

High HIV Prevalence and Associated Risk Factors Among Female Sexual Partners of Male Injection Drug Users (MWID) in Ho Chi Minh City, Vietnam

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Abstract Injection drug use is a major factor in acquiring and transmitting HIV in Vietnam. This analysis aims to present estimates of HIV infection and factors associated with HIV infection among female sex partners (FSP) of MWID in Ho Chi Minh City (HCMC), Vietnam. Cross-sectional surveys were conducted in 2011 and 2013 among males who inject drugs (MWID) who then referred their FSP for a behavioral and biologic survey. In total, 445 MWID and FSPs were enrolled. HIV prevalence among MWID was 50 and 35 % among FSPs. Among FSPs, 60.3 % reported ever using illegal drugs and among those, 72.7 % reported ever injecting illicit drugs. Among FSP, injection drug for >1 year [adjusted Odds Ratio (aOR), 95 % CI 2.94, 1.19–7.26], p value = <0.001] and having a male partner infected with HIV [(aOR 3.35: 1.97–5.69), p value = <0.001] were associated with HIV infection. The prevalence of HIV infection is high among FSP of MWID in HCMC and is highly associated with the injection drug use behavior of the FSP. Harm-reduction intervention programs that focus on the MWID-FSP couple or directly on the FSPs are required.

Keywords Female sex partners · Male injection drug users · HIV/AIDS · Concentrated epidemic

Background

Vietnam's concentrated HIV/AIDS epidemic is largely influenced by injection drug use with the vast majority of whom are estimated to be male. There are up to 335,000 males who inject drugs (MWID) in Vietnam. The median HIV prevalence among these MWID is estimated to be 12 % with wide variation in prevalence by province [1]. An estimated 89 % of MWID in Vietnam report to be sexually active with a regular female sex partner (FSP) [2]. Consistent condom use with regular FSP ranged between 15 and 56 %, by province and between 40 and 84 % with female sex workers [3]. Other studies in the Asia region have also reporting low levels of consistent condom use by MWID with their regular sex partners [4–11].

While there is clear evidence for the risk for HIV among male injection drug users, significantly less data are available for their FSP [12–14]. Given the high HIV prevalence among MWID, it is reasonable to assume that their FSPs are at increased risk of acquiring HIV through sex or other high-risk behaviors, such as injection drug use. Global evidence indicates that female injection drug users are at least as high, if not greater, risk for HIV infection due to greater stigma, gender-power imbalances that influence risk behavior, and economic or structural barriers that limit female access to harm-reduction services [15, 16]. This may be particularly relevant in Vietnam given the male dominance in sexual practice and influence on risk-behavior practices [17–21].

A 2008, study in Hanoi, Vietnam reported that 14 % of sexual partners of MWID were infected with HIV and

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69 % were in a sero-discordant or unknown status relationship but did not present an analysis of risk factors that may have been associated with the HIV status of the FSP [19, 22]. A recently completely review reported that up to 160,000 women in Vietnam have been exposed to HIV from their long-term sero-positive male partner and that the majority of HIV cases among women were attributed solely to their male partners high-risk behavior [23].

In Vietnam, there are limited data for FSP of MWID and their HIV risk behaviors. In particular, there are no local data on the prevalence of injection drug use, a key risk factor for HIV, among this population. The availability of such data are important to define the potential burden and the specific risk factors associated with HIV among FSPs in Vietnam. Such data would provide information to guide and focus intervention programs, such as condom use, harm-reduction (e.g. needles and syringe exchange, opioid substitution therapy), and anti-retroviral therapy (ART) for the infected partners, that have the potential to reduce HIV transmission within the couple over time [13, 14].

Ho Chi Minh City (HCMC) is Vietnam's most populous city and has an estimated 20,000 active MWID, with more than 90 % reporting ever having sex and one-third reporting sex with a regular partner in the last 12 months [2]. In 2014, the HIV prevalence in HCMC was estimated to be 46.1 % among MWID and 1.1 % among the general adult population translating to an estimated 85,000 PLHIV [3, 24].

Given the potential risk among and limited data available for FSP, the objectives of this analysis are to estimate the HIV prevalence and associated factors, such as high-risk sexual practices or injection drug use, among FSP of MWID in Vietnam.

