
REVIEW ARTICLE

HIV Epidemic Among Men Who Have Sex with Men (MSM) and Transgender Women (TGW) in Sarawak, Malaysia: An analysis from the Integrated Biological and Behavioural Surveillance (IBBS) Lite 2024

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ABSTRACT

Introduction	Men who have sex with men (MSM) and transgender women (TGW) are among the key populations affected by the HIV epidemic in Sarawak, Malaysia. The objective of this study was to determine HIV prevalence and associated behaviour among MSM and TGW in Sarawak.
Methods	Respondent-driven sampling (RDS) was used to recruit MSM and TGW between June and August 2024. The study consisted of two components. The first component was a behavioural survey, conducted through a self-administered online questionnaire via a web-based platform. The second component involved biological testing, where respondents were instructed to visit a community-based testing site of their choice for blood testing after completing the online survey. Statistical analysis was performed in RStudio using the Gile's Successive Sampling Estimator.
Results	This study recruited 217 MSM and 151 TGW. Consistent condom use among both groups remains low. While most MSM and TGW reported recent HIV testing, Hepatitis C testing and treatment rates are still low. HIV prevalence in Sarawak was 9.5% (95% CI: 2.9, 16.0) among MSM and 10.1% (95% CI: 1.8, 18.5) among TGW, with syphilis prevalence among MSM reaching a concerning 12% (95% CI: 1.8, 22.3).
Conclusions	In conclusion, improving HIV prevention and care for MSM and TGW in Sarawak requires promoting condom use, increasing awareness of Hepatitis C, and including substance use interventions in HIV programs. Community outreach using culturally sensitive approaches is crucial to improving access to services and building trust. Furthermore, integrating syphilis management into HIV prevention efforts is critical, given its strong association with increased HIV risk. Findings highlight the need for targeted interventions and continued surveillance among key populations in Sarawak to ensure a sustained and effective public health response.
Keywords	Human immunodeficiency virus (HIV); Integrated biological and behavioural surveillance (IBBS); Men who have sex with men (MSM); Transgender women (TGW)

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INTRODUCTION

At the end of 2023, Malaysia had an estimated 85,283 people living with HIV (PLHIV). Among them, 84% were aware of their status. A total of 68% of PLHIV were on life-saving anti-retroviral therapy (ART) by December 2023. Notably, the number of new HIV infections has decreased by over 50%, dropping from 6,978 cases in 2002 to 3,220 cases in 2023.

It is worth highlighting that Malaysia is characterised by a concentrated epidemic, with HIV prevalence exceeding 5% in specific sub-populations while remaining below 1% in the general population. Initially, people who inject drugs (PWID) was the primary driver of the HIV epidemic in Malaysia. However, recent data in 2023 indicates a shift in the trend, with sexual transmission, particularly among MSM, now being the predominant mode of transmission.¹

Malaysia has been using the IBBS survey since 2009 as part of its national HIV surveillance system in order to monitor and comprehend the spread of the HIV epidemic. This allows the country to gather data on biological markers, such as HIV prevalence, as well as behavioural factors, such as risk behaviours and knowledge, among specific populations. The national IBBS survey conducted in 2022 did not include Sarawak due to logistical and implementation challenges. This omission left a significant data gap, particularly in understanding the HIV epidemic and the needs of MSM and TGW in the region.

Sarawak, located in East Malaysia, faces distinctive challenges in HIV prevention and care compared with West Malaysia. Its vast geography dispersed rural communities and limited healthcare infrastructure create substantial barriers to HIV testing and treatment access.² Persistent stigma and discrimination, particularly toward sexual minorities and key populations further discourage individuals from utilising HIV-related services. Efforts to expand community-based outreach are often hampered by long travel distances, resource constraints and cultural sensitivities, making it difficult to sustain engagement and continuity of care, especially in remote indigenous and coastal areas. Addressing these structural and social barriers is essential to ensuring an equitable and effective HIV response in East Malaysia.

