HIV infection, had at least one active STI documented during clinical evaluation, and had medical records containing the information required for the study analyses. Patients were excluded if they were younger than 18 years, did not have an active STI, or had incomplete medical records regarding the demographic, sexual-behavior, or STI-related variables required for analysis.

Data collection and study variables

Data were retrospectively extracted from patients' medical records. Variables included age, education level, sexual orientation, number of sexual partners, and documented STI diagnosis. Age was analyzed according to the categories recorded in the study dataset. Education level was categorized as low, medium, or high. Sexual orientation or sexual-behavior category was recorded as MSM, bisexual, or heterosexual. The number of sexual partners was categorized as one partner or more than one partner.

STI diagnoses were identified from diagnoses documented in the patients' medical records during clinical evaluation at the Dermatology and Venereology Clinic. All active STIs recorded for each patient were extracted and categorized according to the documented diagnosis, including condyloma acuminata, syphilis, genital herpes, lymphogranuloma venereum, molluscum

contagiosum, and gonorrhea. Participants were subsequently classified according to the number of documented STIs into two groups: single STI and multiple STIs.

Outcome definition

The primary outcome was the occurrence of multiple STIs among male patients living with HIV. Participants were classified into two groups according to the number of active STIs documented: single STI, defined as one STI diagnosis, and multiple STIs, defined as two or more STI diagnoses.

The prevalence of multiple STIs was calculated as the proportion of participants classified as having two or more STIs among all included patients. Patterns of STI co-occurrence were described according to the specific combinations of infections documented among patients with multiple STIs.

Statistical analysis

Categorical variables were summarized as frequencies and percentages. The distribution of individual STIs and combinations of multiple STIs was described using descriptive statistics. For the analytical component, participants were categorized according to the presence of a single STI or multiple STIs. Associations between demographic and behavioral characteristics and the occurrence of multiple STIs were initially assessed using bivariate analysis. The chi-square test was used to evaluate associations between categorical variables and STI status. The variables evaluated included age, education level, STI diagnosis, sexual orientation, and number of sexual partners. Variables with a $p < 0.250$ in the bivariate analysis were considered for inclusion in the multivariable binary logistic regression. Associations were expressed as odds ratios (ORs) with 95% confidence intervals (CIs). All statistical tests were two-sided, and a $p < 0.050$ was considered statistically significant. Data were managed using Microsoft Excel and analyzed using IBM SPSS Statistics version 30 (IBM Corp., Armonk, NY, USA).

Results

Participant characteristics

A total of 70 male patients living with HIV who were diagnosed with at least one STI were included in the analysis and their characteristics are presented in **Table 1**. Of these, 57 patients (81.4%) had a single STI, whereas 13 (18.6%) had multiple STIs. Half of the participants were aged 21–30 years (50.0%), followed by those aged 31–40 years (37.1%), >40 years (8.6%), and 18–20 years (4.3%). Most participants had a medium education level (72.9%), while 17.1% and 10.0% had low and high education levels, respectively. Regarding sexual orientation, 45.7% were classified as MSM, 44.3% as bisexual, and 10.0% as heterosexual. Slightly more than half of the participants reported having one sexual partner (52.9%), whereas 47.1% reported having more than one sexual partner (**Table 1**).

Table 1. Demographic characteristics of males living with HIV included in this study (n=70)

Characteristics	Frequency	Percentage (%)
Age group (years)		
18–20	3	4.3
21–30	35	50.0
31–40	26	37.1
>40	6	8.6
Education level		
Low	12	17.1
Medium	51	72.9
High	7	10.0
Sexual orientation		
Men who have sex with men (MSM)	32	45.7
Bisexual	31	44.3
Heterosexual	7	10.0
Number of sexual partners		
One partner	37	52.9
More than one partner	33	47.1

Distribution and patterns of sexually transmitted infections (STIs)

Condyloma acuminata was the most frequently documented STI, accounting for 50.0% of all participants, followed by syphilis (27.1%). Genital herpes, lymphogranuloma venereum, and molluscum contagiosum were each documented in 1.4% of participants (**Table 2**).

