KNOWLEDGE OF HIV TRANSMISSION AND ITS ASSOCIATION WITH SOCIODEMOGRAPHIC FACTORS AMONG MALE DRUG USERS IN MALAYSIA: FINDINGS FROM THE INTEGRATED BIOLOGICAL AND BEHAVIORAL SURVEILLANCE SURVEY (IBBS) 2017

Cheah YK[1], Suleiman A[2], Ramly M[2], Kee CC[3], and Lim KK[4].

[1]School of Economics, Finance and Banking, College of Business, Universiti Utara Malaysia, 06010 Sintok, Kedah, Malaysia
[2]HIV/STI/Hepatitis C Sector, Ministry of Health Malaysia, 62590 Putrajaya, Malaysia
[3]Sector for Biostatistics and Data Repository, National Institutes of Health, Ministry of Health Malaysia, No. 1, Jln Setia Murni U13/52, Seksyen U13, 40170 Shah Alam, Selangor, Malaysia
[4]Centre for Occupational Health Research, Institute for Public Health, National Institutes of Health, Ministry of Health Malaysia, No. 1, Jln Setia Murni U13/52, Seksyen U13, 40170 Shah Alam, Selangor, Malaysia

Correspondence:

Yong Kang Cheah,
School of Economics, Finance and Banking,
College of Business,
Universiti Utara Malaysia,
06010 Sintok, Kedah, Malaysia
Email: yong@uum.edu.my

Abstract

Controlling the spread of HIV requires essential knowledge. This study explores how sociodemographic factors relate to HIV transmission knowledge among male drug users in Malaysia. This study utilised cross-sectional data from the Integrated Biological and Behavioral Surveillance Survey (IBBS) 2017 (n = 1,413). An ordered probit regression was used to evaluate parameters influencing the probabilities of having low-, middle- and high-level knowledge of HIV transmission. Almost half of drug users had low- and middle-level knowledge of HIV transmission. The likelihood of possessing low- and middle-level knowledge about HIV transmission were 2.1%–8.3% lower among drug users aged 30–49 than those aged ≥50. Drug users with secondary- and tertiary-level education were 5.8%–14.9% more likely to possess high-level knowledge about HIV transmission compared to individuals with primary-level education. The odds of possessing high-level knowledge of HIV transmission was 6.3% higher among divorced/widowed drug users, while it was 23%–32.9% lower among non-Malays when compared with others. In conclusion, drug users are more likely to have poor knowledge about HIV transmission if they are older, less educated, non-Malays and single. Future HIV-control initiatives should give particular consideration to the populations with these sociodemographic traits.

Keywords: Cross-sectional Studies, Drug Users, HIV, Knowledge, Sociodemographic Factors

Introduction

Human immunodeficiency virus (HIV) infection is an expanding and significant public health issue (1). The number of people living with HIV is growing worldwide. In 2020, HIV was responsible for approximately 700,000 deaths worldwide (1). About 37.7 million people were living with HIV globally (1). As the latest report of the Ministry of Health Malaysia shows, approximately 87041 Malaysians were diagnosed with HIV in 2018, yet fewer than two-thirds received antiretroviral treatment (2). Until year 2018, the cumulative numbers of HIV patients in Malaysia were nearly 12,000 (2). These were accompanied with 43843 cumulative HIV-induced death cases. Annually, the money spent by the Malaysian government on HIV is

approximately Ringgit Malaysia (RM) 90 million, which is a sizeable amount of the yearly health budget (2).

Understanding of HIV plays a crucial role in encouraging safe sex, which lowers the risk of HIV (3). It is abundantly obvious that the HIV risk is higher among drug users than the general population due to their needle-sharing behaviours (4). Educating drug users about HIV could therefore be one of the effective intervention measures directed toward reducing the newly diagnosed HIV infection (5). The prevalence of HIV among Malaysian drug users reduced from 18.9% in 2012 to 13.4% in 2017, and it was lower than the prevalence of HIV in the population of men who have sex with men (MSM) (2). Drug users are recommended to have enough knowledge about HIV. With

sufficient knowledge, drug users will know more about HIV prevention and consequently have a lower likelihood of acquiring HIV (6). However, a recent national health survey report demonstrates that fewer than 60% of male drugs users have comprehensive knowledge of HIV (2). This could be one of the contributing causes to the high rate of HIV and low use of condoms among male drug users. Although increasing awareness of HIV in drug users is a serious public health priority, little is known about sociodemographic differences in HIV knowledge in this population. A thorough comprehension of the relationships between knowledge of HIV and sociodemographic characteristics could help the Ministry of Health Malaysia in creating an efficient HIV-control programme. As pointed out by Tulloch et al. (7), good understanding of HIV is associated with strong desire for risk reduction, thus leading to safe sex practice. Given the concerning statistics regarding HIV, this study aims to evaluate the relationships between sociodemographic characteristics and awareness of HIV transmission among male drug users in Malaysia. Findings from this study are significant in the sense that they are useful for strategic planning and resource allocation.