Recognising the importance of having up-to-date and comprehensive data to inform evidence-based programming, an IBBS Lite was conducted specifically for Sarawak in 2024. This targeted survey aims to provide critical insights into the epidemiological and behavioural trends among MSM and TGW in Sarawak, ensuring that interventions are contextually relevant and responsive to the unique challenges faced in this region.

By addressing this data gap, the findings from the Sarawak IBBS Lite serve as a robust foundation for tailored HIV prevention, treatment and care strategies, ultimately contributing to Malaysia's broader goal of achieving the End AIDS targets by 2030. The main objective of this study was to determine HIV prevalence and associated behaviour among MSM and TGW in Sarawak.

METHODS

Study Setting and Sample Size

The study was conducted among MSM and TGW in Sarawak between June and August 2024. According to the specified inclusion criteria, MSM enrolled were: individual who were biological male, aged 18 years or older and who had engaged in anal penetrative sex with men at least once in the previous six months. TGW were included based on the specified inclusion criteria: individuals who were biologically male, aged 18 years or above, but with female identity and had anal penetrative sex at least once in the previous six months. Additional inclusion criteria were the ability to understand Malay or English language and willing to provide informed consent. Exclusion criteria included the inability to understand Malay or English language, member of the IBBS research team, and paid staff of the site organisations.

Sample size was calculated to be 350 consisting of 200 MSM and 150 TGW with 95% confidence level, 5% margin error, design effect of three and HIV prevalence of the key population groups from the previous IBBS survey. The sample size was further inflated by 20% to accommodate for possibility of missing data or non-responder.

Sampling

Using the RDS method, the sampling process started with identifying three or five seeds, but only one seed was planted at a time to initiate the recruitment process. If no new recruits were found or the recruitment rate was too slow, new seed was planted. Prior to enrolment, each respondent underwent eligibility screening with predetermined questions to exclude those who do not meet the study criteria. Each seed was issued three quick response (QR) codes to enlist the first wave of respondents from within their network. The QR codes were valid for five days. Up until the target sample size is met, each wave of respondents recruited the following wave.

After completing the online survey, respondents were instructed to visit their chosen community-based testing sites for blood testing. Rapid tests for HIV, syphilis and Hepatitis C were administered to all respondents by trained community health workers.

Respondents received an incentive of RM40 for completing the online survey and blood tests. This incentive was provided to cover for the transport, time/effort, and costs that they had

incurred whilst taking part in this study. They also received additional RM10 as incentive for each successful referral (up to a maximum of RM30). To ensure anonymity, no personal information was requested from the respondents. This study was registered with the Medical Research and Ethics Committee, Ministry of Health, Malaysia.

Data Collection

The study utilised a self-administered online questionnaire survey which was conducted via a web-based platform. The questionnaire was adapted from Family Health International (FHI) guidelines for repeated behavioural surveys in populations at risk of HIV. It was written in the two main languages of the region, Malay and English. The survey gathered information on respondents' socio-demographic characteristics, sexual and drug use behaviours, sexually transmitted infection (STI) symptoms, services utilisation, HIV knowledge and social networks.

Data Analysis

Weights were calculated using RDS Analyst to adjust for respondents' reported network sizes, ensuring that estimates accounted for differential recruitment probabilities inherent in RDS designs. Data analysis employed the Gile's Successive Sampling (SS) Estimator, which is specifically

developed to generate population estimates in RDS studies. All analyses were conducted using R version 4.4.2, which provided a robust statistical environment for data processing and computation.

RESULTS

Network Characteristics

This study recruited a total of 217 MSM respondents, initiated with three seeds and successfully completing nine waves of recruitment. In parallel, 151 TGW respondents were recruited, starting with two seeds and advancing through eleven waves of recruitment.

Homophily

The homophily by selected characteristics of the MSM and TGW were summarised in Table 1. The homophily values for MSM were 1.01 for HIV status and 1.08 for age, indicating a slight tendency for MSM to associate with others of the same HIV status and age group. However, these preferences were not statistically significant. For TGW, the homophily values were 0.96 for HIV status and 1.01 for age, both close to 1. This suggested a mild inclination for TGW to cluster within the same HIV status and age categories, but the non-significant p values indicated that these differences in distribution were not statistically meaningful.