Among the 13 patients with multiple STIs, the most frequently documented combination was condyloma acuminata with syphilis, identified in 10 patients (14.3% of the total study population). Condyloma acuminata with molluscum contagiosum, syphilis with gonorrhea, and syphilis with molluscum contagiosum were each identified in one patient (1.4%) (**Table 2** and **Figure 1**).

Table 2. Distribution of sexually transmitted infections among male patients living with HIV (n=70)

Type of sexually transmitted infections	Frequency (%)
Condyloma acuminata	35 (50.0)
Syphilis	19 (27.1)
Genital herpes	1 (1.4)
Lymphogranuloma venereum	1 (1.4)
Molluscum contagiosum	1 (1.4)
Condyloma acuminata + syphilis	10 (14.3)
Condyloma acuminata + molluscum contagiosum	1 (1.4)
Syphilis + gonorrhea	1 (1.4)
Syphilis + molluscum contagiosum	1 (1.4)

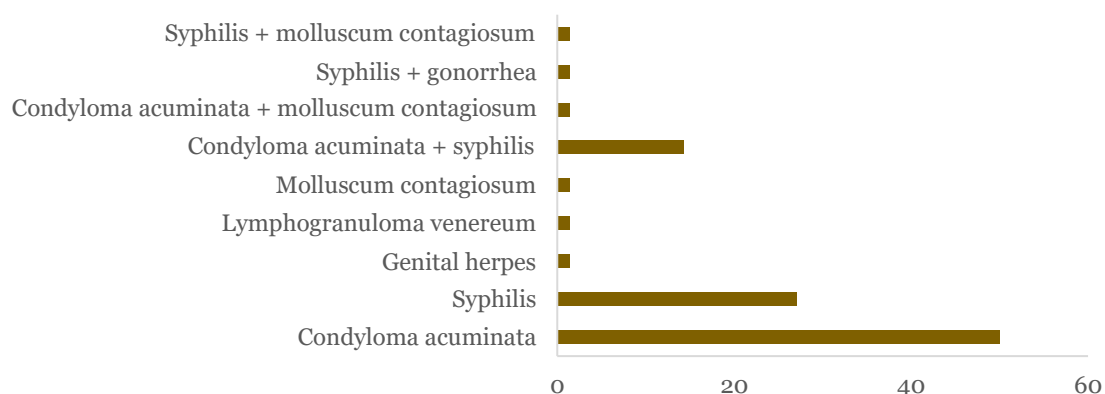


Figure 1. Distribution of sexually transmitted infections among male patients living with HIV.

Factors associated with multiple sexually transmitted infections

The occurrence of multiple STIs did not differ significantly according to age ($p=0.478$) or education level ($p=0.543$) (**Table 3**). Multiple STIs were most frequently observed among participants aged 21–30 years, in whom eight patients had multiple STIs, followed by those aged 31–40 years, in whom five patients had multiple STIs (**Table 3**).

In contrast, sexual orientation was significantly associated with the occurrence of multiple STIs ($p=0.005$) (**Table 3**). Multiple STIs were identified in 11 of 31 bisexual participants, compared with two of 32 MSM participants, while no multiple STIs were documented among the seven heterosexual participants (**Table 3**). The number of sexual partners was also significantly associated with multiple STIs ($p=0.003$); 11 of 33 participants reporting more than one sexual partner had multiple STIs, compared with two of 37 participants reporting one sexual partner (**Table 3**).