Methods

Two cross-sectional surveys were conducted in HCMC in March–September 2011 and January–February 2013. The same methodology was used for both surveys. MWID were recruited by trained study staff using 'time location sampling (TLS)' of mapped locations where MWID were known to congregate as determined by formative research (e.g. interviews and focus group discussions with key informants). A random selection of time-periods and locations of this sampling frame was conducted by population proportional to size to identify sampling locations for the survey. Eligible MWID were defined as consenting, adult (aged ≥ 18 years) males who injected drugs in the last 30 days prior to the survey who have a regular FSP. Participants were approached at random at these selected locations and were explained the purpose of the study and encouraged to visit a designated study center together, if

available, with their FSP or to give their FSP a referral coupon to allow them to visit the study center individually. FSPs were defined as consenting females (aged ≥ 18 years) who are married to or cohabiting with a male IDUs or reported to have had sexual intercourse with such a partner (IDU) at least one time per week in the past 6 months.

Study centers were established based on proximity to the recruitment sites in order to facilitate ease of access for the study recruits with information related to the study site (e.g. address, working hours) provided verbally by the study staff and printed on each recruitment coupon.

At the study center, eligibility screening was conducted and informed consent obtained. Next, demographic and risk behavior data were collected through privately administered, separate interviews of both the MWID and their FSP using structured questionnaires. Data collected for MWID and their FSP included: demographic characteristics, sexual behavior including types and numbers of partners, condom usage, risk perception for HIV, drug use and associated HIV risk behaviors, and access to health services such as HIV counseling and testing. Biological specimens were collected for HIV (blood) and opiate (urine) testing. Blood samples were tested for HIV using a rapid test (Determine (Abbott, Japan) and confirmed by two EIA tests: Genscreen HIV 1/2 (Biorad, US) and Murex HIV 1/2 (Murex Biotech, UK) as per national guidelines. All enrollees were provided a referral card to allow them to return to the study site after 2 weeks to receive their HIV test results and to receive appropriate counseling and referral to services as per national guidelines. Urine samples (20 ml) were collected for each FSP enrollee for opiate testing at the provincial AIDS center using rapid test (One step, ACON) [25] to estimate current opiate use.

De-identified codes were generated for each MWID and FSP enrolled based on their location of recruitment. These codes were linked to the codes for their respective partner to classify the MWID-FSP pair for analysis.

The study protocol was reviewed and approved by the Abt Associates Ethics Review Board and the Internal Review Board of the Hanoi School of Public Health in Vietnam.

Analysis

To approximate random sampling, probability sampling weights were calculated for each enrolled MWID using the total MWID enumerated and the numbers enrolled at each recruitment location with the individual sampling weight being the inverse of the total probability of being enrolled [26]. As described in other similar studies [27], the calculated sampling weight of the MWID was also applied to their respective FSP in each analysis.

Frequencies and proportions were calculated for categorical variables with means and medians calculated for continuous variables. Prevalence estimates for HIV among MWID and their FSP with 95 % confidence intervals (95 % CI) were calculated individually and as a MWID-FSP pair to estimate the proportion of HIV concordance or discordance in the enrolled couples. HIV status categories were calculated and reported for each possible outcome (i.e., Category 1 = Male (HIV+)/Female (HIV+); Category 2 = Male (HIV-)/Female (HIV-); Category 3 = Male (HIV+)/Female (HIV-); Category 4 = Male (HIV-)/Female (HIV+). Comparison of categorical data was done using the Pearson Chi square test or Fisher's exact test (if reported frequencies were <5). The Mann-Whitney test was used to compare median values for different groups. Any indicator missing more than 5 % of the total responses by province were reported in the respective output tables.

Univariate and multivariate risk factor analysis was limited to the HIV status among enrolled FSPs as the primary outcome. Odds ratios (OR) and 95 % CI were calculated by stratified (conditional) logistic regression with HIV status as the outcome variable and stratified by the survey year (i.e., 2011 or 2013) [28]. All independent factors associated with HIV status in the univariate analysis (p value ≤ 0.20) were entered into a multivariate logistic regression model. The final multivariate model was then determined using backward, step-wise selection and the Wald test after estimation. STATA version 12.0 (College Station, TX) was used for all analyses.