Table 1 Homophily by selected characteristics of MSM and TGW in Sarawak, 2024

Characteristics	Categories	MSM		TGW	
		Homophily	p value	Homophily	p value
HIV status	Positive, Negative, Indeterminate, Don't know status	1.01	0.90	0.96	0.61
Age	18-24 years, > 24 years	1.08	0.23	1.01	0.78

Socio-demographic Characteristics

The socio-demographic characteristics of MSM and TGW were detailed in Table 2. Most MSM were young adults aged 18 to 24, with a median age of 24 years. A large proportion identified as Pribumi Sarawak and were predominantly Christian. More than half had completed tertiary education, and the vast majority were unmarried. In terms of employment, most MSM were employed. For TGW, the majority were aged 30 to 39, with a median age of 36 years. They were primarily Malay and Muslim, with most having completed secondary education. A substantial portion of TGW reported being employed, while some stated they were unemployed, and none identified as students.

Key HIV Risk Behaviours

The key HIV risk behaviours of MSM and TGW were presented in Table 3. MSM reported an average age of 18 for their first anal sex experience. A significant portion had regular sexual partners, the majority of whom were male. More than half reported consistent condom use with these partners during sexual activities. Regarding transactional sex, some MSM admitted to selling or paying for anal sex, while over half reported engaging in consensual anal sex. A considerable number of MSM indicated consuming alcohol before or during sexual activities in the past month, with syabu/ice being the most commonly used drug in these situations. Only five MSM reported injecting drugs, and all denied sharing needles, indicating minimal risk related to injection drug use within this group.

Among TGW, the median age of sexual debut was 17 years. Nearly half reported having a regular sexual partner, all of whom were male. Compared to MSM, TGW reported higher rates of transactional sex and alcohol use before sexual activities. Most TGW denied using drugs during sexual activities, but among those who did, syabu/ice was the most frequently used substance. Only three TGW disclosed injecting drugs.

Table 2 Socio-demographic characteristics of MSM and TGW in Sarawak, 2024

Variable	MSM				TGW			
	n/N	Unweighted count (%)	Estimated population (%)	95 % CI Lower Upper	n/N	Unweighted count (%)	Estimated population (%)	95 % CI Lower Upper
Age								
≤ 24	116/217	53.5	55.9	46.9 64.9	26/151	17.2	24.9	14.5 35.5
25 - 29	61/217	28.1	22.5	16.4 28.5	17/151	11.3	16.8	6.12 27.4
30 - 39	36/217	16.6	19.5	11.3 27.6	53/151	35.1	30.3	19.6 41.0
40 - 49	3/217	1.4	1.9	-0.8 4.6	31/151	20.5	13.8	7.4 20.1
≥ 50	1/217	0.5	0.3	-0.3 0.8	24/151	15.9	14.2	4.9 23.5
Median age (years)	24 (18-55)				36 (18-69)			
Ethnicity								
Malay	63/217	29.0	32.3	23.3 41.4	126/151	83.4	83.9	75.7 92.2
Chinese	24/217	11.1	15.9	7.2 24.6	0/151	0	0	0 0
Indian	2/217	0.9	0.7	-0.5 2	0/151	0	0	0 0
Pribumi Sabah	3/217	1.4	1.8	-1.2 4.8	0/151	0	0	0 0
Pribumi Sarawak	121/217	55.8	47.1	37.5 56.5	25/151	16.6	16.1	7.8 24.3
Others	4/217	1.8	2.2	-0.6 5.1	0/151	0	0	0 0
Education level								
No formal education	0/217	0	0	0 0	5/151	3.3	2.8	-0.4 6.0
Primary	3/217	1.4	1.4	0.2 2.5	24/151	15.9	12.0	5.3 18.7
Secondary	102/217	47.0	47.1	38.4 55.8	102/151	67.5	71.4	61.4 81.3
Tertiary	112/217	51.6	51.6	42.7 60.5	20/151	13.2	13.9	5.8 21.9
Religion								
Islam	72/217	33.2	36.1	27.8 44.3	127/151	84.1	84.4	75.9 92.5
Buddhism	9/217	4.1	5.7	1.1 10.2	0/151	0	0	0 0
Hinduism	2/217	0.9	0.7	-0.6 2.1	0/151	0	0	0 0
Christianity	132/217	60.8	54.9	45.9 64.1	24/151	15.9	15.6	7.5 24.1
Sikhism	0/217	0	0	0 0	0/151	0	0	0 0

