ORIGINAL ARTICLE

Integrated Biological and Behavioural Surveillance (IBBS) Survey 2022: Risk Behaviours among People Who Inject Drugs (PWID) in Malaysia

Zailatul Hani Mohamad Yadzir*, Mazliza Ramly, Anita Suleiman

HIV/STI/Hep C Sector, Disease Control Division, Ministry of Health Malaysia, Federal Government Administrative Centre, 62590 Putrajaya, Malaysia

Keywords:
integrated biological and behavioural surveillance (IBBS); people who inject drugs (PWID); risk behaviours; HIV prevalence

Article history:
Received: 7 April 2025
Accepted: 16 June 2025

ABSTRACT

Background: People who inject drugs (PWID) are among the key populations most affected by the HIV epidemic in Malaysia. The objective of this study was to examine the risk behaviours and prevalence of human immunodeficiency virus (HIV) among PWID. **Methods:** Respondent-driven sampling (RDS) was employed to recruit PWID for the Integrated Biological and Behavioural Surveillance (IBBS) survey conducted between July and December 2022. Participants completed online behavioural surveys and underwent rapid HIV testing. **Results:** 824 respondents participated in this study. 96.9% of respondents reported using clean needles and syringes in their last injection. Most respondents (96.7%) also reported they had no problem getting access to sterile needles and syringes. Only 9.6% of respondents stated that they shared needles and syringes with friends in the past 3 months. A total of 54.6% of respondents are enrolled in the Methadone Maintenance Therapy (MMT). It is concerning that 90.0% of respondents who reported being sexually active had sex without using a condom. The HIV prevalence among PWID was 7.5%. **Conclusion:** In Malaysia, HIV prevalence among PWID has significantly declined over the past decade, largely in line with reduced risk behaviours, particularly increased use of safe needles and syringes. To sustain this downward trend, continued surveillance and prevention efforts are essential. Additionally, prevention strategies should also aim to promote safer sexual practices among PWID.

INTRODUCTION

As of the end of 2018, the estimated number of people who inject drugs (PWID) in Malaysia was approximately 75,000. (MOH, 2018). The 2017 Integrated Biological and Behavioural Surveillance (IBBS) survey among male PWID reported an HIV prevalence of 13.4%, making it the second highest among all identified high-risk groups (MOH, 2019).

PWID was initially responsible for the HIV epidemic in Malaysia primarily via the sharing of injecting paraphernalia, however, in the past decade, sexual transmission has emerged as the main mode of transmission (MOH, 2021). Nevertheless, continued research on HIV risk among PWID remains crucial to ultimately ending the HIV epidemic within this population.

Since 2009, Malaysia has added the IBBS survey to its national HIV surveillance system in order to track the trajectory and pattern of the HIV epidemic. This study, carried out every two to three years, aims to evaluate the local trend of the HIV epidemic in the country and to identify the factors that may have an impact on how the epidemic develops in the region and population under study. The objective of this study was to examine the risk behaviours and prevalence of HIV among PWID.

MATERIALS AND METHODS

Study Setting and Sample Size

The study was conducted among male PWID in eight states in Malaysia. PWID were enrolled based on predefined inclusion criteria: individuals aged 18 years or older, with a history of injecting drugs for at least six months prior to the survey date, able to understand either Bahasa Malaysia or English, and willing to provide informed consent. The target sample size was calculated to be 900 assuming 95% confidence level with 5% margin error and 50% response rate.

Study Design

Respondent-driven sampling (RDS) was used to recruit respondents into the study because it is specifically designed to avoid many of the biases and issues of other chain referral system, such as snowballing. RDS has been demonstrated to be an effective sampling approach for hidden and difficult to reach or invisible populations that have no sampling frame (Heckathorn, 1997).