Given the gaps in the existing literature related to knowledge of HIV (6, 8-25), the goal of this study is to make many contributions. First, to our knowledge, this is the first study to gain insight into the influences of sociodemographic factors on knowledge of HIV transmission with concentration on Malaysia, where empirical studies are lacking. Nations in Africa, such as Ethiopia, Uganda, Kenya, Nigeria and Ghana, were frequently the focus of earlier research. In Malaysia, an early study by Singh et al. (26) discovered that the HIV infection rates among drug users decreased from 70% to 80% in 1990s to 38.7% in 2011. Furthermore, Hiebert et al. (27) observed the number of drug users living with HIV to reduce from 28,670 in 2011 to 21,010 in 2017. Although these studies offered thorough information on the trends of HIV among drug users in Malaysia, they did not clarify aspects related to HIV transmission awareness in the drug user community. Furthermore, the current study utilises a sizeable nationwide dataset to produce significant and reliable results.

Second, young adults (15–29 years) and women in the reproductive age group (15–49 years) are often the priority populations in previous studies. Nevertheless, the target population of the present study is drug users. It is well known that the primary factors contributing to the elevated risk of HIV infection in drug users are inadequate awareness about HIV, limited condom use and needle-sharing behaviours (28, 29). Therefore, a good understanding of which cohorts of drug users comprehend or do not comprehend the causes and consequences of HIV can assist policymakers in formulating more effective intervention measures.

Third, almost all previous research used logistic regressions to investigate the likelihood of possessing thorough understanding of HIV (yes vs. no). The current study expands this approach by using an ordered probit, i.e. an ordinal regression model, to evaluate variables influencing the likelihood of having different levels of HIV transmission knowledge: low, middle and high. Information on how these levels of HIV transmission knowledge vary across sociodemographic factors would be of interest to researchers and stakeholders. Ordered probit model uses normal cumulative distribution function, whereas ordered logistic regression is based on cumulative logistic function (30). This indicates that the conditional probability in probit model approaches 0 or 1 more quickly than in logistic regression, but both models provide fairly comparable results. In the present study, we assume our analysis model to have normal cumulative distribution function; thus, ordered probit is used instead of logistic regression.

Materials and Methods

Data

This investigation used secondary data that were extracted from the Integrated Biological and Behavioral Surveillance Survey (IBBS) 2017 (31). Although the IBBS 2017 was conducted by the Ministry of Health Malaysia a long time ago, it is thorough and includes specific data on drug users' sociodemographic traits and knowledge of HIV. The IBBS 2022 is the latest survey, but its data were not publicly available at the time the current investigation was conducted. The aim of the IBBS 2017 is to provide policymakers and researchers with information about the trend and pattern of HIV epidemic among people who inject drugs, female sex workers, transgender people and MSM. Measuring awareness of HIV transmission is the secondary goal of the IBBS 2017; consequently, details regarding the current study's results may be few. The poll started in March 2017 and ended in June 2017. In order to recruit a large number of respondents, a respondent driven sampling approach was adopted, especially in light of the fact that the targeted respondents were hard-to-reach populations and there was no clear sampling frame. Based on this approach, a link-tracing network sampling utilised a social structure to gather information.

The sample consisted of multiple waves. In each of these waves, respondents persuaded their peers to participate in the survey. At the initial stage, three to five respondents were identified in every survey setting. These respondents were then used to commence the recruitment process. New initial respondents were identified again if the recruitment process slowed down or was terminated. The chosen respondents were given vouchers and incentives to enrol more respondents from their network. The recruitment procedure was continued until the desired sample size was reached. In the present study, the inclusion criteria were male adults aged 18 or above who had been injecting drugs for the last 6 months. The exclusion criteria were those who could not comprehend the languages used by the interviewers. A total of 1,413 drug users were gathered, which was equal to a response rate of 99.8%.

The questionnaires used in the survey were constructed based on the Family Health International Guidelines for Repeated Behavioural Surveys in Population at Risk of HIV. They were written in the Malay language and were translated to English by a qualified translator. This translation procedure included a reverse translation. Given that not all the respondents understood Malay or English, interviewers were allowed to use other languages to interview the respondents. Informed consent was obtained from the respondents before the interviews. Those who failed to provide consent were prohibited to participate in the poll. Ethical approval was sought from the National Research Committee of Malaysia (NMRR-17-998-33876).

