Published in final edited form as:

Sex Transm Dis. 2017 November ; 44(11): 663–670. doi:10.1097/OLQ.0000000000000662.

Prevalence of HIV and sexually transmitted infections among cisgender and transgender women sex workers in Greater Kuala Lumpur, Malaysia: Results from a respondent-driven sampling study

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Abstract

Background—Sex workers face a disproportionate burden of HIV and sexually transmitted infections (STI) worldwide. For cisgender women sex workers (CWSW), global HIV prevalence is over 10%, while transgender women sex workers (TWSW) face an HIV burden of 19%–27%.

Methods—We used respondent-driven sampling to recruit 492 sex workers, including CWSW (n=299) and TWSW (n=193) in Greater Kuala Lumpur, Malaysia. Participants completed an in-depth survey and were screened for HIV, syphilis, *Chlamydia trachomatis*, and *Neisseria gonorrhoeae*. Sample characteristics stratified by gender identity and interview site are presented. Bivariate analyses comparing CWSW and TWSW were conducted using independent samples t-tests for continuous variables and chi-squared tests for categorical variables.

Results—Pooled HIV prevalence was high (11.7%; 95%CI 8.8–14.5), and was similar for CWSW (11.1%) and TWSW (12.4%). Rates of syphilis 25.5% (95%CI 21.6–29.5), *C. trachomatis* (14.8%; 95%CI 11.6–18.0) and *N. gonorrhoeae* (5.8%; 95%CI 3.7–7.9) were also concerning.

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Conflicts of Interest: There are no conflicts of interest to disclose.

Both groups reported lifetime HIV testing (62.4%), but CWSW were less likely to have ever been HIV tested (54.5%) than TWSW (74.6%). Median time since last HIV test was 24 months. Previous screening for STI was low. Inconsistent condom use and drug use during sex work were not uncommon.

Conclusions—High HIV and STI prevalence, coupled with infrequent HIV and STI screening, inconsistent condom use, and occupational drug use, underscore the need for expanded HIV and STI prevention, screening, and treatment efforts among CWSW and TWSW in Malaysia.

Keywords

sex work; HIV; transgender; women; Malaysia

INTRODUCTION

Sex workers are a key population at high risk for HIV and sexually transmitted infections (STI).¹ Sex work, the exchange of sex for money, goods, housing, or other services, presents health hazards to those who work in the industry, including a heightened risk of disease exposure, both from sexual- and drug use-related risk behaviors.² A number of structural, environmental, social, and individual factors mediate this risk and contribute to an increased HIV prevalence in this population, with both shared and differing impacts between cisgender and transgender women.³ A cisgender woman is someone whose natal sex is female and who identifies as a woman. A transgender woman, however, is someone who identifies psychologically as a woman, but was assigned male sex at birth.⁴ While the terms “female sex worker” or “FSW”, which refer to the biological female sex, are commonly used to refer to cisgender women involved in sex work. We use the term cisgender women to recognize the preferred gender identity of this group in parity with the recognition of the gender identity of transgender women.

Though disease levels vary widely by geography, global HIV prevalence among cisgender women sex workers (CWSW) in low and middle-income countries has been estimated to be 11.8% (95% CI 11.6–12.0).⁵ For transgender women, regardless of sex work involvement, HIV prevalence is estimated at 19.1% (95% CI 17.4–20.7) – among the highest HIV burden of any key population.⁶ The estimated global HIV prevalence among transgender women sex workers (TWSW) has been estimated to be even greater, at 27.3%.^{2, 6, 7}

In Southeast Asia, HIV prevalence is high in CWSW, including in Cambodia (23.0%)⁸ and Thailand (20.2%).⁹ While there are no studies from the region specific to TWSW, HIV prevalence in transgender women is 18.0% in Vietnam¹⁰ and 24.4% in Indonesia.¹¹ In Malaysia, however, little attention has been directed at assessing the HIV burden among CWSW and TWSW. In 2014, Malaysia reported a national adult HIV prevalence of 0.4% (adults age 15–49 years of age).¹² Since HIV was first detected here in 1986, Malaysia’s HIV epidemic has been driven primarily by people who inject drugs, but harm reduction programs have reduced HIV incidence among this population,^{13, 14} while incident cases due to sexual transmission have continued to increase.¹² As of 2014, 78% of all new HIV diagnoses in Malaysia were attributed to sexual transmission,¹² yet little is known about HIV among sex workers. Ministry of Health surveillance data (2014) found an HIV

prevalence of 7.3% in CWSW and 5.6% in all transgender women, however, data were not specific to TWSW.¹² STI surveillance data have not been reported in either of these populations.