Table 3. Bivariate analysis showing factors associated with multiple sexually transmitted infections among male patients living with HIV

Variables	Total n (%)	≥2 STIs (n=13) n (%)	Single STI (n=57) n (%)	p-value
Age group				0.478
18–20 years	3 (4.3)	0 (0)	3 (4.3)	
21–30 years	35 (50.0)	8 (11.4)	27 (38.6)	
31–40 years	26 (37.1)	5 (7.1)	21 (30.0)	
>40 years	6 (8.6)	0 (0)	6 (8.6)	
Education level				0.543

Variables	Total n (%)	≥2 STIs (n=13) n (%)	Single STI (n=57) n (%)	p-value
Low	12 (17.1)	1 (1.4)	11 (15.7)	
Medium	51 (72.9)	11 (15.7)	40 (57.1)	
High	7 (10.0)	1 (1.4)	6 (8.6)	
Sexual orientation				0.005*
Men who have sex with men (MSM)	32 (45.7)	2 (2.9)	30 (42.9)	
Bisexual	31 (44.3)	11 (15.7)	20 (28.6)	
Heterosexual	7 (10.0)	0 (0.0)	7 (10.0)	
Number of sexual partners				0.003*
One partner	37 (52.9)	2 (2.9)	35 (50.0)	
More than one partner	33 (47.1)	11 (15.7)	22 (31.4)	

STI: sexually transmitted infections

* Statistically significant at $p < 0.05$

Multivariable analysis of factors associated with multiple sexually transmitted infections

The results of the multivariable binary logistic regression analysis are presented in **Table 4**. After adjustment, the number of sexual partners remained significantly associated with the occurrence of multiple STIs. Participants reporting more than one sexual partner had approximately seven-fold higher odds of having multiple STIs compared with those reporting one sexual partner (OR=6.93; 95%CI: 1.20–39.95; $p=0.030$). Compared with heterosexual participants, MSM had higher estimated odds of multiple STIs, although the association did not reach statistical significance (OR=5.66; 95%CI: 0.94–33.90; $p=0.057$) (**Table 4**). The effect estimate for bisexual participants was not reliably estimable because of sparse data and the absence of multiple-STI events in the heterosexual reference group.

Table 4. Multivariable analysis of factors associated with multiple sexually transmitted infections among male patients living with HIV

Variable	B	Odds ratio (95% confidence interval)	p-value
Sexual orientation			0.165
Heterosexual	Reference	Reference	-
Bisexual	-19.15	0.00 ^a	0.999
Homosexual/men who have sex with men (MSM)	1.73	5.664 (0.94–33.90)	0.057
Number of sexual partners (more than one partner vs one partner)	1.93	6.93 (1.20–39.95)	0.030*
Constant	-6.28	0.001	0.001

* Statistically significant at $p < 0.05$ ^a The odds ratio for bisexual participants was not reliably estimable because of sparse data and zero events in the heterosexual reference group.

Discussion

This study characterized the distribution and co-occurrence of STIs and evaluated factors associated with multiple STIs among male patients living with HIV. Multiple STIs were identified in 18.6% of participants, while 81.4% had a single STI. Condyloma acuminata was the most frequently documented single STI, and the combination of condyloma acuminata and syphilis was the predominant pattern of multiple STIs. In the bivariate analysis, sexual orientation and number of sexual partners were significantly associated with multiple STIs, whereas age and education level were not. After adjustment, having more than one sexual partner remained significantly associated with multiple STIs, while sexual orientation was no longer statistically significant. These findings indicate that behavioral exposure, particularly having multiple sexual partners, may be more strongly associated with the occurrence of multiple STIs than demographic characteristics in this population.

Most participants were aged 21–40 years, with those aged 21–30 years accounting for the largest proportion of the study population. HIV continues to impose a substantial burden among sexually active adults worldwide, while studies from Indonesia and other settings have documented substantial STI burdens among men who have sex with men (MSM) and other populations with increased sexual exposure [10–12]. Although most cases of multiple STIs in the present study occurred among participants aged 21–30 years, age was not significantly associated

with multiple STI occurrence. Education level was similarly not associated with multiple STIs. These findings suggest that demographic characteristics alone may have limited value for identifying individuals with concurrent STIs and emphasize the importance of directly assessing sexual behaviors and exposure patterns.