In this study, respondents included i) seeds act as the initial respondents for the recruitment process, and ii) new survey respondents recruited by the previous survey respondents. About three to five seeds were pre-identified by the person in charge for each study site, but only one

* *Corresponding author.*
E-mail address: zailatul@moh.gov.my

seed was planted at a time to initiate the recruiting process. In the event that no new recruits were found or the rate of recruiting was too slow, new seed was planted. In order to ensure diversity, seeds were chosen, to the greatest extent possible, based on geographic, demographic and key outcome variables such as HIV status, socio-economic status, age, gender and their acquaintance with diverse people. In this study, eight seeds were use in the recruitment process.

Each respondent was subjected to eligibility screening using screening questions before enrolment to eliminate those who were outside the study's target population. After completing the online survey and blood test, each seed received three quick response (QR) codes to use in recruiting the initial wave of respondents from his network of peers. The QR code was valid for five days. Each wave of responders recruited the next wave until the desired sample size was reached.

After completing the online survey and blood test, respondents were given an incentive of RM40. This incentive was provided to respondents as a token of appreciation for the transport, time/effort and costs that they had incurred whilst taking part in this study. They also received RM10 as an additional incentive for each successful referral (maximum of RM30).

This study comprised two parts. The first part consisted of a behavioural survey that was carried out using a self-administered online questionnaire survey via a web-based platform. After completing the online survey, respondents were instructed to go to the community-based testing sites of their choice for HIV blood testing. This study was registered with the Medical Research and Ethics Committee, Ministry of Health, Malaysia.

Study Instrument

The instrument used was a self-administered online questionnaire survey via web-based platform. The questionnaire was adapted from the Family Health International Guidelines for Repeated Behavioural Surveys in Population at Risk of HIV. The questionnaires were written in Bahasa Malaysia and English, which are the two main languages of Malaysia. The questionnaire contained questions about sexually transmitted infections (STI) symptoms, HIV knowledge and stigma, sexual history, injectable drugs, coverage of interventions, testing, and treatment, and sociodemographic traits. No personal information was asked to maintain anonymity.

Statistical Analysis

Statistical analysis was done using the Statistical Package for Social Sciences (SPSS 26.0) software. Data was entered, cleaned and checked before data analysis. Frequencies and simple associations were calculated**.**

RESULTS

Socio-Demographic Characteristics

The socio-demographic characteristics of the PWID respondents are summarized in Table 1. The response rate for the study sample was 91.6%. In total, 824 male PWID participated in this study. Most respondents (40.7%) were between the ages of 40 to 49, with a median age of 42. The majority of respondents (93.9%) identified as Malay, were Muslim (96.4%), had completed at least secondary school (83.9%) and not being married (49.4%). More than half of the respondents (66.4%) claimed to have worked.

Table 1: Socio-demographic characteristics of PWID respondents

	n	%
Age		
≤ 24	10	1.2
25 - 29	27	3.3
30 - 39	250	30.3
40 - 49	335	40.7
≥ 50	202	24.5
Median age (years)	42 (21-69)	
Ethnic		
Malay	774	93.9
Chinese	15	1.8
Indian	19	2.3
Pribumi Sabah	2	0.2
Orang Asli	10	1.2
Others	4	0.5
Education		
No formal education	10	1.2
Primary	105	12.7
Secondary	691	83.9
Tertiary	18	2.2
Marital status		
Unmarried	407	49.4
Married	205	24.9
Divorced	204	24.8
Widower	8	1.0
Source of income		
Employed	547	66.4
Unemployed	218	26.5
Student	0	0.0
Others	59	7.2
Faith		
Islam	794	96.4
Buddhism	11	1.3
Hinduism	14	1.7
No religion	5	0.6
Duration of living in the city		
Median duration (years)	37 (0.1-69)	

Drug Use and Injecting Practices

The drug use and injecting practices among the PWID respondents are displayed in Table 2. The majority of PWID respondents reported using and injecting drugs for more than or equal to 5 years. 20 years was the median age at which respondents started using drugs of any type, whereas the median age at which respondents started injecting drugs was 25. The most frequently injected drug was reportedly heroin (92.1%). The majority of PWID respondents (94.5%) stated that they injected drugs no more than four times per week. About 90.4% and 96.9% of PWID, respectively, stated that they had used sterile syringes and needles within the previous three months and at their most recent injection. Most PWID respondents (96.7%) reported they had no problem getting access to sterile needles and syringes.