No religion	2/217	0.9	2.6	0.1	5.1	0/151	0	0	0	0
Employment status										
Employed	150/217	69.1	72.6	65.4	79.9	107/151	70.9	66.6	55.2	78.2
Unemployed	10/217	4.6	4.1	1.2	7.0	44/151	29.1	33.4	21.8	44.9
Student	57/217	26.3	23.3	16.7	29.9	0/151	0	0	0	0

Table 3 Key HIV risk behaviours of MSM and TGW in Sarawak, 2024

Variable	n/N	MSM			TGW		
		Unweighted count (%)	Estimated population (%)	95 % CI Lower Upper	Unweighted count (%)	Estimated population (%)	95 % CI Lower Upper
Age at first had anal sex with men	18 (7-47)						
Median age (years)	18 (7-47)				17 (9-35)		
Condom use the last time had anal sex							
Yes	158/217	72.8	75.1	68.5 81.7	83.4	84.8	77.9 91.6
No	59/217	27.2	24.9	18.3 31.5	16.6	15.2	8.4 22.1
Had a regular sex partner							
Yes	99/217	45.6	51.2	41.8 60.5	47.7	49.3	37.5 60.5
No	118/217	54.4	48.8	39.5 58.2	52.3	50.7	39.5 62.5
Frequency of condom used with regular sex partner							
Always	61/99	61.6	59.7	47.1 72.2	52.8	48.1	32.4 63.9
Not always	30/99	30.3	32.5	23.0 42.0	34.7	37.5	24.2 50.5
Never use	8/99	8.1	7.9	-1.4 17.1	12.5	14.4	-2.6 31.6
Had sex with men in exchange for money or in kind (selling sex)							
Yes	83/217	38.2	32.9	25.4 40.2	68.9	68.0	56.6 79.4
No	134/217	61.8	67.1	59.8 74.6	31.1	32.0	20.6 43.4
Frequency of condom used with clients during selling sex							
Always	55/83	66.3	67.9	54.1 81.9	56.7	57.4	43.7 71.2
Not always	26/83	31.3	29.4	20.2 38.5	41.3	39.8	29.2 50.4
Never use	2/83	2.4	2.6	-8.2 13.5	1.9	2.8	-7.1 12.8
Had paid men for sex							
Yes	40/217	18.4	15.4	10.2 20.6	25.2	30.6	18.6 42.8
No	177/217	81.6	84.6	79.4 89.8	74.8	69.4	57.2 81.4
Frequency of condom used with men during paid sex							
Always	28/40	70.0	71.3	51.2 91.4	52.6	57.9	34.1 81.7
Not always	10/40	25.0	26.3	8.6 44.0	36.8	26.8	13.2 40.3
Never use	2/40	5.0	2.4	-10.6 15.4	10.5	15.3	-9.2 39.8
Had consensual sex							
Yes	108/217	49.8	54.2	45.5 62.8	61.6	57.7	45.3 70.2
No	109/217	50.2	45.8	37.2 54.5	38.4	42.3	29.8 54.7
Frequency of condom used with sex partner during consensual sex							
Always	62/108	57.4	59.0	48.5 69.6	47.3	49.3	33.8 64.8
Not always	42/108	38.9	38.6	29.4 47.8	50.5	49.1	36.2 62.1