HIV prevention efforts among sex workers in Malaysia are complicated by laws prohibiting sex work, resulting in a largely hidden population. Sex workers are often the targets of unlawful arrest and detention, physical and sexual violence, and discrimination, which undermine public health interventions.¹⁵ Transgender women face additional burdens, with frequent detention and prosecution under Malaysia's Islamic legal code for engaging in so-called "cross-dressing" – the wearing of stereotypically women's clothing in public – a practice which remains illegal under Malaysian Syariah law.¹⁶

This paper reports findings from a respondent-driven sampling (RDS) study of CWSW and TWSW in Greater Kuala Lumpur, Malaysia. These findings represent the first HIV and STI prevalence estimates to appear in the peer-reviewed literature and provide the most reliable estimates of disease burden among this underserved, highly vulnerable population. These findings may inform important directions for HIV prevention interventions among CWSW and TWSW.

METHODS

Site Selection

From February 2014 through December 2014, we recruited 492 sex workers, including CWSW (n=299) and TWSW (n=193), via RDS to complete structured surveys and HIV and STI testing. Participants were recruited from three interview sites around Greater Kuala Lumpur, the geographic region including Kuala Lumpur and surrounding suburbs. Prior to the study, we conducted formative interviews with community-based organizations serving the sex worker community and with TWSW and CWSW themselves to inform selection of the interview sites. Site selection prioritized locations where sex workers engaged in their trade, including soliciting clients, density of sex work activity, proximity to public transportation, and acceptability of the interview site (e.g., location, safety, privacy). The three selected locations were: 1) Downtown Kuala Lumpur (a central, urban area); 2) Petaling Jaya (a densely populated peri-urban area 20km west of Kuala Lumpur; and 3) Klang (a port region 40km west of Kuala Lumpur).

Participants and Sampling

We recruited participants using RDS, a chain referral method with demonstrated success in recruiting hard-to-reach populations.¹⁷ During our formative work, initial RDS participants, called "seeds," were carefully selected with assistance from community-based organizations serving sex workers. Each seed was selected based on her representativeness of the target population and her large network size. We recruited 28 seeds across the three interview sites ($N_{\text{Kuala Lumpur}}=12$; $N_{\text{Klang}}=5$; $N_{\text{Petaling Jaya}}=11$), among whom 10 were CWSW and 18 were TWSW. Each enrolled seed participant received three recruitment "coupons" to give to peers in her network who might be interested in participating in the study. Each seed participant could recruit a maximum of three peers. Recruited peer participants were also provided three

coupons each to recruit her peers, thus creating multiple waves of recruitment. Recruitment at each site occurred independent from the other sites (e.g., Kuala Lumpur seeds and peers could only recruit to the Kuala Lumpur site). As such, all coupons were site-specific. Coupons were valid for a maximum of two weeks after being issued. Participants received 50 Malaysian Ringgit (MYR) (USD \$17) for study participation and an additional MYR 20 (USD \$7) for each of up to three peers they recruited into the study. In total, 507 individuals presented for eligibility screening, 504 underwent eligibility screening, 494 were identified as eligible, and 492 enrolled in the study. A total of 1236 coupons were distributed during the study, with 476 coupons being returned, of which 464 resulted in an enrolled recruit. Primary reasons for non-participation include not meeting eligibility criteria, refusal to undergo HIV or STI testing, unable to provide informed consent, and not having a recruitment coupon.

RDS studies require larger sample sizes than simple random sampling because of dependence in the sample.^{18, 19} The number of times larger an RDS sample must be to estimate prevalence with the same precision as a simple random sample is referred to as the “design effect.” Design effects from RDS studies vary greatly; however, in sex work studies, design effects around 3 are commonly used.²⁰ Using a design effect of 3 and a prevalence estimate of 20% (based on literature review), we calculated that we would need 534 participants to estimate prevalence with a standard error of 0.03.

Eligibility

Inclusion criteria were: 1) identification as a cisgender woman or transgender woman; 2) report of having exchanged sex for money, goods, or services within the past 90 days; 3) 18 years of age or older; 4) able to speak Bahasa Malaysia, Tamil, or English; 5) able to provide informed consent; and 5) identified as a “seed” participant or recruited by a seed and presented a valid recruitment coupon. Transgender men (female-to-male) were not included.