Dependent variable

The dependent variable employed in this study, knowledge of HIV transmission, is a categorical variable with a three-category ordinal outcome: low-, middle- and high-level knowledge of HIV transmission. It was assessed based on five questions asked in the interviews: 1) 'Can a person reduce the risk of HIV by having one faithful, uninfected sex partner?' 2) 'Can a person lower the risk of HIV by using condoms?' 3) 'Can a healthy-looking person have HIV?' 4) 'Can a person become infected through mosquito bites?' 5) 'Can a person contract HIV by sharing meal with someone who is infected with HIV?'. A value of 1 was assigned to each successful response, while a value of 0 was given to each incorrect answer. Hence, the maximum value was 5, and the minimum value was 0. Low-, middle- and high-level knowledge of HIV transmission comprised the values of 0–2, 3–4 and 5, respectively. In other words, respondents who accurately answered any 0–2, 3–4 and 5 questions were deemed to have low-, middle- and high-level knowledge of HIV transmission, respectively. A somewhat similar type of operationalisation of HIV knowledge has been employed in several past studies (13, 14, 18).

Independent variables

The independent variables used in this study, sociodemographic characteristics, included age, income, educational level, ethnicity, marital status and employment status. They were chosen based on the results from earlier research related to HIV awareness as well as the data accessibility (6, 8-25). Respondents' age was grouped into four categories: ≤ 29, 30–39, 40–49 and ≥50 years. Respondents' monthly individual incomes (in RM) were segmented into five groups: ≤RM 499, RM 500–999, RM 1,000–1,499, RM 1,500–1,999 and ≥RM 2,000. Respondents' educational backgrounds comprised three categories: primary, secondary and tertiary. Ethnic variable consisted of Malay, Chinese, Indian and other ethnicities (others). The largest ethnic group in Malaysia is Malay, followed by Chinese, Indian and others. Others include Iban, Kadazan, Dusun, Bajau and Bidayuh. Respondents' marital status included single, married, divorced and widowed. Divorced and widowed were grouped together to form a single category because of the small number of observations. Data on respondents' work status

was obtained from a question: 'What is your source of revenue in the past 1 month?' Respondents who answered 'student', 'unemployed' or 'retiree' were considered to be unemployed.

Statistical analyses

The data of 1,413 drug users from the IBBS 2017 were extracted and analysed. Pearson's chi-squared tests were performed to determine whether there were any sociodemographic variations in HIV transmission knowledge. In terms of multivariate analysis, the current study used an ordered probit regression model to evaluate the relationships between sociodemographic characteristics and the likelihood of having low-, middle- and high-level knowledge of HIV transmission (32). The marginal effect and robust standard error of each independent variable were calculated. To ensure no model specification error, a link test introduced by Pregibon (33) was conducted. Furthermore, to check for multicollinearities, the present study calculated variance inflation factors (VIFs) for all the explanatory variables. The significance level of $p < 0.05$ was selected. Statistical analyses were performed using Stata statistical software (34).

Results

Of the 1,413 respondents, 7.5%, 38.1% and 54.4% had low-, middle- and high-level knowledge of HIV transmission, respectively. A large proportion of respondents aged between 30 and 39 years (37.2%) and had a monthly income of RM 500–999 (38.7%). The majority of respondents had secondary-level education (79.6%) and were Malays (88.6%). Most of respondents were single (51.2%) and employed (89.5%) (Table 1).

Table 1: Summary statistics of variables (n = 1,413)

Variables	Count	Percent
Dependent variable		
Knowledge of HIV transmission		
Low-level	106	7.5
Middle-level	538	38.1
High-level	769	54.4
Independent variables		
Age (years)		
≤ 29	128	9.1
30–39	526	37.2
40–49	489	34.6
≥ 50	270	19.1
Income (RM)		
≤ 499	264	18.7
500–999	547	38.7

Table 1: Summary statistics of variables (n = 1,413) (continued)

Variables	Count	Percent
1,000–1,499	426	30.2
1,500–1,999	118	8.4
≥ 2,000	58	4.1
Education		
Primary	260	18.4
Secondary	1124	79.6
Tertiary	29	2.1
Ethnicity		
Malay	1252	88.6
Chinese	89	6.3
Indian	53	3.8
Others	19	1.3
Marital status		
Single	723	51.2
Married	366	25.9
Divorced/widowed	324	22.9
Employment status		
Employed	1265	89.5
Unemployed	148	10.5

Source: IBBS 2017.