Never use	4/108	3.7	2.4	-4.6	9.4	2/93	2.2	1.6	-6.4	9.5
Ever consumed alcohol before/during sex in the last 1 month										
Yes	46/217	21.2	20.3	13.4	27.3	49/151	32.5	34.6	23.5	45.7
No	171/217	78.8	79.7	72.7	86.6	102/151	67.5	65.4	54.3	76.6
Substances used before/during sex in the last 12 months (multiple response)										
Ecstasy	2/217	0.9	0.3	-0.2	0.9	2/151	1.3	1.3	-0.2	2.8
Syabu/ice	3/217	1.4	1.3	-0.1	2.7	7/151	4.6	2.1	-0.1	4.2
Cocaine	0/217	0	0	0	0	0/151	0	0	0	0
Heroin	0/217	0	0	0	0	2/151	1.3	0.5	-0.1	0.9
Others	0/217	0	0	0	0	2/151	1.3	0.4	100	100
Not taking drug	212/217	97.7	98.4	96.6	100.1	139/151	92.1	96.0	93.0	99.0

HIV/Hepatitis C/Sexually Transmitted Infection (STI) Services Utilisation

HIV/Hepatitis C/STI services utilisation among MSM and TGW were shown in Table 4. The majority of MSM reported having undergone blood testing for HIV, with most having their most recent test within the past six months. Community-based testing services were the primary point of access for HIV testing among MSM. More than half indicated that their regular partners or spouses had also been tested for HIV. Seven MSM disclosed their HIV-positive status, and two of them had never started ART because they were not offered treatment. Over half of the MSM living with HIV reported having a suppressed viral load. Regarding Hepatitis C, most MSM had never been tested, primarily due to a lack of knowledge about the testing process and available treatment. The most commonly reported risk factors for Hepatitis C infection among MSM were the use of sex toys during sex, followed by having tattoos. A small proportion of MSM reported visiting an STI clinic in the past three months. The most frequently experienced STI symptoms in the past 12 months were dysuria and penile discharge. Nearly half of the MSM diagnosed with an STI sought treatment at government health facilities.

Among TGW, most had undergone HIV testing, and a portion of their regular partners or spouses had also been tested. Similar to MSM, the majority of TGW accessed HIV testing through community-based services. Notably, all TGW living with HIV were on ART, and none had defaulted on their treatment. More than half reported having a suppressed viral load. Nearly half of the TGW had never been tested for Hepatitis C, with the primary reason being a lack of knowledge about where to access testing. The most commonly cited risk factors for Hepatitis C among TGW were the use of sex toys during sex and injecting drugs. Regarding STI services, a small proportion of TGW reported visiting an STI clinic within the past three months. The most frequently reported STI symptoms in the past 12 months were dysuria and penile ulcers. Among TGW diagnosed with an STI, the majority sought treatment at government health facilities.

Knowledge and Opinion on HIV/AIDS

The knowledge and opinion towards HIV/AIDS among MSM and TGW were presented in Table 5. A portion of MSM perceived themselves to be at risk of HIV infection. However, less than half displayed a high level of knowledge about HIV. Nearly half of the MSM were aware of the Undetectable=Untransmittable (U=U) concept.

Among TGW, some recognised their risk of acquiring HIV, while nearly half reported having adequate knowledge about the virus. A smaller proportion of TGW were familiar with the U=U concept, despite their general understanding of HIV.

HIV, Syphilis and Hepatitis C Prevalence

HIV, syphilis and Hepatitis C prevalence among MSM and TGW were summarised in Table 6. The HIV prevalence among MSM was 9.5%. The prevalence of syphilis and Hepatitis C in this group were 12% and 0.7%, respectively.

The HIV prevalence among TGW was found to be 10.1%. In this group, the prevalence rates for syphilis and Hepatitis C were 0.8% and 3.9%, respectively. Reactive cases were exclusively observed in TGW aged 25 and older.