Condyloma acuminata was the most frequently documented single STI, accounting for 50.0% of participants. A substantial burden of human papillomavirus (HPV)-related disease has been reported among people living with HIV, including among men with anal or genital condyloma acuminata [13-17]. HIV-associated impairment of cellular immune responses may reduce HPV clearance and facilitate persistent infection, viral reactivation, and progression to clinically apparent disease [13,16,17]. Consequently, HPV-related lesions among people living with HIV may be more persistent, extensive, recurrent, or difficult to manage than those among immunocompetent individuals [15-17]. The high proportion of condyloma acuminata observed in this study should nevertheless be interpreted in the context of a clinic-based population comprising male patients living with HIV who had already been diagnosed with at least one active STI and should not be interpreted as the prevalence of condyloma acuminata among all men living with HIV.

Condyloma acuminata with syphilis was the predominant co-infection pattern among participants with multiple STIs. STI co-infections have been frequently documented among people living with HIV and populations with overlapping sexual exposures [18,19]. The coexistence of HPV-related disease and syphilis may reflect shared sexual transmission networks and repeated exposure to multiple sexually transmitted pathogens. Syphilis is particularly relevant in the context of HIV because syphilitic lesions and associated inflammatory responses may facilitate HIV acquisition and influence virological and immunological outcomes among people living with HIV [20,21]. Simultaneously, HIV-associated immune dysfunction may promote persistent HPV infection [13,16,17]. The coexistence of viral and bacterial STIs observed in this study therefore supports comprehensive STI assessment rather than evaluation limited to the infection responsible for the presenting clinical complaint.

Sexual orientation was significantly associated with multiple STIs in the bivariate analysis. Multiple STIs were documented in 11 of 31 bisexual participants and two of 32 MSM participants, whereas no multiple STIs were documented among the seven heterosexual participants. Previous studies have demonstrated substantial STI burdens among MSM and identified sexual and behavioral characteristics as important correlates of STI acquisition [19,22-24]. In the present study, however, sexual orientation was not significantly associated with multiple STIs in the overall multivariable model. Compared with heterosexual participants, MSM had higher estimated odds of multiple STIs, although the association did not reach statistical significance (OR=5.66; 95%CI: 0.94–33.90; $p=0.057$). Moreover, the estimate for bisexual participants was not reliably estimable because of sparse data and the absence of multiple-STI events in the heterosexual reference group. Therefore, the higher proportion of multiple STIs among bisexual participants should not be interpreted as evidence that bisexual orientation independently increases the likelihood of multiple STIs.

The observed distribution according to sexual orientation nevertheless highlights the importance of considering sexual behavior and sexual-network characteristics rather than relying solely on identity-based classifications. Men who have sex with both men and women may participate in different sexual networks, potentially increasing opportunities for exposure to different sexually transmitted pathogens [25]. Specific sexual practices and exposure behaviors have also been associated with STI acquisition among MSM [26]. In addition, knowledge of HIV and STI transmission, disclosure, stigma, and barriers to accessing sexual health services may influence preventive practices and healthcare utilization among sexual and gender minority populations [27,28]. These factors were not directly assessed in the present study and therefore cannot be assumed to explain the observed distribution. Future studies with larger samples and more detailed assessment of sexual practices, condom use, partner concurrency, and sexual networks are warranted to clarify these relationships.

The number of sexual partners showed the most consistent association with multiple STIs. Participants reporting more than one sexual partner were significantly more likely to have multiple STIs in the bivariate analysis, and this association remained significant after adjustment.