Results

Description of Sample

During the study period in 2011 [n = 191(43 %)] and 2013 [n = 254 (57 %)], a total of 445 FSPs were enrolled in the survey and included in the analysis. Overall (i.e., combined data from the 2011 and 2013 surveys) HIV prevalence was 50.0 % (44.5–55.6 %) among the enrolled MWID and 35.0 % (30.9–39.1 %) among their referred FSP with no significant differences between 2011 and 2013 (Table 1).

Analysis of the MWID-FSP couple indicates that among the four possible HIV-status categories for the couple, an estimated 35.8 % were in an HIV-discordant relationship [Category 3: 25.3 % (21.4–29.3 %) and Category 4: 10.4 % (8.0–12.9 %)] with the majority of those in a discordant relationship in which the MWID is HIV-positive and the FSP is HIV-negative.

The socio-demographic characteristics and key risk factors for the FSP by year of survey and overall are

summarized in Tables 2 and 3. Overall, the mean age of the FSPs and MWID was 30.2 and 33.0 years respectively.

Most (69.1 %) of the FSPs enrolled had received less than a secondary level of education with an overall 73.5 % reported to work 'at home' or 'part-time'. Very few (0.7 %) of the FSPs lived alone with the majority reporting to live with their family, husband, or sex partner. The proportion of FSP reporting to be married or co-habiting with a male increased from 86.8 % in 2011 to 97.5 % (p value = 0.001) in 2013.

The mean (95 % CI) duration of injection drug use among the MWIDs enrolled was 7.5 years (6.9–8.2). Overall, most (87.1 %) FSP reported having had sex with MWID in the last 30 days with a significant increase in those reporting such between 2011 and 2013 (74.5 vs. 97.1 %, p value <0.001). Consistent condom use over the past month¹ was reported by 19.7 % (14.5–24.9 %) of the FSP respondents. The overall majority (92.6 %) of FSP indicated that their only sexual activity over the past 6 months was with the MWID that referred them to the survey but this appears to be decreasing in the 2011–2013 surveys (97.2 vs. 89.1 %, p value <0.05).

From 2011 to 2013, the proportion of FSP that reported that they knew that their referring partner injected drugs (77.9 vs. 95.0 %, p value <0.001); that provided financial support for their partners injection drug use (31.9 vs. 50.4 %, p value = 0.001); and that believed that their partner was infected with HIV (18.2 vs. 40.9 %, p value <0.001) was significantly different. Other indicators were statistically similar across the survey years.

Among the 60.3 % of FSP that reported to have every used illegal drugs, the vast majority (96.2 %) reported ever using heroin with 13.3 % reporting amphetamine use and 11.4 % reporting having used psychotropic (e.g. 'Ecstasy') drugs previously. Among illegal drug user, 72.7 % indicated that they had ever *injected* illegal drugs and for an average (95 % CI) duration of 5.5 (4.7–6.4) years. This results in an estimated 44 % of all FSP recruited reported ever injected illegal drugs. The majority (74.6 %) of injection drug users reported injecting more than one time per day in the last 6 months. Among those FSPs reporting injection drug use, 42.5 % reported injecting drugs for the same duration (5.6 %) or longer (36.9 %) than the MWID that referred them to the survey. Among FSP with urinalysis results, 48.3 % tested positive for the presence of opioids indicating recent opioid use. A cross-tabulation of self-reported 'ever' injected illegal drugs with the urinalysis results indicate that 24.1 % of FSP reported to have 'never

¹ 'Condom use' was calculated by dividing the number of times using condoms during sex in the past month by the number of reported times having sex in the past month. 'Consistent condom use in the past month' was defined categorically as those enrollees with 100 % condom use in the past month.