DISCUSSION

The IBBS Lite survey conducted among MSM and TGW in Sarawak offers valuable insights into socio-demographic profiles, sexual behaviours, substance use and health services utilisation. These findings reveal both advancements and persistent challenges in improving the health and well-being of MSM and TGW in the region.

In this study, consistent condom uses among MSM and TGW remains inadequate, aligning with results from other studies.³⁻⁶ This highlights the urgent need to raise awareness about pre-exposure prophylaxis (PrEP) as a highly effective preventive measure. When used in conjunction with consistent and correct condom use, PrEP can reduce the risk of HIV transmission through sexual contact by approximately 99%.⁷

Although alcohol and substance use are not widespread among most MSM and TGW, they still contribute to risky sexual behaviours. The reported use of syabu/ice during sexual encounters aligns with findings from other Asian countries, where stimulant use is linked to increased rates of risky behaviour.⁸ This highlights the necessity of incorporating substance use interventions into HIV prevention programs.

The use of HIV testing services reflects positive trends, as most MSM and TGW report having undergone recent HIV testing. However, the low rates of Hepatitis C testing and treatment reveal a notable knowledge gap, in line with studies that recognise Hepatitis C as a neglected issue among MSM worldwide.⁹ Therefore, targeted educational campaigns focused on Hepatitis C testing and treatment options are crucial.

Despite some advancements, gaps in HIV knowledge remain, with fewer than 50% of MSM and TGW being aware of the U=U concept. Enhancing efforts to promote awareness of U=U is essential, as improved treatment literacy is linked to lower HIV prevalence and reduced risk behaviours. Additionally, increased knowledge enables MSM and TGW to advocate for their fundamental human rights and contributes to decreasing the stigma associated with HIV.

The HIV prevalence of 9.5% among MSM in this study is lower than the national prevalence of 12.9% reported in 2022. This suggests that

Sarawak's targeted prevention strategies, including condom distribution, community outreach programs, and harm reduction initiatives, are effective in mitigating HIV transmission within this group. These findings are consistent with research from other Southeast Asian regions, which highlight the effectiveness of community-based interventions in reducing HIV rates.¹⁰

In contrast, the HIV prevalence of 10.1% among TGW is notably higher than the national prevalence of 5.9% reported in 2022, emphasising the urgent need to strengthen prevention efforts. This should involve expanding HIV testing and counselling services, enhancing sexual health education and improving access to free condoms for TGW.

The 12% prevalence of syphilis among MSM is alarming, given that syphilis has been demonstrated to significantly elevate the risk of acquiring HIV.¹¹ This finding highlights the urgent need to enhance syphilis screening and treatment programs within the current sexual health framework. Early detection and prompt treatment of syphilis are crucial not only for controlling its transmission but also for reducing its impact as a co-factor in HIV transmission.

While individual-level behaviours contribute to HIV and STI risks, broader structural conditions also play a critical role in shaping health outcomes among MSM and TGW. Beyond these epidemiological and behavioural findings, structural barriers remain a significant challenge to HIV prevention and care in Sarawak and across East Malaysia. Geographic remoteness, limited transportation infrastructure and unequal distribution of healthcare resources restrict access to timely testing, treatment, and follow-up services, particularly for individuals in rural and interior areas. Persistent stigma and discrimination toward sexual and gender minorities further discourage MSM and TGW from seeking care, especially where confidentiality cannot be assured or where healthcare providers hold stigmatizing attitudes. Such systemic inequities perpetuate social marginalisation and diminish the impact of otherwise effective public health interventions. Addressing these barriers requires sustained multisectoral collaboration to expand culturally competent and stigma-free services, strengthen sensitivity training among healthcare personnel, and scale up community-based and peer-led delivery models that can effectively reach marginalized populations in remote and underserved communities.

This study has several limitations that should be considered when interpreting the findings. First, the data were collected through self-reported measures, which are inherently prone to recall errors and social desirability bias, particularly given the sensitivity of topics such as sexual practices and

substance use. These factors may have led to underreporting or overreporting of certain behaviours. Second, the cross-sectional study design limits causal interpretation of associations.