High-level knowledge of HIV transmission was more likely among middle-aged respondents than young and older respondents. Significantly higher percentages of respondents with tertiary-level education and Malays had high-level knowledge compared with others. Taken together, results of the present study indicated that there were income, educational and ethnic differences in the proportions of respondents with different levels of HIV transmission knowledge, which provided support for the use of an ordinal regression in assessing the independent relationships between sociodemographic variables and HIV transmission knowledge (Table 2).

Table 2: Number and proportion of respondents with low-, middle- and high-level knowledge of HIV transmission

Variables	Low-level (n = 106)	Middle-level (n = 538)	High-level (n = 769)
Age (years)			
≤ 29	14	54	60
	(10.9)	(42.2)	(46.9)
30–39	38	189	299

Table 2: Number and proportion of respondents with low-, middle- and high-level knowledge of HIV transmission (continued)

Variables	Low-level (n = 106)	Middle-level (n = 538)	High-level (n = 769)
	(7.2)	(35.9)	(56.8)
40–49	23	174	292
	(4.7)	(35.6)	(56.7)
≥ 50	31	121	118
	(11.5)	(44.8)	(43.7)
p-value		< 0.001*	
Income (RM)			
≤ 499	12	122	130
	(4.6)	(46.2)	(49.2)
500–999	51	197	299
	(9.3)	(36.0)	(54.7)
1,000–1,499	35	147	244
	(8.2)	(34.5)	(57.3)
1,500–1,999	2	49	67
	(1.7)	(41.5)	(56.8)
≥ 2,000	6	23	29
	(10.3)	(39.7)	(50.0)
p-value		0.007*	
Education			
Primary	28	116	116
	(10.8)	(44.6)	(44.6)
Secondary	78	412	634
	(6.9)	(36.7)	(56.4)
Tertiary	0	10	19
	(0.0)	(34.5)	(65.5)
p-value		0.003*	
Ethnicity			
Malay	71	463	718
	(5.7)	(37.0)	(57.4)
Chinese	15	48	26
	(16.9)	(53.9)	(29.2)
Indian	14	19	20
	(26.4)	(35.9)	(37.7)
Others	6	8	5
	(31.6)	(42.1)	(26.3)
p-value		< 0.001*	

Table 2: Number and proportion of respondents with low-, middle- and high-level knowledge of HIV transmission (continued)

Variables	Low-level (n = 106)	Middle-level (n = 538)	High-level (n = 769)
Marital status			
Single	59	292	372
	(8.2)	(40.4)	(51.5)
Married	29	138	199
	(8.0)	(37.7)	(54.4)
Divorced/ widowed	18	108	198
	(5.6)	(33.3)	(61.1)
p-value		0.063	
Employment status			
Employed	98	478	689
	(7.8)	(37.8)	(54.5)
Unemployed	8	60	80
	(5.4)	(40.5)	(54.1)
p-value		0.539	

Note: Row percentages in parentheses. The *p*-values are based on Pearson's chi-squared tests. Significance level of *p* < 0.05 is selected. **p* < 0.05
Source: IBBS 2017.

The value of prediction squared was insignificant, implying that the regression was well-specified. Multicollinearity did not exist as the VIFs were low. Respondents aged 30–39 and 40–49 years were 2.1%–3.6% and 4.6%–8.3% less likely to have low- and middle-level knowledge of HIV transmission, respectively, than those aged ≥50. These respondents were also 6.8%–11.9% more likely to have high-level knowledge of HIV transmission. Compared to respondents with primary-level education, those with secondary- and tertiary-level education had 5.8%–14.9% higher probabilities of possessing high-level knowledge of HIV transmission. Likewise, respondents with secondary- and tertiary-level education had 2%–3.8% and 3.8%–11.1% lower probabilities of possessing low- and middle-level knowledge of HIV transmission, respectively, when compared with those having primary-level education. Chinese, Indians and respondents of other ethnic groups were 23%–32.9% less likely to have high-level knowledge of HIV transmission relative to Malays. These ethnic groups of respondents also had 10.9%–20.2% and 12.1%–12.7% higher probabilities of possessing low- and middle-level knowledge of HIV transmission, respectively. The likelihood of having high-level knowledge of HIV transmission was 6.3% higher among divorced/widowed respondents than single respondents. This was followed by 1.9%–4.4% reduced odds of possessing low- and middle-level knowledge (Table 3).