Table 1 Individual and couple HIV status among recruited FSP and their MWID partner in HCMC

| | 2011 Prevalence (%), (n = 191) | 2013 Prevalence (%), (n = 245) | p value | Total Prevalence (%) |
|--------------------------------------|-----------------------------------|-----------------------------------|---------|-------------------------|
| Female sex partner (FSP) | | | | |
| HIV-positive | 32.1 | 37.3 | 0.256 | 35 |
| HIV-negative | 67.9 | 62.7 | | 65 |
| Male who inject drugs partner (MWID) | | | | |
| HIV-positive | 53.4 | 47.3 | 0.334 | 50 |
| HIV-negative | 46.6 | 52.7 | | 50 |
| HIV sero-status by couple | | | | |
| Concordant (Category 1): M+/F+ | 23.6 | 25.9 | 0.358 | 25.0 |
| Concordant (Category 2): M-/F- | 37.6 | 40.7 | | 39.2 |
| Discordant (Category 3): M+/F- | 29.7 | 21.8 | | 25.3 |
| Discordant (Category 4): M-/F+ | 9.0 | 11.5 | | 10.4 |

Table 2 Socio-demographic characteristics and risk behaviors of female sex partners (FSP) in Ho Chi Minh City, Vietnam

| | 2011 Value | 2013 Value | p value | Total Value |
|-----------------------------------|---------------|---------------|---------|----------------|
| FSP enrolled (n) | 191 | 254 | 0.962 | 445 |
| Mean age (years): FSP | 30.1 | 30.4 | | 30.2 |
| Mean age (years): male MWID | 32.7 | 33.2 | 0.184 | 33.0 |
| FSP education (%) | | | | |
| Illiterate | 8.0 | 12.0 | 0.460 | 10.3 |
| Primary | 37.3 | 30.2 | | 33.1 |
| Secondary | 34.0 | 37.2 | | 36.0 |
| High school or college/university | 20.7 | 20.6 | | 20.6 |
| Marital status (%) | | | | |
| Single or widowed | 13.2 | 2.4 | 0.001 | 7.1 |
| Married/co-habiting | 86.8 | 97.5 | | 92.9 |
| Current living arrangement (%) | | | | |
| Alone/no fixed address/other | 2.5 | 1.2 | 0.006 | 1.8 |
| Husband, family, or friends | 23.8 | 44.1 | | 35.3 |
| With sex partner | 73.7 | 54.7 | | 63.0 |
| Occupation (%) | | | | |
| House-work/part-time work | 76.3 | 71.4 | 0.220 | 73.5 |
| Full-time work | 3.6 | 4.4 | | 4.1 |
| Unemployed/looking for employment | 1.8 | 7.7 | | 5.1 |
| Other | 18.3 | 16.5 | | 17.3 |

injected drugs' but tested positive for the presence of opioids in their urine. Over half (54.3 %) of the FSP enrolled had ever been tested for HIV with 92.5 % of those FSPs informing their partners of the test results.

HIV Risk Factors in FSP

Univariate analysis (Table 4) of HIV-status and key risk factors among the FSP identified key associations (OR, 95 % CI) between HIV infection and injection drug use

behaviors. Those FSP reporting a history of injection drug use (OR 6.42, 3.93–10.48, p value <0.001) and those FSP currently using opioid drugs, as determined by urinalysis results (OR 2.03, 1.36–3.02, p value <0.001), had significantly increased odds of being infected with HIV. This significant association between HIV-status and injection drug use is reflected in the univariate association between HIV-status and those FSP reporting any duration [i.e., >year (reference) vs. ≤1 year] and intensity (i.e., times injection per day) of injection drug use. Sexual activity and

Table 3 Socio-demographic characteristics and risk behaviors of female sex partners (FSP) in Ho Chi Minh City, Vietnam

