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Original Article

The Association of HIV and Syphilis among Men Who Have Sex with Men: An Integrated Biological and Behavioral Survey

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ABSTRACT

Increasing rates of syphilis in diverse geographical settings demand that people should have a heightened awareness of syphilis, especially in high-risk patients, including those who are MSM contracting HIV-positive. This study aimed to assess the association of HIV and syphilis among men who have sex with men (MSM) in Depok and Bogor using an Integrated Biological and Behavioral Survey 2018/2019. A cross-sectional study was conducted involving 750 eligible participants. Inclusion criteria: MSM living in study location, aged over 15, and had sexual relations with men at least once in the previous year. A prevalence ratio was obtained through multivariate Cox regression analysis. This study found that 11.3% of subjects were identified as having syphilis, and 20.1% were declared positive for HIV. The final model evidence a PR value of 2.46; 1.59-3.81 with a p-value of 0.00 for the risk of MSM infected with HIV to develop syphilis. Overall, HIV has a statistically significant relationship with the incidence of syphilis after being adjusted by the use of condoms with non-permanent partners and STI screening. Integrated intervention techniques, HIV testing, and enhanced awareness are required to reduce HIV, syphilis, and co-infection; targeting MSM and other vulnerable groups is in urge.

Keywords: *HIV, Syphilis, MSM*

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INTRODUCTION

Sexually transmitted infections (STIs) have significant implications for sexual and reproductive health, including stigmatization, infertility, cancer, and pregnancy complications, and an increased risk of contracting HIV. The World Health Organization (WHO) estimates that in 2020, there were approximately 374 million new STI cases worldwide, with 156 million cases of Trichomoniasis, 129 million cases of Chlamydia, 82 million cases of Gonorrhea, and 7.1 million cases of syphilis [1]. These infections pose a serious threat to public health and require effective preventative measures, such as comprehensive sex education, access to STI testing and treatment, and the use of barrier methods during sexual activity. Failure to address this issue could result in significant long-term health consequences for individuals and communities.

Syphilis is caused by the bacterium *Treponema pallidum*, which commonly spreads by direct contact with a syphilitic sore [2]. It developed to the secondary stage to include symptoms such as skin rashes and mucous membrane lesions. The disease rates are climbing rapidly, especially among gays, bisexuals, and men who have sex with men (MSM) [3–5]. Between 2020 and 2021,

reported primary and secondary cases increased around 29% in the United States, while the majority (36%) of these cases occurred only in MSM and men who have sex with men and women. Notably, the highest cases of syphilis among MSM occur in areas with HIV prevalence of more than 5% and lower-middle-income countries [5].

Numerous studies from diverse geographic locations documented that the clinical course of HIV was associated with increasing syphilis cases[6,7]. A significant increase followed the increase in HIV rates in syphilis infections[8]. Syphilis causes inflammatory genital ulcers and lesions, which can increase the risk of HIV transmission by increasing HIV shedding and acquisition by providing a portal of entry to HIV [9].

In Indonesia, the highest HIV prevalence recorded as of September 2022 was among men (71%), while the number of HIV cases in the MSM group reached 27.5% [10]. Also, a previous study confirmed MSM with HIV infection are more likely to develop syphilis with a HR= 4.53; 2.24-9.17 [11]. A similar trend was also found in China, where the prevalence of syphilis is relatively high among HIV-positive MSM (14.9%; 12.7–17.2). These figures alert the increasing number of vulnerable groups against STIs, mostly syphilis.

Given the continued risk of syphilis transmission and its close association with HIV infection among MSM, this study addresses the issue using a large Integrated Biological and Behavioral Survey. Few studies have been conducted to determine the prevalence and risk factors of syphilis among MSM in Indonesia; however, a smaller sample size may be the limitation. This study aims to evaluate the prevalence of syphilis and determine the risk factors of syphilis among MSM in Depok and Bogor.

METHOD

A cross-sectional study was designed using a large Integrated Biological and Behavioral Survey (STBP 2018/2019). STBP study participants were 750 individuals identified as MSM living in Bogor and Depok. Men aged over 15 and who had sexual relations with men at least once in the last year were eligible for the study. Study participants completed a structured questionnaire about their sexual and health behaviors over time and provided biological samples at each study visit. The participants provided written informed consent before enrolling.