Table 2: Drug use and injecting practices among PWID respondents

	n	%
Duration of drug use		
≤ 1 years	1	0.1
2-4 years	7	0.8
≥ 5 years	816	99.0
Duration of injecting drug		
≤ 1 years	13	1.6
2-4 years	30	3.6
≥ 5 years	781	94.8
Types of drugs injected* *(*multiple response)*		
Heroin	759	92.1
Diazepam	32	3.9
Amphetamines	304	36.9
Suboxone/Methadone	102	12.4
Codeine	16	1.9
Opium	18	2.2
Ketamine	44	5.3
Ecstasy/Methamphetamine	153	18.6
Ketum	87	10.6
Opiates** + Others types of drugs	823	99.9
*(**refer to Heroin, Codeine, Opium & Suboxone/Methadone)*		
Injection frequency per week		
≤ 4 times	624	94.5
5 - 9 times	33	5.0
≥ 10 times	3	0.5
Median injection per day	2 (1-13)	
Injecting practices in the past 3 months		
Shared needle and syringe with friends	79	9.6
Injecting practices at last injection		
Not using a clean needle	21	3.1
Had problem getting sterile needle and syringes		
Yes	27	3.3

Sexual Practices

The sexual practices among the PWID respondents are shown in Table 3. A quarter of the PWID respondents (25.5%) reported having sex in the past 1 month and the majority of them (90.0%) reported not wearing a condom for their most recent encounter.

Table 3: Sexual practices among PWID respondents

	n	%
Had sexual intercourse in the past 1 month		
Yes	210	25.5
Used condom during last sex (N=210)		
Yes	21	10.0

Services Exposure and Utilization

The services exposure and utilization among the PWID respondents are summarized in Table 4. Regarding HIV, 93.3% of PWID respondents had ever had their blood tested for HIV. Of those, 49.0% and 33.3% had their test less than 6 months ago and 6 to 12 months ago, respectively. Almost three-quarters of the respondents (77.8%) had access to an HIV test at community based testing. A total of 45.0% of respondents claimed that their partner/spouse had also undergone the HIV testing.

Just 8.3% of respondents who self-reported having a negative or unknown HIV status had heard of pre-exposure prophylaxis (PrEP) in relation to HIV prevention. Only 36.5% of respondents stated that they would consider using PrEP in the future. The top three reasons cited by respondents who are not interested in taking PrEP are that it is too costly (35.0%), they are not interested in taking PrEP (30.0%), and they are not yet prepared for PrEP (15.0%). When it comes to HIV prevention, the majority of respondents (88.1%) favoured condoms over PrEP.

Approximately half of the respondents (54.6%) had enrolled in the MMT programme. A total of 81.4% of respondents had a Hep C blood test. As for STI, a low proportion of PWID respondents (4.5%) reported visiting a STI clinic in the past 3 months. The respondents were also asked if they had experienced STI symptoms in the past 12 months. Extreme burning pain when urinating (2.1%), rectal discharge/bleeding (0.4%) and penile ulcer (0.2%) were the most frequent STI symptoms reported by the respondents and 40.0% of them admitted using government-run facilities for treatment.