| | 2011 | | 2013 | | p value | Total % |
|---|------|------|------|------|---------|---------|
| | n | % | n | % | | |
| Last sex with MWID | 191 | | 248 | | | |
| Within last 30 days | | 74.5 | | 97.1 | <0.001 | 87.1 |
| Between 1 and 6 months | | 25.5 | | 3.2 | | 12.9 |
| Condom use at last sex with MWID | 178 | 27.7 | 248 | 29.3 | 0.820 | 28.5 |
| Who suggested condom use at last sex? | 54 | | 72 | | | |
| FSP | | 39.6 | | 60.6 | 0.150 | 51.5 |
| Male MWID | | 22.1 | | 11.3 | | 16.4 |
| Joint decision | | 38.3 | | 28.2 | | 32.1 |
| Condom use with MWID over past month ^a | 191 | | 254 | | | |
| Never | | 46.8 | | 53.9 | 0.040 | 50.8 |
| Inconsistent (0 < x < 100 %) | | 6.2 | | 13.0 | | 10.1 |
| 100 % of the time | | 19.2 | | 20.1 | | 19.7 |
| Don't remember/no answer | | 27.7 | | 13.0 | | 19.3 |
| Condom use with MWID over the past 6 months | 178 | | 246 | | | |
| Always | | 14.6 | | 19.2 | 0.570 | 17.0 |
| ≥50 % of the time | | 15.1 | | 13.0 | | 13.9 |
| Rarely | | 15.8 | | 10.4 | | 12.8 |
| Never | | 54.5 | | 57.1 | | 56.4 |
| Believes partner injects drugs | 191 | | 248 | | | |
| Yes | | 77. | | 95.0 | <0.001 | 87.4 |
| No | | 16.5 | | 3.3 | | 9.2 |
| Don't know | | 5.6 | | 1.7 | | 3.3 |
| Provides money for MWIDs drug use | 191 | 31.9 | 248 | 50.4 | <0.001 | 42.3 |
| Believes MWID is infected with HIV | 191 | | 248 | | | |
| Yes | | 18.2 | | 40.9 | <0.001 | 30.9 |
| No | | 43.6 | | 30.2 | | 36.3 |
| Don't know | | 38.2 | | 28.9 | | 32.8 |
| Sex with person other than MWID in past 6 months | 191 | 2.8 | 248 | 10.9 | <0.001 | 7.4 |
| Ever used illegal drugs | 190 | 56.8 | 248 | 63.2 | 0.160 | 60.3 |
| Ever injected illegal drugs | 109 | 71.2 | 156 | 73.2 | 0.620 | 72.7 |
| Mean duration (years) of drug use | 107 | 6.8 | 147 | 7.6 | 0.239 | 7.2 |
| Mean duration (years) of <i>injecting</i> drug use | 75 | 5.1 | 110 | 5.9 | 0.386 | 5.5 |
| Mean duration (years) of <i>injecting</i> drug use (MWID) | 186 | 7.7 | 241 | 7.4 | 0.730 | 7.5 |
| Opioid test results (% positive) | 191 | 44.7 | 247 | 51.0 | 0.390 | 48.3 |
| Frequency of injecting drug use in past 6 months | 75 | | 115 | | | |
| Don't inject | | 10.1 | | 21.7 | 0.180 | 17.1 |
| 1 or more times per day | | 82.2 | | 69.6 | | 74.6 |
| <1 time per day | | 7.7 | | 8.7 | | 8.3 |
| Frequency of needle/syringe sharing in past 6 months (%) | 64 | | 90 | | | |
| Always | | 6.2 | | 16.7 | 0.200 | 12.1 |
| More than half of the time | | 18.3 | | 26.7 | | 23.0 |
| Occasionally | | 27.5 | | 14.4 | | 20.1 |
| Never | | 48.0 | | 42.2 | | 44.7 |
| Self-perceived at risk for HIV infection ^b (%) | 190 | | 235 | | | |
| Yes | | 25.9 | | 41.7 | <0.001 | 34.4 |
| No | | 40.7 | | 51.7 | | 46.9 |
| Don't know | | 33.4 | | 6.5 | | 18.7 |

Table 3 continued

| | 2011 | | 2013 | | p value | Total % |
|---|------|------|------|------|---------|------------|
| | n | % | n | % | | |
| Ever tested for HIV (%) | 190 | 53.9 | 234 | 55.0 | 0.860 | 54.3 |
| Notified sex partner of HIV test results? (%) | 94 | 93.7 | 118 | 91.5 | 0.680 | 92.5 |

^a Calculated as a function of times used condom/times had sex in past month

^b Determined by asking FSP: “With your current behaviors, do you think that you are at risk for HIV infection?”

behavior with the MWID as measured by recency [i.e., sex with another person who inject drugs with last 30 days (reference) vs. >30 days] (OR 1.32; 0.69–2.54, p value = 0.400), condom use [yes (reference) vs. no] at last sex (OR 0.79; 0.52–1.22, p value = 0.296), and consistent condom use [100 % condom use (reference) vs. never condom use] in last month of sexual activity (OR 1.24; 0.75–2.04, p value = 0.800) did not appear to be associated with HIV status among FSP.