The purpose of this research is to examine the correlation between HIV status (as an independent variable) and the occurrence of syphilis in MSM (dependent variable). We also assessed the other associated factors, including age, education, employment, marital status, symptoms, Hepatitis B and Hepatitis C status, number of partners, having a permanent partner, consistency of condom use, circumcision, STI screening, STI treatment, information exposure, gathering behavior, and residence. All data was compiled from STBP, with HIV and syphilis variables specifically being obtained from the rapid test results.

Univariate analysis was used to summarize the descriptive frequency for each variable. Stratification analysis was used to determine confounding variables. Multivariate analyses were used in Cox regression to identify the estimation of HIV against syphilis infections after adjusting confounders. Factors that were determined as confounders (Prevalence ratio discrepancy ≥10%) in the stratification analysis were considered when computing the final model.

RESULTS

The demographic characteristics of STBP participants at baseline are described in Table 1 below.

Table 1. Participants' Demographic Characteristics

Characteristics	Frequency	%
Age		
≤35	653	87,07
>35	97	12,93
Occupation		
Employed	550	73,33
Unemployed	200	26,67
Marital status		
Not married	659	87,87
Married	60	8,00
Divorced	31	4,13
Education		
High	575	76,67
Low	175	23,33

The overall participants were predominantly aged ≤35 years, employed (73.33%), not married (87.87%), and had a higher educational background (76.67%).

The biological examinations (syphilis

status, HIV status, Hepatitis B, and Hepatitis C), and social behavior was displayed on table 2.

Table 2. Distribution of behavioural characteristics, health access, and environment

Variable	Frequency	%
Syphilis		
Positive	85	11,33
Negative	665	88,67
HIV		
Positive	207	27,64
Negative	542	72,36
Syphilis symptoms		
Detected	90	12,00
Undetected	660	88,00
Hepatitis B		
Positive	38	5,07
Negative	712	94,93
Hepatitis C		
Positive	3	0,40
Negative	747	99,60
Number of partners		
>1	232	31,18
0-1	512	68,82
Permanent partner		
Yes	343	45,73
No	407	54,27
Selling sex to men		
Yes	261	34,80
No	489	65,20
Buying sex from men		
Yes	75	10,00
No	675	90,00
Use of condoms In a permanent partner		
Consistent	158	21,07
Inconsistent	185	24,67
N/A	407	54,27
Use of condoms in non-permanent couples		
Consistent	136	18,13
Inconsistent	160	21,33
N/A	454	60,53
Use of condoms in transgender couples		
Consistent	7	0,93
Inconsistent	11	1,47
N/A	732	97,60
Circumcision		
Yes	730	97,33
No	20	2,67
STI screening		
Never	591	78,80
Ever	159	21,20
STI treatment		
Never	90	56,60
Ever	69	43,40
Information exposure		
Unexposed	526	70,13
Exposed	224	29,87
Gathering behavior		
Yes	735	98,00
No	15	2,00
Residence		
With family/female partner	476	65,56
With a male friend/partner/transvestite	73	10,06
Alone	177	4,38

The results showed that 11% of the total 750 respondents were identified as having syphilis and 27% were declared HIV positive and based on the history of the symptoms experienced, most admitted that they did not show any symptoms of syphilis. In the results of hepatitis tests, both hepatitis B and C, <5% positive cases were found. From personal confessions, 68% have 0-1 partners, 54% do not have a permanent partner, more than 30% of respondents admit to selling commercial sexual services to men, and only 10% buy services from other men.

The results of assessing the consistency of condom use in different categories of partners show that only 21% consistently use condoms, both in regular and casual partners. Meanwhile, <1% of transgender sexual partners consistently use condoms. Moreover, almost 80% of respondents underwent circumcision. From the results of data collection on screening and treatment history, only around 21% had ever had an STI examination, and 43% had had STI treatment. Only a third of respondents had ever been exposed to information related to syphilis.

In terms of social behaviour, as many as 98% of respondents have the habit of gathering in various public facilities, and most of them admit to living with their family/partner. Woman/wife (65%).