Table 4: Services exposure and utilization among PWID respondents

	n	%
Contacted by NGO outreach worker (ORW) or healthcare worker (HCW)		
Yes	754	91.5
HIV		
HIV testing		
Ever had blood tested for HIV	769	93.3
Access to HIV test*: (N=769)		
a) Government clinic	329	42.8
b) Private clinic	12	1.6
c) Community based testing	598	77.8
d) Self-testing	3	0.4
*(*multiple response)*		
Last take HIV blood test: (N=769)		
a) Less than 6 months ago	377	49.0
b) 6 to 12 months ago	256	33.3
c) more than 12 months ago	136	17.7
Regular partner/spouse taken the HIV testing: (N=769)		
Yes	346	45.0
No	250	32.5
Does not have permanent partner or spouse	173	22.5
HIV prevention		
Heard about pre-exposure prophylaxis (PrEP) (N=779)	65	8.3
Taken PrEP in the past 12 months (N=65)	2	3.1
Where get PrEP: (N=2)		
a) Private clinic	2	100
b) Pharmacy	0	0.0
c) Online	0	0.0
Interested in taking PrEP in the future (N=63)	23	36.5
Reason did not interested in taking PrEP in the future: (N=40)		
a) Not interested to take PrEP	12	30.0
b) Financial problem	1	2.5
c) Too expensive	14	35.0
d) I am not ready yet for PrEP	6	15.0
e) Afraid of stigma or rejection	3	7.5
f) Afraid of the side effects of PrEP	0	0.0
g) No risk of being infected with HIV	4	10.0
Prefer as HIV prevention: (N=779)		
a) PrEP	93	11.9
b) Condom	686	88.1
Heard about post-exposure prophylaxis (PeP) (N=779)	44	5.6
Taken PeP in the past 12 months (N=44)	1	2.3
Where get PeP: (N=1)		
a) Private clinic	0	0.0
b) Pharmacy	1	100
c) Online	0	0.0
Methadone Maintenance Therapy (MMT)		
Enrolled in MMT program	450	54.6
Still receiving MMT (N=450)	252	56.0
Hepatitis C		
Ever had blood tested for Hep C	671	81.4
Reason did not get tested*: (N=153)		
a) Did not aware about Hep C test and treatment	82	53.6
b) Don't know where to get tested	14	9.2
c) Refused to get tested	55	35.9
d) Testing facilities not available or too far	4	2.6
e) Others	8	5.2
*(*multiple response)*		
Sexually transmitted infections (STI)		
Visited STI clinic in the past 3 months	37	4.5
Experienced symptoms in the past 12 months*:		
a) Extreme burning pain when urinating	17	2.1
b) Penile ulcer	2	0.2
c) Penile discharge	0	0.0
d) Rectal discharge/bleeding	3	0.4
e) Never experienced any of those symptoms	804	97.6
*(*multiple response)*		
Action taken by respondents the last time had STI symptoms: (N=20)		
a) Did not treat	5	25.0
b) Self treated/sought advice from pharmacy	3	15.0
c) Sought treatment from government health facility	8	40.0
d) Sought treatment from private health facility	0	0.0
e) Went to traditional healer	4	20.0
f) Others	0	0.0

The findings related to access and utilization of prevention services are presented in Table 5. A total of 82.5% of PWID respondents reported having received information on HIV/STI/safer injecting use. The majority of respondents (90.4%) reported to have received new, clean needles and syringes in the past 3 months. Only 9.0% of respondents claimed they had not received any HIV prevention package in the past 3 months.

Table 5: Access and utilization of prevention services by PWID respondents

	n	%
Received information on HIV/STI/safer injecting use	680	82.5
HIV prevention services*		
Received new, clean needles or syringes	745	90.4
Received condoms and lubricants	104	12.6
Received counselling on condom use and safe sex	160	19.4
Did not receive any HIV prevention package	74	9.0
*(*multiple response)*		

Treatment Status

The treatment status among the PWID respondents are shown in Table 6. In this study, 45 respondents disclosed that they were HIV positive. Of those, 82.2% were already receiving antiretroviral therapy (ART). However, 5 respondents (13.5%) had defaulted treatment for a variety of reasons, including financial problems (20%), loss of interest in the program (20%), unable to handle ART's side effects (20%), arrested at prison or drug rehabilitation centre (20%) and others (20%). A total of 37.5% of respondents claimed that their viral load had not been suppressed.