FSP reporting to not be at risk for HIV (OR 0.16, 0.18–0.25, p value <0.001) and who do not believe their MWID to be infected with HIV (OR 0.38; 0.23–0.63, p value <0.001) appeared to have lower relative odds of being infected with HIV themselves. An HIV-positive status for the MWID partner at the time of the survey was significantly associated (OR 3.98; 2.59–6.11, p value <0.001) with an HIV-positive status among the referred FSP.

In a sub-analysis among those FSPs reporting no injection drug use, there was no association between condom use with referring MWID and HIV while those FSP not tested for HIV (OR 2.88; 1.44–5.74, p value = 0.003) and with a HIV-infected MWID partner (OR 4.78; 2.08–11.00, p value <0.001) had a higher odds of being infected with HIV.

In the adjusted analysis, HIV status among the FSP was associated with increased duration of injection drug use. FSP reporting injection drug use less than or equal to 1 year (OR 2.94; 1.19–7.26, p value = 0.019) and >1 year (OR 5.04; 2.83–8.96, p value <0.001) were at increased odds of being HIV-positive relative to FSPs reporting no injection drug use. In addition, FSP with an MWID who was HIV-infected at the time of the survey was at increased odds (OR 3.35; 1.97–5.69, p value <0.001) for being HIV-positive. FSP reporting no self-perceived risk of HIV had lower relative odds (OR 0.36; 0.20–0.66, p value = 0.001) of being infected with HIV than those FSP reporting such risk.

Discussion

This analysis from HCMC, Vietnam reports a high HIV prevalence among FSP of MWID that appears to be largely associated with their individual injection drug use rather

than sex practices such as condom usage. Furthermore, it provides critical estimates of the potential level of HIV discordance and risk behavior among the sexual network of MWID, which is important given that the majority of MWID in Vietnam are either married or are sexually active with a regular non-commercial female partner. This analysis indicates that, in HCMC, the majority of FSP that report using illegal drugs have either used injected illegal drugs with almost half of them testing positive for current opioid use. This is higher than in similar surveys among FSP in Dien Bien province and Hanoi, Vietnam where the self-reported injection drug use was 1.7 and 6.0 % respectively [29]. There also appears to be evidence that a large proportion of FSPs reported to be injecting drugs for a longer duration than their current MWID partner. This indicates that these FSPs had begun injection drug use prior to their current male sex partner. It is also possible that drug using females are more likely to partner with drug using males to allow them to share drug using habits as was reported in a survey among female sex workers in Hanoi [30].

The primary risk factor for HIV infection among these FSP in HCMC appears to be linked to their own injection drug use, duration of injection drug use (e.g. ≥ 1 year), and the status of their MWID partner rather than direct sexual activity or behavior within or outside of that dyad. This is in-line with data from Central Asia that indicates similar sex practices (e.g. condom use) among injection and non-injection drug using female partners of male injection drug users [31].

There appears to be a low levels of consistent condom use among this population, which is similar with other studies from Vietnam and the region [10, 21–23, 32, 33]. Despite the absence of association of condom use with the HIV status of the FSP in this analysis, this is an area of concern, given the proven effectiveness of condoms to prevent sexual transmission of HIV if used consistently and correctly over time [13, 34–36]. This inconsistent condom use is particularly interesting considering that the vast majority (>85 %) of FSP indicate that they correctly believe that their male partner is an injection drug user. This could indicate a lack of knowledge about the risk and