Table 3. The Association of HIV and Syphilis Stratified by Covariates

Covariates	Syphilis (+)				Syphilis (-)				Prevalence Ratio (PR)			Homogeneity test
	HIV (+)		HIV (-)		HIV (+)		HIV (-)					
	n	%	n	%	n	%	n	%	Crude	Adjusted	ΔPR (%)	
Age												
≤35	35	19,13	34	7,25	148	80,87	435	92,75	2,81 (1,98-4,17)	2,83 (1,91-4,19)	0,71	0,43
>35	9	37,50	7	9,59	15	62,50	66	90,41				
Occupation												
Employed	35	20,59	30	7,92	135	79,41	349	92,08	2,81 (1,89-4,17)	2,78 (1,87-4,13)	1,08	0,49
Unemployed	9	24,32	11	6,75	28	75,68	152	93,25				
Marital status												
Not married	38	20,11	39	8,32	151	79,89	430	91,68	2,81 (1,89-4,17)	2,75 (1,86-4,07)	2,18	0,23
Married	3	27,27	2	4,08	8	72,73	47	95,92				
Divorced	3	42,86	0	0,00	4	57,14	24	100				
Education												
High	40	23,12	35	8,73	133	76,88	366	91,27	2,81 (1,89-4,17)	2,66 (1,79-3,95)	5,6	0,95
Low	4	11,76	6	4,26	30	88,24	135	95,74				
Syphilis's symptoms												
Detected	8	22,22	3	5,66	28	77,78	50	94,34	2,81 (1,89-4,17)	2,84 (1,90-4,24)	1,06	0,58
Undetected	36	21,05	38	7,77	135	78,95	451	92,23				
Hepatitis B												
Positive	6	28,57	2	11,76	15	71,43	15	88,24	2,81 (1,89-4,17)	2,72 (1,82-4,05)	3,31	0,87
Negative	38	20,43	39	7,43	148	79,57	486	92,57				
Hepatitis C												
Positive	0	0,00	1	50,00	1	100	1	50,00	2,81 (1,89-4,17)	2,80 (1,89-4,15)	0,36	0,88
Negative	44	21,36	40	7,41	162	78,64	500	92,59				
No. of partners												
>1	11	25,58	10	5,29	32	74,42	179	94,71	2,81 (1,89-4,17)	2,68 (1,81-3,95)	4,85	0,10
0-1	33	20,25	31	8,91	130	79,75	317	91,09				
Permanent partner												
Yes	19	19,39	17	6,97	79	80,61	227	93,03	2,81 (1,89-4,17)	2,82 (1,90-4,18)	0,36	0,95
No	25	22,94	24	8,05	84	77,06	274	91,95				
Selling sex to men												
Yes	15	22,06	15	7,77	53	77,94	178	92,23	2,81 (1,89-4,17)	2,81 (1,89-4,17)	0,00	0,97
No	29	20,86	26	7,45	110	79,14	323	92,55				
Buying sex from men												
Yes	6	35,29	4	6,90	11	64,71	54	93,10	2,81 (1,89-4,17)	2,82 (1,90-4,17)	0,36	0,28
No	38	20,00	37	7,64	152	80,00	447	92,36				

Use of condom in permanent partner												
Consistent	13	20,63	9	9,47	50	79,37	86	90,53	2,81 (1,89-4,17)	2,69 (1,81-3,99)	4,46	0,80
Inconsistent	6	17,14	8	5,37	29	82,86	141	94,63				
N/A	25	22,94	24	8,05	84	77,06	274	91,95				
Use of condom in non-permanent partner												
Consistent	8	21,05	9	9,18	30	78,95	89	90,82	2,81 (1,89-4,17)	2,58 (1,76-3,77)	8,9*	0,01*
Inconsistent	9	32,14	1	0,76	19	67,86	131	99,24				
N/A	27	19,15	31	9,94	114	80,85	281	90,06				
Use of condom in transgender couple												
Consistent	0	0,00	1	20,00	2	100	4	80,00	2,81 (1,89-4,17)	2,81 (1,89-4,18)	0,00	0,98
Inconsistent	0	0,00	1	11,11	2	100	8	88,89				
N/A	44	21,67	39	7,39	159	78,33	489	92,61				
Circumcision												
Yes	44	21,78	40	7,59	158	78,22	487	92,41	2,81 (1,89-4,17)	2,81 (1,89-4,16)	0,00	0,91
No	0	0,00	1	6,67	5	100	14	93,33				
STI screening												
Never	24	17,52	31	6,84	113	82,48	422	93,16	2,81 (1,89-4,17)	2,55 (1,70-3,83)	10,19*	0,99
Ever	20	28,57	10	11,24	50	71,43	79	88,76				
STI treatment												
Never	10	27,78	8	14,81	26	72,22	46	85,19	2,81 (1,89-4,17)	2,65 (1,29-5,39)	6,04	0,22
Ever	10	29,41	2	5,71	24	70,59	33	94,29				
Information exposure												
Unexposed	26	20,80	28	6,98	99	79,20	373	93,02	2,81 (1,89-4,17)	2,73 (1,84-4,05)	2,93	0,59
Exposed	18	21,95	13	9,22	64	78,05	128	90,78				
Gathering behavior												
Yes	43	21,50	40	7,49	157	78,50	494	92,51	2,81 (1,89-4,17)	2,80 (1,89-4,15)	0,36	0,49
No	1	14,29	1	12,50	6	85,71	7	87,50				
Residence												
With family/female partner	23	17,83	20	5,76	106	82,17	327	94,24	2,81 (1,89-4,17)	2,80 (1,88-4,08	0,36	0,54
With a male friend/partner/transvestite	3	13,64	5	10,00	19	86,36	45	90,00				
Alon	18	36,00	16	12,60	32	64,00	111	87,40				