Table 6: Treatment status among PWID respondents

	n	%
HIV status (N=769)		
Positive HIV	45	5.9
Negative HIV	716	93.1
Indeterminate	3	0.4
Don't know HIV status	5	0.7
HIV treatment		
Received ART (N=45)	37	82.2
Never on ART (N=45)	8	17.8
Still receiving ART (N=37)	32	86.5
Defaulted ART (N=37)	5	13.5
Reason defaulted ART: (N=5)		
a) Opting for other form of treatment (spiritual/alternative treatment)	0	0.0
b) Financial problem	1	20.0
c) No time to seek for regular treatment	0	0.0
d) Loss of interest in the program	1	20.0
e) Cannot tolerate the side effects of ART	1	20.0
f) Afraid of stigma or rejection	0	0.0
g) Got arrested at prison or drug rehabilitation centre	1	20.0
h) Others	1	20.0
Reason did not received ART: (N=8)		
a) Opting for other form of treatment (spiritual/alternative treatment)	0	0.0
b) Financial problem	0	0.0
c) No time to seek for regular treatment	0	0.0
d) Loss of interest in the program	3	37.5
e) Cannot tolerate the side effects of ART	0	0.0
f) Afraid of stigma or rejection	0	0.0
g) I was offered but I am not ready yet for ART	5	62.5
h) I was not offered to start treatment	0	0.0
i) Others	0	0.0
Viral load suppressed: (N=32)		
Yes	14	43.8
No	12	37.5
Not sure/Not remember	6	18.8

Awareness on HIV, Risk and Prevention Efforts

The knowledge of HIV, risk and prevention efforts among the PWID respondents are shown in Table 7. A total of 46.5% of respondents believed they were at risk of contracting HIV. Regarding HIV knowledge, 73.7% of the respondents indicated to have adequate overall knowledge on HIV. The majority of respondents (> 85%) also correctly responded to each of the five questions about their understanding of HIV but only 16.4% were aware of the concept of U=U (Undetectable=Untransmittable).

HIV Prevalence

The HIV prevalence among PWID respondents was 7.5%. Five participants in this study were found to be reactive and had never had an HIV blood test.

Table 7: Knowledge of HIV, risk and prevention efforts among PWID respondents

	n	%
Felt at risk of being infected with HIV	383	46.5
Knowledge of HIV*		
A person can reduce risk of HIV by having one faithful, uninfected partner	710	86.2
A person can reduce HIV transmission by using condom	791	96.0
A healthy looking person can have HIV	761	92.4
A person cannot become infected through mosquito bites	769	93.3
A person cannot get HIV by sharing meal with someone who is infected with HIV	772	93.7
*(*number with correct answer)*		
Score Knowledge of HIV		
5 score	607	73.7
4 score	158	19.2
3 score	30	3.6
2 score	20	2.4
1 score	6	0.7
0 score	3	0.4
(score 5=adequate knowledge, score 0-4=inadequate knowledge)		
Know about U=U (Undetectable=Untransmittable)	135	16.4

DISCUSSION

The percentage of respondents in the 24–39 age category is decreasing in comparison to prior years, indicating that PWID in Malaysia are growing older (63.1% in 2009, 59.3% in 2012, 50.2% in 2014, 46.3% in 2017 and 34.8% in 2022), while the proportion of respondents in the 40 to 50 years of age and above are increasing (37.0% in 2009, 40.7% in 2012, 49.8% in 2014, 53.7% in 2017 and 65.2% in 2022) (MOH, 2019). This might be because of the same

respondents participating in each IBBS survey cycle, which causes their age to increase in each cycle. Additionally, more young people nowadays use drugs orally, inhaled or smoked rather than injecting them.

In this study, most respondents (90.4%) claimed to have received new, clean needles and syringes in the past 3 months. In addition, 96.9% of respondents reported using clean needles and syringes in their last injection. Only 9.6% of respondents stated that they shared needles and syringes with friends in the past 3 months. This is evidence of the Harm Reduction Programme's efficacy, which was launched in 2005-2006. Needle/Syringe Exchange Programme (NSEP) and MMT are two components of this programme. The NSEP facilitated access to clean needle and syringes among the PWID. Furthermore, the median number of injections per day remained low at about 2.0 in 2012, 2014, 2017 and 2022 (MOH, 2019). Therefore, with low injection frequency and consistent use of clean needles and syringes, there is a larger likelihood of reducing the risk of HIV transmission and, in turn, the prevalence of HIV among PWID over the long term.