Table 4 Crude and adjusted associations between FSP HIV infection and select risk factors

| | Odds ratio (OR) | 95 % CI | | p value | Adjusted odds ratio (aOR) | 95 % CI | | p value |
|--|-----------------|---------|-------|---------|---------------------------|---------|------|---------|
| Survey year | | | | | | | | |
| 2011 | REF | | | | | | | |
| 2013 | 1.26 | 0.84 | 1.88 | 0.256 | | | | |
| Education | | | | | | | | |
| Illiterate | REF | | | | | | | |
| Primary | 0.79 | 0.38 | 1.63 | 0.483 | | | | |
| Secondary | 0.83 | 0.41 | 1.68 | 0.563 | | | | |
| High school or college/university | 1.14 | 0.54 | 2.42 | 0.768 | | | | |
| Last sex with MWID | | | | | | | | |
| Within last 30 days | REF | | | | | | | |
| >30 days | 1.32 | 0.69 | 2.54 | 0.400 | | | | |
| Condom use at last sex with MWID | | | | | | | | |
| Yes | REF | | | | | | | |
| No | 0.79 | 0.52 | 1.22 | 0.296 | | | | |
| Condom use with MWID (past month) | | | | | | | | |
| Never | REF | | | | | | | |
| Inconsistent (0 < x>100 %) | 1.08 | 0.55 | 2.09 | 0.250 | | | | |
| 100 % of the time | 1.24 | 0.75 | 2.04 | 0.800 | | | | |
| Don't remember; no answer | 0.78 | 0.45 | 1.35 | 0.322 | | | | |
| History of illegal drug use | | | | | | | | |
| No reported drug use | REF | | | | | | | |
| Non-injection drug use only | 1.07 | 0.53 | 2.16 | 0.849 | | | | |
| Injecting drug use | 6.42 | 3.93 | 10.48 | <0.001 | | | | |
| Opioid test results | | | | | | | | |
| Negative | REF | | | | | | | |
| Positive | 2.03 | 1.36 | 3.02 | <0.001 | | | | |
| Duration of IDU | | | | | | | | |
| Never injected drugs | REF | | | | | | | |
| ≤1 year | 2.69 | 1.23 | 5.89 | 0.014 | 2.94 | 1.19 | 7.26 | 0.019 |
| >1 year | 7.57 | 4.76 | 12.06 | <0.001 | 5.04 | 2.83 | 8.96 | <0.001 |
| Frequency of IDU in past 6 months | | | | | | | | |
| Don't inject drugs | REF | | | | | | | |
| <1 time/day | 8.72 | 2.73 | 27.83 | <0.001 | | | | |
| ≥1 time/day | 3.15 | 1.99 | 4.98 | <0.001 | | | | |
| Frequency of needle/syringe sharing in past 6 months | | | | | | | | |
| Always | REF | | | | | | | |
| More than half of the time | 0.72 | 0.24 | 2.15 | 0.553 | | | | |
| Occasionally | 0.69 | 0.21 | 2.32 | 0.551 | | | | |
| Never | 1.04 | 0.37 | 2.88 | 0.944 | | | | |
| Diagnosed with STD or hepatitis in past 6 months (self-reported) | | | | | | | | |
| No | 0.51 | 0.23 | 1.11 | 0.090 | | | | |
| Self-perceived at risk for HIV | | | | | | | | |
| Yes | REF | | | | | | | |
| No | 0.16 | 0.10 | 0.25 | <0.001 | 0.36 | 0.20 | 0.66 | 0.001 |
| Don't know | 0.27 | 0.15 | 0.50 | <0.001 | 0.62 | 0.29 | 1.32 | 0.210 |
| Believes MWID is infected with HIV | | | | | | | | |
| Yes | REF | | | | | | | |
| No | 0.38 | 0.23 | 0.63 | <0.001 | | | | |
| Don't know | 0.52 | 0.32 | 0.85 | 0.01 | | | | |

Table 4 continued

| | Odds ratio (OR) | 95 % CI | | p value | Adjusted odds ratio (aOR) | 95 % CI | | p value |
|-----------------------------|-----------------|---------|------|---------|---------------------------|---------|------|---------|
| Ever tested for HIV | | | | | | | | |
| Yes | REF | | | | | | | |
| No | 1.46 | 0.98 | 2.18 | 0.064 | | | | |
| HIV test result (male MWID) | | | | | | | | |
| HIV-negative | REF | | | | | | | |
| HIV-positive | 3.98 | 2.59 | 6.11 | <0.001 | 3.35 | 1.97 | 5.69 | <0.001 |

modes of HIV acquisition and transmission, and may also be reflective of gender dynamics in Vietnam where a female is often not able or expected to negotiate condom use or safe sex practices with their male partners [4]. Such power imbalances may also result in intimate partner violence and have a negative influence on other behaviors such as injection drug use and practices as has been reported in other settings [31, 37, 38].