**Confounders: ⊿PR ≥10% or substantial justification*

STI screening was considered a confounder in assessing the association of HIV with the incidence of syphilis. However, by considering the substance assumption, the variable consistency of the use of condoms in non-permanent partners is still included in the modelling even though the PR difference is <10%. It was also identified that there was a potential interaction between HIV and consistent use of condoms in casual partners (p-value <0.05) on syphilis.

After being included in multivariate modeling, it appears that the interaction variable is not significant enough to explain the difference in the risk of syphilis due to HIV between those who are consistent and inconsistent in using condoms in casual or non-permanent partners (p value> 0.05), so the interaction is ignored and the final model is obtained (Table 4).

Table 4. Final Adjusted Model of the Association of HIV with Syphilis

Variable	Adj.PR	95% CI		p-value
		Lower	Upper	
HIV				
Positive	2,46	1,59	3,81	0,000
Negative	Ref.			
Use of condoms in non-permanent partner				
Consistent	Ref.			
Inconsistent	0,62	0,28	1,36	0,231
N/A	1,06	0,61	1,83	0,837
STI screening				
Never	0,62	0,39	0,98	0,042
Ever	Ref.			

Table 4 shows an assessment of the relationship between HIV and the incidence of syphilis after controlling for the variables of condom use in casual partners and STI examination. Respondents who were identified as HIV positive had more than double the risk of experiencing syphilis compared to those who were HIV-negative.

DISCUSSION

This cross-sectional population-based study using an Integrated Biological and Behavioral Survey sample showed that the overall prevalence of syphilis among MSM in Depok and Bogor City was 11.3%. This prevalence of syphilis is lower than that reported in a previous study among MSM in Southeast Asia studies, which ranged between 12-14% [12,13]. However, our studies found various factors associated with an increased probability of syphilis infection. This information will be critical for the prevention of syphilis in Indonesia.

Syphilis is a growing public health concern, and the prevalence of syphilis is increasing among MSM globally [14,15]. This study addresses the tendency of a large number of HIV-positive MSM and explores the risk estimate by considering other covariates. The present study suggests that HIV-positive participants were associated with syphilis (PR= 2.46; 1.59-3.81) with a prevalence of 20.1% cases. The prevalence ratio was obtained after being adjusted by consistency of condom use with sexual non-permanent partners and STI screening. It is also important to highlight that these findings were slightly higher than the rate reported in a recent study in Jiangsu Province, which reported 13.64% of active syphilis infection [16].

Compared with heterosexual men, MSM is more likely to have a history of multiple STIs, including HIV, syphilis, gonorrhea, lymphogranuloma venereum (LGV), enteric STIs, HPV, human herpes virus (HHV-8), hepatitis B, and possibly hepatitis A and C. As the main focus of the study, the prevalence of active syphilis infection is even higher in HIV-positive MSM than in the general MSM population, and it ranges from 1.8 to 9.7%. This might be attributable to the social behavior reason. It is well established that the MSM is the most vulnerable group of people who are being at a high level of risk of HIV and STIs due to unprotected anal sex, heterosexuality, and multiple sex partners [17,18].

Risky behaviors that put people at greater risk of contracting HIV include having anal or vaginal sex without a condom and suffering from other sexually transmitted infections (STIs) such as syphilis, herpes, chlamydia, gonorrhea, and bacterial vaginosis [19]. Recently, in the United States, about half of MSM who suffer from primary and secondary syphilis are also living with HIV [20]. Skin sores caused by STDs such as syphilis allow HIV to enter the body more easily. In addition, it is possible to contract HIV because behavior and circumstances that put you at risk of contracting other STDs can also provide a greater risk of contracting HIV [20].