Table 3: Marginal effects of sociodemographic variables on knowledge of HIV transmission (n = 1,413)

Variables	Low-level	Middle-level	High-level
Age (years)			
≤ 29	0.007	0.015	-0.022
	(0.018)	(0.034)	(0.052)
30–39	-0.021*	-0.046*	0.068*
	(0.011)	(0.026)	(0.037)
40–49	-0.036*	-0.083*	0.119*
	(0.011)	(0.025)	(0.036)
≥ 50	Ref.	Ref.	Ref.
Income (RM)			
≤ 499	Ref.	Ref.	Ref.
500–999	-0.010	-0.021	0.030
	(0.012)	(0.027)	(0.039)
1,000–1,499	-0.016	-0.036	0.053
	(0.012)	(0.029)	(0.041)
1,500–1,999	-0.023	-0.057	0.080
	(0.013)	(0.038)	(0.052)
≥ 2,000	0.016	0.029	-0.045
	(0.027)	(0.045)	(0.072)
Education			
Primary	Ref.	Ref.	Ref.
Secondary	-0.020*	-0.038*	0.058*
	(0.012)	(0.021)	(0.033)
Tertiary	-0.038*	-0.111*	0.149*
	(0.016)	(0.066)	(0.082)
Ethnicity			
Malay	Ref.	Ref.	Ref.
Chinese	0.109*	0.121*	-0.230*
	(0.032)	(0.017)	(0.047)
Indian	0.119*	0.121*	-0.240*
	(0.047)	(0.019)	(0.064)
Others	0.202*	0.127*	-0.329*
	(0.094)	(0.014)	(0.085)
Marital status			
Single	Ref.	Ref.	Ref.
Married	0.001	0.001	-0.002
	(0.010)	(0.021)	(0.031)
Divorced/ widowed	-0.019*	-0.044*	0.063*
	(0.009)	(0.023)	(0.033)

Table 3: Marginal effects of sociodemographic variables on knowledge of HIV transmission (n = 1,413) (continued)

Variables	Low-level	Middle-level	High-level
Employment status			
Employed	0.019	0.046	-0.066
	(0.013)	(0.035)	(0.047)
Unemployed	Ref.	Ref.	Ref.
Wald test		89.670	
p-value		< 0.001*	
Prediction squared		0.007	
p-value		0.978	
Maximum VIF		2.650	

Note: Robust standard errors in parentheses. Ref refers to a reference category. Significance level of $p < 0.05$ is selected. *$p < 0.05$
Source: IBBS 2017.

Discussion

To our knowledge, this is the first study to examine sociodemographic correlates of knowledge of HIV transmission among male drug users in Malaysia. Findings from the present study demonstrated that nearly half of drug users had low- and middle-level knowledge of HIV transmission. Results of the Pearson's chi-squared tests showed that knowledge of HIV transmission increased with educational levels but reduced with age. Being Malay and divorced/widowed was linked to increased understanding of HIV transmission. The relationships between sociodemographic factors and HIV transmission knowledge were further analysed using an ordered probit. Age, educational levels, ethnicity and marital status were found to be independently associated with knowledge of HIV transmission. However, there appeared to be no significant associations between knowledge of HIV transmission and income, and employment status factors, even though the proportion of respondents with different levels of HIV transmission knowledge varied across income levels.

In the present study, older drug users (≥50 years) were less likely to have high-level knowledge of HIV transmission and more likely to have low-level knowledge when compared with their younger counterparts (30–49 years). The proportion of drug users in this age group having high-level knowledge was also the lowest. A possible reason is that older persons tend to have a poor literacy skill and a weak cognitive ability, that can be seen as a barrier to obtaining insightful health information (35). These findings are in contrast to the evidence from previous studies, which show older adults to have better general knowledge of HIV than their younger peers (8, 15-20). Regarding policy consequences, the Malaysian government is advised to take the age factor into account when developing a HIV-prevention programme directed toward increasing HIV awareness among male drug users. Special attention should be given to the population aged ≥50 years.

Drug users were found to be more likely to have high-level knowledge of HIV transmission and less likely to have low-level knowledge if they were more educated. In particular, most of the drug users with high-level knowledge had tertiary-level education. These results emphasise the crucial role of education in the fight against HIV transmission. Similar outcomes were evidenced in several previous studies using different datasets and methodologies (8, 9-14). There are two reasons for these outcomes (36). First, education improves drug users' interpretative skills and health knowledge. Second, better educated drug users are more conscious of their health compared to those with lower educational attainments. It appears, therefore, that there is an urgent need to improve HIV knowledge in the less educated segment of the population. In an effort to educate less educated male drug users about HIV, a nationwide HIV-specific health awareness campaign could be held more frequently.