There are at least several limitations of this analysis that may affect the validity and application of its findings. First, the majority of information related to risk behaviors, such as illegal drug use and condom use, were collected via self-report which is subject to recall and social desirability biases, as may be reflected in the nearly 25 % of respondents who reported never using injection drugs but testing positive for the presence of opioids in their urine. This reporting bias may also be an explanation for the high (16.6 %) prevalence among those FSP reporting no history of injection drug use [39]. Efforts to mitigate such biases included obtaining informed consent, focused training for staff related to interview techniques to establish trust with the enrollee, triangulating responses with multiple questions to identify discrepancies, and the objective analysis of urine specimens for indication recent opioid use bearing in mind that the presence of opioids in urine may not be used to confirm that the drugs were injected. In addition, the survey questionnaire did not collect information on the drug sharing practices between the MWID and the FSP which is important to understanding the possibility for couples to ‘sort’ themselves based on such risk behaviors as well as the potential risks of transmission between these couples. A second limitation of this study is that the interpretation of its findings may be limited to HCMC. Other surveys in select provinces in Vietnam report a lower proportion of injection drug use among FSP of MWID, with their primary risk of acquiring HIV potentially being via sexual transmission rather than injection drug use [40]. This issue does reflect the geographic variation of the HIV epidemic in Vietnam [1–3] and highlights the need for additional surveillance among sexual partners of MWID to

obtain a more nationally representative profile of the HIV risk and prevalence in this population. A third limitation is the lack data on those MWID and FSP that may have refused to participate in the survey which is an important consideration for estimating potential selection biases that may be introduced if those enrolled differ from the respective populations. Included in this issue, is the potential bias that may have been introduced by limiting enrolment to adults (i.e., those ≥ 18 years) which prevents an understanding of the younger injection drug use population. Finally, because no phylogenetic genetic analysis was done among those infected with HIV, it was not possible to confirm any specific transmission linkage to determine if the source of HIV infection (specifically, whether, the HIV-infected couple transmitted the virus to each other or if each of the members of the couple were infected from a source outside of the couple).

This study provides evidence of the increased risk of HIV infection and transmission among MWID and their FSP, who may also be current or previous injection drug users, in HCMC, Vietnam. It highlights the need for focusing on both male and female injection drug users with evidence-based interventions, such as needle and syringe distribution, opioid substitution therapy, HIV counseling and testing, and HIV care and treatment [16, 41]. It also strengthens the evidence to implement and evaluate programs that engage couples, and other networks (e.g. women drug-users), in addition to the individual at risk, for increased efficiency and impact on HIV transmission as has been studied in other settings where HIV is concentrated in injection drug users [42]. In Vietnam, there have been few interventions that focus on FSP of MWID or that address the potential increase in sexual or injection drug use risk factors among the MWID-sexual partner dyad [4, 43, 44]. Such interventions may include: couples HIV counseling and testing, immediate initiation of ART for HIV discordant couples to prevent transmission to the uninfected partner, harm-reduction for drug use, and care services (e.g. linkage to maternal health) that are sensitive to the local gender dynamics and are tailored to FSP of MWID,

who themselves may have a history of injection drugs. Outreach interventions that focus on couples that are at increased risk of being sero-concordant (HIV+) or sero-discordant have been piloted in select districts Vietnam and have indicated promising results at increasing condom use and HIV counseling and testing uptake and may have contributed to the increase in FSPs that reporting knowing their male partners HIV status [22] Data from these programs should be routinely reviewed and analyzed to monitor trends in HIV risk behavior and infection among female partners of males at increased risk for HIV. Further study into the ‘behavioral sorting’ of male and female drug users into sexual relationship and their high risk behaviors, such as needle and syringe sharing, is also warranted.

In conclusion, this study provides strong evidence that FSP of MWID are at increased risk for HIV acquisition and potential onward transmission in HCMC, where an estimated 35–40 % of the estimated people living with HIV/AIDS in Vietnam reside. This increased risk appears to be largely associated to their own injection drug use. Immediate review and, if necessary, expansion of HIV prevention, care, and treatment services for the FSP of MWID is recommended.

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