CONCLUSION

In conclusion, enhancing HIV prevention and care for MSM and TGW in Sarawak requires a multifaceted approach that promotes consistent condom use, raises awareness of Hepatitis C, and integrates substance use interventions within HIV programs. Strengthening community-based outreach through culturally sensitive strategies is essential to improve service uptake and foster trust among key populations. The findings also underscore the need to incorporate syphilis management into HIV prevention efforts, given its association with increased HIV risk. Future interventions should strengthen peer-led and community-driven initiatives to ensure sustainable and long-term impact. Addressing these issues can help reduce HIV, syphilis, and Hepatitis C among MSM and TGW, supporting Malaysia's goal of ending AIDS as a public health threat by 2030.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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REFERENCES

1. Ministry of Health Malaysia (MOH). *Global AIDS Monitoring: Country Progress Report – Malaysia*. Putrajaya: MOH; 2023. Available from: https://www.moh.gov.my/moh/resources/Penerbitan/Laporan/Umum/Laporan_Global_AIDS_Monitoring_2023.pdf
2. Lemin AS, Rahman MM, Pangarah CA, Kiyu A. Factors affecting voluntary HIV testing among general adult population: A cross-sectional study in Sarawak, Malaysia. *J Fam Reprod Health*. 2020;14(1):45–51.
3. Bavinton BR, Mahendra IG, Kaldor J, Law M, Grulich AE, Januraga PP. Estimation of potential HIV transmission risk in recent anal intercourse events among men who have sex with men and transgender women in Bali, Indonesia. *Trop Med Infect Dis*. 2021;6(3):139.
4. Kumar P, Aridoss S, Mathiyazhakan M, Balasubramanian G, Jaganathasamy N, Natesan M, et al. Substance use and risk of

- HIV infection among men who have sex with men in India: Analysis of National IBBS data, India. *Medicine (Baltimore)*. 2020;99(35):e21360.
5. Chhim S, Ngim C, Chhoun P, Tuot S, Ly C, Mun P, et al. HIV prevalence and factors associated with HIV infection among transgender women in Cambodia: results from a national Integrated Biological and Behavioral Survey. *BMJ Open*. 2017;7(8):e015390.
6. Holtz TH, Pattanasin S, Chonwattana W, Tongtoyai J, Chaikummao S, Varangrat A, et al. Longitudinal analysis of key HIV-risk behavior patterns and predictors in men who have sex with men, Bangkok, Thailand. *Arch Sex Behav*. 2015;44:341–8.
7. Centers for Disease Control and Prevention (CDC), US Public Health Service. *Preexposure Prophylaxis for the Prevention of HIV Infection in the United States – 2021 Update: A Clinical Practice Guideline*. Atlanta (GA): CDC; 2021. Available from: <https://www.cdc.gov/hiv/pdf/risk/prep/cdc-hiv-prep-guidelines-2021.pdf>
8. Guadamuz TE, McCarthy K, Wimonasate W, Thienkrua W, Varangrat A, Chaikummao S, et al. Psychosocial health conditions and HIV prevalence and incidence in a cohort of men who have sex with men in Bangkok, Thailand: evidence of a syndemic effect. *AIDS Behav*. 2014;18:2089–96.
9. Fierer DS, Wyles DL. Re-treatment of hepatitis C infection after multiple failures of direct-acting antiviral therapy. *Open Forum Infect Dis*. 2020;7(4):ofaa095.
10. Joint United Nations Programme on HIV/AIDS (UNAIDS). *Global AIDS Update 2021*. Geneva: UNAIDS; 2021. Available from: https://www.unaids.org/sites/default/files/media_asset/2021-global-aids-update_en.pdf
11. Chow EP, Dutt K, Fehler G, Denham I, Chen MY, Batrouney C, et al. Duration of syphilis symptoms at presentation in men who have sex with men in Australia: are current public health campaigns effective? *Epidemiol Infect*. 2016;144(1):113–22.