Similar to previous rounds of the IBBS survey, heroin continued to be the most commonly injected drug in 2022 among PWID. However, nearly all respondents (99.9%) also injected other types of drugs in addition to opioids (i.e., heroin, codeine, opium, suboxone/methadone). The use of other injectable drugs such as amphetamines and ecstasy/methamphetamine has increased in 2022 compared to 2017. This is consistent with a recent statistic from the National Anti-Drugs Agency (NADA), which showed that methamphetamine use has increased, while opiates use has decreased since 2016 (NADA, 2020). Since MMT has been used to treat opioids dependence, additional intervention strategies are required to treat other kinds of drug addiction.

In this study, the majority of PWID (90.0%) reported being sexually active and not using a condom during their last sexual encounter. Notably, 78.3% of them who did not use condoms stated that they would rather use condoms than PrEP to prevent HIV. This could be because they were still high at the time of the sexual encounter and failed to use a condom. Similar to the findings of this study, numerous studies found that a large proportion of drug users use condoms inconsistently (Mishra et al., 2014; Boltaev et al., 2013; Mahanta et al., 2008). Unfortunately, in this study, only 12.6% and 19.4% of respondents claimed to have received condoms and lubricants and counselling on safe sex and condom use, respectively. Thus, prevention initiatives should focus to increase protective sexual behaviours among PWID. Programmes to increase knowledge and focus on consistent and correct condom use, including the use of lubrication should be strengthened. Additionally, PWID must be educated about taking PrEP as a preventive measure. PrEP is highly effective for reducing the risk of getting HIV from sex by about 99% (Centres for Disease Control and Prevention, 2021) and reduced HIV transmission by 74% in injecting drug users (Choopanya et al., 2013) when taken consistently as prescribed.

By 2030, Malaysia aims to "End AIDS" by reaching the 95-95-95 target, which calls for 95% of critical populations to have had HIV testing and be aware of their results, 95% of HIV-positive individuals to be on ART, and 95% of those on treatment to have their viral load suppressed. 72.6% of PWID in this study had received HIV testing and were aware of the results. Among those who have been infected, 82.2% received ART and 43.8% adhered to their treatment regime with suppressed viral load. In order to close this gap and reach the 95-95-95 target by 2030, prevention initiatives should be prioritized, accelerated and scaled up. Additional testing strategies, including self-testing methods should be incorporated to improve testing coverage among PWID. In addition, collaboration between the government, non-governmental organizations and PWID support groups is necessary to provide an accessible supply of ART and ensure treatment adherence.

In general, 73.7% of PWID respondents indicated to have adequate overall knowledge on HIV in 2022 which is an improvement over previous year (49.7% in 2009, 53.8% in 2012, 58.3% in 2014 and 54.4% in 2017) (MOH, 2019). However, only 16.4% of respondents were aware of the concept U=U. As a result, further efforts are needed to raise awareness of this idea because better treatment literacy is also responsible for the decline in HIV-associated prevalence and risk behaviours. The findings warrant the need to empower PWID to understand and assert their basic human rights.

The prevalence of HIV among PWID in Malaysia decreased steadily from 18.9% in 2012 (MOH, 2019) to 7.5% in 2022 with consistently low injection frequency and a high percentage of safe injecting practices at the last injection. This calls for continued preventive efforts as well as surveillance to sustain the observed downward trend. Thus, it is possible to end an HIV epidemic among PWID in Malaysia in the future.