Although some studies evidence the linkage between HIV infection and syphilis

incidence among gays, there is no definitive explanation for the pathway. Refugio and Klausner proposed a few hypotheses from the literature review [21]. First, the increasing depletion of CD4 T-cells in persons with HIV reduces the host's ability to protect itself against infections [22]. Second, it's also possible that HIV infection is simply a cover for engaging in syphilis-promoting behaviors. It has been claimed that the availability of highly active antiretroviral treatment (HAART) may have indirectly boosted syphilis incidence by increasing sexual risk behavior. Furthermore, HIV-infected MSM may engage in other risk-reduction behaviors such as serosorting (i.e., sex partners are only HIV-infected men) or strategic positioning, in which the HIV-infected person assumes the receptive role during anal sex rather than the insertive role, which is more likely to transmit HIV [23].

Although this study prevents the risk of bias by controlling association estimation by several covariates, we acknowledged its limitations. Since it was a cross-sectional study, a chronological event between independent and dependent variables exists. This study cannot explain which cases were infected first, whether HIV infection or syphilis infection. Moreover, bias due to participants' responses is possible owing to the fact that this secondary data is collected by someone else, and we could not control over the data collection process.

CONCLUSION

Based on the results of this study, HIV is related to the incidence of syphilis in MSM. In this variable, STI testing is a confounding variable, and there is a potential interaction between HIV and consistent condom use in irregular partners. In the final model assessing the relationship between HIV and the incidence of syphilis after controlling for the variables of condom use in casual partners and STI examination, it was found that the risk of syphilis in HIV-positive respondents was 2.4 times. Risk factor screening in key populations as a way to prevent and control HIV and STIs, it is hoped that government institutions (Ministry of Health, District/City Health Services, Health Service Facilities, NGOs related to HIV and STIs) can work together to increase outreach to risk groups such as MSM.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest

REFERENCES

1. WHO. Sexually transmitted infections (STIs) [Internet]. WHO. 2023 [cited 2024 Jan 11]. Available from: https://www.who.int/news-room/fact-sheets/detail/sexually-transmitted-infections-(stis)
2. Van Gerwen OT, Muzny CA, Marrazzo JM. Sexually transmitted infections and female reproductive health. Vol. 7, Nature Microbiology. Nature Research; 2022. p. 1116–26.
3. Solomon MM, Mayer KH. Evolution of the syphilis epidemic among men who have sex with men. Vol. 12, Sexual Health. CSIRO; 2015. p. 96–102.
4. Abara WE, Hess KL, Fanfair RN, Bernstein KT, Paz-Bailey G. Syphilis trends among men who have sex with men in the United States and Western Europe: A systematic review of trend studies published between 2004 and 2015. Vol. 11, PLoS ONE. Public Library of Science; 2016.
5. CDC. Sexually Transmitted Disease Surveillance [Internet]. U.S. Department of Health & Human Services. 2021 [cited 2024 Jan 11]. Available from: https://www.cdc.gov/std/statistics/2021/default.htm
6. Tsuboi M, Evans J, Davies EP, Rowley J, Korenromp EL, Clayton T, et al. Prevalence of syphilis among men who have sex with men: a global systematic review and meta-analysis from 2000–20. Lancet Glob Health. 2021 Aug 1;9(8):e1110–8.
7. Mahmud S, Mohsin M, Muyeed A, Islam MM, Hossain S, Islam A. Prevalence of HIV and syphilis and their co-infection among men having sex with men in Asia: A systematic review and meta-analysis. Heliyon.