Ethnic variations in HIV knowledge were seldom explored in past studies due to homogenous characteristics of the populations (8-24), but they were nonetheless noteworthy. In this study, Malays were found to have a higher likelihood of possessing high-level understanding about HIV transmission compared with Chinese, Indians and members of other ethnic groups. The prevalence and probability of having low-level knowledge were the lowest among Malays. These findings were in agreement with earlier Malaysian studies focusing on other types of health knowledge (35, 36). More specifically, these studies found that Malays tended to have better knowledge of smoking and high sodium-related diseases compared to non-Malays. The Malay language is frequently used for sending vital messages given that it is the official language in Malaysia (36). As a result, Malays may have the advantage of acquiring better knowledge of health than their non-Malay counterparts. The mediating effects of cultural and religious factors on the association between ethnicity and HIV knowledge could be another plausible explanation, but they need to be explored thoroughly in a future study when more data are available. In view of the present study's findings, policymakers could devote their attention to the effect of the ethnic factor on HIV knowledge when designing HIV-control programmes. A concerted effort could be made to overcome the language barrier in these programmes by using multilingual communication. It is imperative for policymakers to gain a deep understanding of why non-Malay drug users tend to have poorer HIV knowledge than Malays, so that a more effective intervention strategy can be formulated.

Results of the current study showed that while there were no marital status differences in the proportion of drug users with varying levels of HIV transmission knowledge, the likelihood of having high-level (low-level) knowledge

of HIV transmission was significantly higher (lower) among divorced/widowed drug users than single individuals, which are consistent with the findings drawn by Dessie (16). While Peltzer et al. (15), Mekonnen et al. (22) and Shamu et al. (23) found a significant relationship between overall awareness of HIV and marital status, their findings did not demonstrate substantial divorced- or widowed-single differences in HIV knowledge. Due to data limitations, the actual reason explaining the effect of marital status on HIV transmission knowledge could not be clearly determined. However, the current study emphasises the important role of marital status in HIV prevention. Public health officials are recommended to consider the impact of marital status on HIV knowledge if the goal of promoting awareness of HIV among drug users is to be attained in an effective manner. It may be worth the government's efforts to ensure that widowed and divorced drug users' knowledge of HIV will continuously improve.

HIV knowledge is a significant determining factor of the success of HIV-control policies (37). Poor knowledge can encourage unsafe sexual behaviours, thereby increasing the risk of HIV (38, 39). Findings from the current study suggest that extra care should be devoted to male drug users who are older, less educated, non-Malays and single. Efficient techniques for raising awareness about HIV are advised to be examined in future research. Education-based HIV programmes, for example, could be implemented throughout the country. More work could be done to guarantee that drug users have easy access to HIV information through the media. It is thought that mass media could pose as the primary source of HIV information for underprivileged groups, particularly drug users.

Several limitations of the current study are noteworthy. First, reporting errors may arise because HIV knowledge was self-reported by respondents. Second, due to the nature of the cross-sectional data, the causal relationship between HIV awareness and HIV risk was not found. Third, the survey utilised for this study was completed several years ago. Hence, its conclusions do not correspond with the current situation in Malaysia. Fourth, the poll did not question female drug users; therefore, the impact of the gender factor on HIV knowledge could not be investigated. Fifth, since interviewers were permitted to use other languages to interview the respondents and the respondent driven sampling approach was used to gather data, the results of the present study may be biased. Finally, the five-item questions are insufficient to evaluate HIV understanding; therefore, the present study's results may not be applicable to the current trends of HIV among drug users in Malaysia and lack usefulness for policy formulation. Notwithstanding these drawbacks, the advantages of the current study are numerous. The current study utilised a sizeable dataset to produce novel and significant findings about the sociodemographic characteristics associated with HIV transmission knowledge. Furthermore, the focus of the present study, drug users in Malaysia, is a relatively new demographic. Furthermore, a solid analytical approach was used to produce accurate and trustworthy outcomes.

Conclusion

Insufficient awareness about HIV among drug users in Malaysia may pose a significant threat to halting HIV transmission. Future national public health programmes should consider the effects of sociodemographic characteristics on knowledge of HIV and continue to give drug users enlightening information about HIV. Findings from this study have reduced the gap in the existing literature on HIV knowledge and prompted a qualitative investigation on how HIV awareness varies across drug users' sociodemographic traits. Use of longitudinal data to investigate the relationship between knowledge and HIV infection and its connection with HIV-prevention policies is advised to be the focus for future study.

Acknowledgement

Competing interests

The authors have no competing interests to declare.

Ethical Clearance

Ethical approval was sought from the National Research Committee of Malaysia (NMRR-17-998-33876).