This study had several limitations that warrant careful consideration when interpreting the results. One significant limitation is the reliance on self-reported responses, which is a common practice in research within this domain. Self-reporting can introduce various biases

that may affect the accuracy of the data collected. Specifically, the findings are susceptible to reporting biases, where respondents may not accurately disclose their behaviours or experiences due to memory recall issues or misunderstanding of the questions. Additionally, there is the potential for social desirability biases, where respondents may provide answers, they believe are more acceptable or favourable in the eyes of researchers or society, rather than their true behaviours or beliefs. These biases highlight the importance of interpreting the results with caution, as they may not fully reflect the actual behaviours and attitudes of the population studied. Future research could benefit from incorporating objective measures or triangulating self-reported data with other sources to enhance the reliability of the findings.

CONCLUSION

In Malaysia, the decline in HIV prevalence among PWID over the past decade was remarkably significant and consistent with an increase in safer use of clean needles and syringes. This necessitates ongoing surveillance and preventive measures in order to maintain the observed decreased trend. In addition to injecting practices, sexual behaviours also increase the risk of HIV among PWID. Currently, sexual transmission of HIV is increasingly substituting injecting practices. Thus, prevention initiatives should also focus to increase protective sexual behaviours among PWID. Furthermore, additional intervention strategies are also needed to treat different types of drug addiction because MMT has only been used to treat opioid dependency.

ACKNOWLEDGEMENT

The authors thank the Director General of Health Malaysia for his permission to publish this paper. The authors also thank all the respondents who participated in the study. This study was funded by Ministry of Health, Malaysia.

REFERENCES

Boltaev AA, El-Bassel N, Deryabina AP, Terlikbaeva A, Gilbert L, Hunt T, Primbetova S, Strathdee SA (2013) Scaling up HIV prevention efforts targeting people who inject drugs in Central Asia: a review of key challenges and ways forward. *Drug and Alcohol Dependence,* 132 (1): 41-7.

Centres for Disease Control and Prevention, US Public Health Service (2021) Preexposure prophylaxis for the prevention of HIV infection in the United States-2021 update: a clinical practice guideline. https://www.cdc.gov/hiv/pdf/risk/prep/cdc-hiv-prep-guidelines-2021.pdf.

Choopanya K, Martin M, Suntharasamai P, Sangkum U, Mock PA, Leethochawalit M, Chiamwongpaet S, Kitisin P, Natrujirote P, Kittimunkong S, Chuachoowong R. (2013) Antiretroviral prophylaxis for HIV infection in injecting drug users in Bangkok, Thailand (the Bangkok Tenofovir Study): a randomised, double-blind, placebo-controlled phase 3 trial. *The Lancet,* 381(9883):2083-90.

Heckathorn, DD (1997) Respondent-driven sampling: a new approach to the study of hidden populations. *Social Problems,* 44: 174-99.

Mahanta J, Medhi GK, Paranjape RS, Roy N, Kohli A, Akoijam BS, Dzuvichu B, Das HK, Goswami P, Thongamba G (2008) Injecting and sexual risk behaviours, sexually transmitted infections and HIV prevalence in injecting drug users in three states in India. *AIDS,* 22 (5): 59-68.

Mishra RK, Ganju D, Ramesh S, Lalmuanpuii M, Biangtung L, Humtsoe C, Saggurti N (2014) HIV risk behaviours of male injecting drug uders and associated non-condom use with regular female sexual partners in north-east India. *Harm Reduction Journal,* 11:5.

Ministry of Health Malaysia (MOH) (2021) Global AIDS Monitoring: Country Progress Report-Malaysia. Putrajaya: Ministry of Health Malaysia (MOH).

Ministry of Health Malaysia (MOH) (2019) Integrated Biological and Behavioural Surveillance Survey 2019. Putrajaya: Ministry of Health Malaysia (MOH).

Ministry of Health Malaysia (MOH) (2018) Size estimations of key populations Malaysia. Putrajaya: Ministry of Health Malaysia (MOH).

National Anti-Drugs Agency (NADA) (2020) Statistic trend of number of drug addicts detected according to type of drugs, 2016 - 2020. Putrajaya: Ministry of Home Affairs (MOHA).