2023 Mar 1;9(3).
8. Ribeiro A, Trevizol A, Oluwoye O, McPherson S, McDonell MG, Briese V, et al. HIV and syphilis infections and associated factors among patients in treatment at a specialist alcohol, tobacco, and drugs center in São Paulo's "cracolândia". Trends Psychiatry Psychother. 2020 Jan 1;42(1):1–6.
9. Buchacz K, Patel P, Taylor M, Kerndt PR, Byers RH, Holmberg SD, et al. Syphilis increases HIV viral load and decreases CD4 cell counts in HIV-infected patients with new syphilis infections. AIDS. 2004 Oct 21;18(15):2075–9.
10. Kementerian Kesehatan. Executive Report on The Development of HIV AIDS and Sexually Transmitted Infections Diseases in 2022 [Internet]. 2022 [cited 2024 Jan 11]. Available from: https://siha.kemkes.go.id/portal/files_upload/Laporan_TW_3_2022.pdf
11. Kawi N, Sihotang E, Nisa T, Hui B, Causer L, Januraga P, et al. Incidence and risk factors for syphilis infection among men who have sex with men: A cohort study from an urban sexual health clinic in Jakarta, Indonesia. Int J STD AIDS [Internet]. 2022 [cited 2024 Jan 11];33(12):1065–72. Available from: https://journals.sagepub.com/doi/10.1177/09564624221125079?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%20%200pubmed
12. Colby D, Nguyen NA, Le B, Toan T, Thien DD, Huyen HT, et al. HIV and Syphilis Prevalence Among Transgender Women in Ho Chi Minh City, Vietnam. AIDS Behav. 2016 Dec 1;20:379–85.
13. Prabawanti C, Bollen L, Palupy R, Morineau G, Girault P, Mustikawati DE, et al. HIV, sexually transmitted infections, and sexual risk behavior among transgenders in Indonesia. AIDS Behav. 2011 Apr;15(3):663–73.
14. Pham QD, Nguyen TV, Hoang CQ, Cao V, Khuu N Van, Phan HTT, et al. Prevalence of HIV/STIs and associated factors among men who have sex with men in An Giang, Vietnam. Sex Transm Dis. 2012;39(10):799–806.
15. Muessig KE, Tucker JD, Wang BX, Chen XS. HIV and syphilis among men who have sex with men in China: The time to act is now. Vol. 37, Sexually Transmitted Diseases. 2010. p. 214–6.
16. Chen L, Yang J, Ma Q, Pan X. Prevalence of active syphilis infection and risk factors among HIV-positive MSM in Zhejiang, China in 2015: A cross-sectional study. Int J Environ Res Public Health. 2019 May 1;16(9).
17. Ekouevi DK, Bitty-Anderson AM, Gbeasor-Komlanvi FA, Konu YR, Sewu EK, Salou M, et al. Low prevalence of syphilis infection among key populations in Togo in 2017: A national cross-sectional survey. Archives of Public Health. 2019 Sep 5;77(1).
18. Duy Pham Q, Vu Nguyen T, Duy Nguyen P, Hoang Le S, Tho Tran A, Thanh Nguyen L, et al. Men who have sex with men in southern Vietnam report high levels of substance use and sexual risk behaviours but underutilise HIV testing services: a cross-sectional study. Sex Transm Infect [Internet]. 2015;91(3):178–82. Available from: http://sti.bmj.com/
19. National Institutes of Health. What factors make HIV more likely? [Internet]. US Department of Health and Human Services. 2023. Available from: https://www.nichd.nih.gov/health/topics/hiv/conditioninfo/factors
20. CDC. Detailed STD Facts - Syphilis [Internet]. U.S. Department of Health & Human Services. 2023 [cited 2024 Jan 11]. Available from: https://www.cdc.gov/std/syphilis/stdfact-syphilis-detailed.htm#:~:text=In%20the%20United%20States%2C%20about,P%26S%20syphilis%20also%20have%20HIV.&text=Additionally%2C%20MSM%20who%20are%20HIV,get%20HIV%20in%20the%20future.&text=Genital%20sores%20caused%20by%20syphilis,and%20acquire%20HIV%20infection%20sexually.
21. Refugio ON, Klausner JD. Syphilis incidence in men who have sex with

men with human immunodeficiency virus comorbidity and the importance of integrating sexually transmitted infection prevention into HIV care. Vol. 16, Expert Review of Anti-Infective Therapy. Taylor and Francis Ltd; 2018. p. 321–31.

22. Burchell AN, Allen VG, Gardner SL, Moravan V, Tan D, Grewal R, et al. High incidence of diagnosis with syphilis co-infection among men who have sex with men in an HIV cohort in Ontario, Canada. BMC Infect Dis. 2015 Aug 1;15(1).

23. Eaton LA, Kalichman SC, Cain DN, Cherry C, Stearns HL, Amaral CM, et al. Serosorting Sexual Partners and Risk for HIV Among Men Who Have Sex with Men. Am J Prev Med. 2007 Dec;33(6):479–85.