Financial support

References

1. World Health Organization. HIV/AIDS. 2022. Available at: https://www.who.int/news-room/fact-sheets/detail/hiv-aids. Accessed 6 July 2022.

2. Ministry of Health Malaysia. Country progress report on HIV/AIDS 2019: Malaysia. Putrajaya, Malaysia: Ministry of Health Malaysia. 2019. Available at: https://www.moh.gov.my/moh/resources/Penerbitan/Laporan/Umum/Report_GAM_2019_(Final).pdf. Accessed 6 July 2022.

3. Smith Fawzi MC, Jagannathan P, Cabral J, Banares R, Salazar J, Farmer P, et al. Limitations in knowledge of HIV transmission among HIV-positive patients accessing case management services in a resource-poor setting. AIDS Care. 2006; 18(7):764-71.

4.   Pinkerton SD, Abramson PR. Effectiveness of condoms in preventing HIV transmission. Soc Sci Med. 1997; 44(9):1303-12.

5.   Gańczak M, Barss P, Alfaresi F, Almazrouei S, Muraddad A, Al-Maskari F. Break the silence: HIV/AIDS knowledge, attitudes, and educational needs among Arab university students in United Arab Emirates. J Adolesc Health. 2007; 40(6):572.e1-8.

6.   Nguyen TMT, Tran BX, Fleming M, Pham MD, Nguyen LT, Nguyen ALT, et al. HIV knowledge and risk behaviors among drug users in three Vietnamese mountainous provinces. Subst Abuse Treat Prev Policy. 2019; 14(1):3.

7.   Tulloch HE, Balfour L, Kowal J, Tasca GA, Angel JB, Garber G, et al. HIV knowledge among Canadian-born and Sub-Saharan African-born patients living with HIV. J Immigr Minor Health. 2012; 14(1):132-9.

8.   Lau JTF, Tsui HY, Siah PC, Zhang KL. A study on female sex workers in southern China (Shenzhen): HIV-related knowledge, condom use and STD history. AIDS Care. 2002; 14(2):219-33.

9.   Ankunda D, Asiimwe JB. Determinants of comprehensive knowledge of HIV/AIDS among women of the reproductive age (15-49) in Uganda. Int J Community Med Public Health. 2017; 4(10):3530-5.

10. Ravi RP, Kulasekaran RA. A cross-sectional study of knowledge, perceptions and misconceptions about RTIs, STIs and HIV/AIDS among young married rural women in Tamilnadu state, India. World Appl Sci J. 2014; 31(1):84-90.

11. Yaya S, Bishwajit G, Danhoundo G, Seydou I. Extent of knowledge about HIV and its determinants among men in Bangladesh. Front Public Health. 2016; 4:246.

12. Wondimu W, Asefa A, Qanche Q, Nigussie T, Yosef T. Determinants of the community knowledge and attitude towards HIV prevention methods in Majang zone, Southwest Ethiopia. HIV AIDS (Auckl). 2021; 13:21-9.

13. Hong SY, Thompson D, Wanke C, Omosa G, Jordan MR, Tang AM, et al. Knowledge of HIV transmission and associated factors among HIV-positive and HIV-negative patients in rural Kenya. J AIDS Clin Res. 2012; 3(7):170.

14. Agyemang S, Buor D, Tagoe-Darko E. The extent of knowledge about HIV/AIDS among young people in the Ejura-Sekyedumase district of Ghana. J AIDS HIV Res. 2012; 4(11):241-247.

15. Peltzer K, Matseke G, Mzolo T, Majaja M. Determinants of knowledge of HIV status in South Africa: results from a population-based HIV survey. BMC Public Health. 2009; 9:174.

16. Dessie DB. Investigating determinants of knowledge about HIV prevention among young in Ethiopia. World J Soc Sci. 2020; 7(1):46-55.

17. Teshale AB, Yeshaw Y, Alem AZ, Ayalew HG, Liyew AM, Tessema ZT, et al. Comprehensive knowledge about HIV/AIDS and associated factors among women of reproductive age in sub-Saharan Africa: a multilevel analysis using the most recent demographic and health survey of each country. BMC Infect Dis. 2022; 22(1):130.

18. Youssef L, Hallit S, Sacre H, Salameh P, Cherfan M, Akel M, et al. Knowledge, attitudes and practices towards people living with HIV/AIDS in Lebanon. PLoS One. 2021; 16(3):e0249025.

19. Abiodun O, Sotunsa J, Ani F, Jaiyesimi E. Knowledge of HIV/AIDS and predictors of uptake of HIV counselling and testing among undergraduate students of a privately owned university in Nigeria. BMC Research Notes. 2014; 7:639.