Participants with more than one sexual partner had approximately seven-fold higher odds of multiple STIs compared with those reporting one sexual partner (OR=6.93; 95%CI: 1.20–39.95; $p=0.030$). This association is epidemiologically plausible because a greater number of sexual partnerships provides more opportunities for exposure to different pathogens and sexual networks. Previous studies have similarly identified multiple partnerships and other sexual behaviors as important correlates of STI acquisition among MSM and other populations at increased risk [11,19,22–26]. These findings emphasize the importance of obtaining a comprehensive sexual history when assessing men living with HIV and suggest that individuals reporting multiple sexual partners may particularly benefit from comprehensive STI screening.

From a clinical and public health perspective, detection of one STI among men living with HIV should prompt consideration of other concurrent infections, particularly among individuals reporting multiple sexual partners. Comprehensive assessment of sexual history, appropriate STI testing, counseling on preventive sexual practices, and timely treatment could facilitate earlier identification and management of concurrent infections. The variation in STI patterns across sexual networks and populations also indicates that prevention approaches should consider local epidemiological and behavioral characteristics rather than relying solely on demographic or identity-based categories [11,19,22–28].

Several limitations should be considered when interpreting these findings. The study was conducted at a single referral hospital and included a relatively small sample, with only 13 participants having multiple STIs. Sparse observations within several sexual-orientation categories resulted in unstable effect estimates, as reflected by the wide confidence interval for MSM and the inability to reliably estimate the effect for bisexual participants. The retrospective cross-sectional design permits assessment of associations but does not establish temporal or causal relationships. Information on sexual behavior was obtained retrospectively from medical records and may have been affected by incomplete documentation or reporting. In addition, the study included only male patients living with HIV who had at least one active STI; therefore, the frequencies of individual STIs should not be interpreted as prevalence estimates among all men living with HIV. Despite these limitations, the study provides local evidence regarding STI co-occurrence and identifies multiple sexual partnerships as an important characteristic associated with concurrent STIs among men living with HIV.

Conclusion

Multiple sexually transmitted infections were identified in 18.6% of male patients living with HIV, with condyloma acuminata as the most frequently documented single STI and condyloma acuminata with syphilis as the predominant co-infection pattern. Sexual orientation and number of sexual partners were associated with multiple STIs in the bivariate analysis; however, after adjustment, only having more than one sexual partner remained significantly associated with multiple STIs. These findings support comprehensive STI screening and careful assessment of sexual behavior among men living with HIV, particularly those reporting multiple sexual partners, to facilitate early detection and appropriate management of concurrent infections.

Ethics approval

This study was approved by the Health Research Ethics Committee of Dr. Moewardi General Hospital (No. 1.588/VII/HREC/2025). The study was conducted in accordance with applicable ethical principles for research involving human participants. Patient information obtained from medical records was used solely for research purposes and was handled to maintain participant confidentiality.

Acknowledgments

The authors thank the staff of the Dermatology and Venereology Clinic of Dr. Moewardi General Hospital for their assistance.

Competing interests

All the authors declare that there are no conflicts of interest.

Funding

This study received no external funding.

Underlying data

Derived data supporting the findings of this study are available from the corresponding author upon request.

Declaration of artificial intelligence use

During the preparation of this manuscript, the authors used ChatGPT (OpenAI, San Francisco, CA, USA) to assist with English language editing, grammar correction, sentence restructuring, and improvement of scientific writing clarity. The artificial intelligence tool was not used to generate, analyze, or interpret research data, perform statistical analyses, or draw scientific conclusions. All scientific content, study design, data interpretation, and final decisions regarding the manuscript remain the sole responsibility of the authors. The authors carefully reviewed and edited all AI-assisted outputs and take full responsibility for the accuracy and integrity of the manuscript.

How to cite

Aquaira LP, Lisnawati E, Ellistasari EY, *et al.* Prevalence, co-occurrence patterns, and factors associated with multiple sexually transmitted infections among men living with HIV in Indonesia: A cross-sectional study in Surakarta. Narra J 2026; 6 (3): e3093 - <http://doi.org/10.52225/narra.v6i3.3093>.

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