20. Shokoohi M, Karamouzian M, Mirzazadeh A, Haghdoost AA, Rafierad AA, Sedaghat A, et al. HIV knowledge, attitudes, and practices of young people in Iran: findings of a national population-based survey in 2013. PLoS One. 2016; 11(9):e0161849.

21. Yang F, Li Z, Subramanian SV, Lu C. Assessment of knowledge of HIV/AIDS and association with socioeconomic disparities among young women in low- and middle-income countries, 2003 to 2018. JAMA Netw Open. 2021; 4(1):e2035000.

22. Mekonnen AG, Bayleyegn AD, Aynalem YA, Adane TD, Muluneh MA, Zeru AB. Determinants of knowledge, attitudes, and practices in relation to HIV/AIDS and other STIs among people with disabilities in North-Shewa zone, Ethiopia. PLoS One. 2020; 15(10):e0241312.

23. Shamu S, Khupakonke S, Farirai T, Slabbert J, Chidarikire T, Guloba G, et al. Knowledge, attitudes and practices of young adults towards HIV prevention: an analysis of baseline data from a community-based HIV prevention intervention study in two high HIV burden districts, South Africa. BMC Public Health. 2020; 20:1249.

24. Najmah, Sari IP, Kumalasari TN, Davies SG, Andajani S. Factors influencing HIV knowledge among women of childbearing age in South Sumatra, Indonesia. Malaysian J Public Health Med. 2020; 20(1):150-9.

25. Van Nguyen L, Nguyen TNP, Thach AN, Lam AN, Lam DQ, Duong CX, et al. Knowledge of antiretroviral treatment and associated factors in HIV-infected patients. Healthcare (Basel). 2021; 9(4):483.

26. Singh D, Chawarski MC, Schottenfeld R, Vicknasingam B. Substance abuse and the HIV situation in Malaysia. J Food Drug Anal. 2013; 21(4):S46-51.

27. Hiebert L, Azzeri A, Dahlui M, Hecht R, Mohamed R, Hana Shabaruddin F, et al. Estimating of the population size of people who inject drugs in Malaysia for 2014 and 2017 using the Benchmark-Multiplier method. Subst Use Misuse. 2020; 55(6):871-7.

28. Bertoni N, Singer M, Silva CM, Clair S, Malta M, Bastos FI. Knowledge of AIDS and HIV transmission among drug users in Rio de Janeiro, Brazil. Harm Reduct J. 2011; 8:5.

29. Chen B, Zhu Y, Guo R, Ding S, Zhang Z, Cai H, et al. HIV/AIDS-related knowledge awareness and risk behaviors among injection drug users in Maanshan, China: a cross-sectional study. BMC Public Health. 2015; 16:97.

30. Cameron AC, Trivedi PK. Microeconometrics: Methods and Applications. Cambridge, United Kingdom: Cambridge University Press. 2005.

31. Ministry of Health Malaysia. Integrated Biological and Behavioral Surveillance Survey 2017. Putrajaya, Malaysia: Ministry of Health Malaysia. 2019. Available at: https://www.moh.gov.my/moh/resources/Penerbitan/Laporan/Umum/Laporan_Kajian_IBBS_2017.pdf. Accessed 6 July 2022.

32. Wooldridge J. Econometric Analysis of Cross Section and Panel Data. 2nd Ed. Cambridge, United States: MIT Press. 2010.

33. Pregibon D. Goodness of link tests for generalized linear models. J Roy Stat Soc. Series C (Applied Statistics). 1980; 29:15-23.

34. StataCorp. Stata statistical software: Release 16.1. Texas, United States: Stata Corporation. 2019.

35. Cheah YK, Teh CH, Lim HK. Sociodemographic differences in smoking knowledge in Malaysia. J Drug Issues. 2019; 49(2):355-68.

36. Cheah YK, Syed Anera SN, Kee CC, Lim KH, Omar MA. Sociodemographic correlates of knowledge about high sodium-related diseases among adults in Malaysia. Hypertens Res. 2022; 45:620-8.

37. Wong LP. Prevalence and factors associated with HIV/AIDS-related stigma and discriminatory attitudes: a cross-sectional nationwide study. Prev Med. 2013; Suppl 57:S60-3.

38. Ackerson LK, Ramanadhan S, Arya M, Viswanath K. Social disparities, communication inequalities, and HIV/AIDS-related knowledge and attitudes in India. AIDS Behav. 2012; 16(7):2072-81.

39. Jean J, Coll A, Monda M, Potter J, Jones D. Perspectives on safer conception practices and preconception counselling among women living with HIV. Health Care Women Int. 2016; 37(10):1096-118.