Coupon management software was used to track distributed and redeemed coupons during the study and a standard numbering system was used to track recruiter-recruit relationship. Participants who presented with a valid coupon underwent an initial eligibility screening during which they reported their gender identity, primary language, birth year, and last date of sex work. If eligible, participants were asked the first two letters of their mother’s name, which was used to generate a semi-unique code comprised of their gender identity, mother’s name, and birth year. This code was used to protect against repeat enrollment. Additionally, study staff, including two research assistants and one clinical coordinator, remained unchanged for the duration of the study, which allowed them to easily identify potential repeat enrollments.

Survey procedures

Each participant completed an in-depth survey in a private room. The survey was administered by a research assistant on a laptop computer using the online survey program, Qualtrics (Qualtrics Inc., Provo, Utah), and required 30–60 minutes to complete. Both research assistants had experience working with the sex work community in Malaysia.

Survey measures

Survey content included information on demographics, sex work involvement, income, harm reduction behaviors, criminal justice involvement, as well as HIV and STI screening, diagnosis, and treatment history. Condom use frequency was defined as the percent of time condoms were used during receptive or insertive vaginal or anal sex. For TWSW, condom use during vaginal sex included acts by transgender women who had not undergone vaginoplasty and were the insertive partner with a cisgender female, as well as transgender women who had a neovagina and were the receptive partner with a cisgender male. Recent drug use was defined as any illicit use of marijuana, heroin, methadone, buprenorphine, benzodiazepines, crystal methamphetamines, amphetamines (e.g., ecstasy), ketamine, ketum, opiate analgesics, or inhalants within the last 30 days.

Personal network size was assessed by asking participants how many CWSW and TWSW they know in Greater Kuala Lumpur who are 18 years of age or older, who have engaged in sex work, and who you would consider recruiting to participate in this study.

Clinical screening procedures

HIV testing procedures followed World Health Organization (WHO) guidelines.²¹ All participants received a rapid 4th generation HIV-1/2 test by whole-blood fingerstick (Alere Determine® HIV-1/2 Ag/Ab Combo; Alere, Waltham, Massachusetts, USA). Participants with a reactive first HIV test underwent a second rapid HIV-1/2 whole-blood fingerstick test (ACON HIV Ultra Rapid Test Device; ACON Laboratories Inc., San Diego, California, USA). All reactive tests in step one were Ab+; no reactive Ag was detected. Participants with two reactive HIV tests were considered HIV-infected. No discordant results were observed. Venous blood was used for syphilis screening using the Rapid Plasma Reagin (RPR; BD Macro-Vue RPR Card Antigen Suspension; Becton, Dickinson and Company, Sparks, Maryland, USA) and confirmed with the Treponema Pallidum Passive Particle-Agglutination Test (TPPA; Serodia-TPPA; Fujirebio, Inc., Tokyo, Japan). Participants with a reactive RPR and TPPA were classified as positive for syphilis serology.²² We further report those with an RPR titer 1:8, which has been shown to be associated with untreated syphilis.^{23, 24} For eight participants, severe vascular scarring prevented venipuncture for sample collection so a rapid finger-stick test for detection of Treponema Pallidum antibody (Alere Determine Syphilis TP, Alere, Waltham, Massachusetts, USA) was used. Transgender women provided 15 mL first-catch urine and cisgender women provided self-collected vaginal swab for *C. trachomatis* and *N. gonorrhoeae* nucleic acid amplification tests (NAAT). Rectal swabs were not collected due to the difficulty in self-collection in the field and the lack of validation of the COBAS CT/NG sample collection kits for obtaining these samples. Vaginal swabs were immediately placed in the transport media tube. Urine and vaginal swab samples were tested for *C. trachomatis* and *N. gonorrhoeae* using PCR (COBAS AMPLICOR CT/NG Test, Roche Molecular Systems Inc., Pleasanton, California, USA). All specimens for syphilis, *C. trachomatis*, and *N. gonorrhoeae* were stored per manufacturer protocol and transported to the University of Malaya Medical Centre's virology and microbiology laboratory in Kuala Lumpur for analysis.

Pre- and post-test HIV counseling was provided. Participants with two reactive HIV tests received additional counseling and information on community-based HIV clinicians who were sensitive to the healthcare needs of sex workers and transgender women and were willing to accept referrals. A medical referral letter was provided describing the two reactive HIV test results and requesting laboratory confirmation tests. Participants were instructed to return to their interview location two weeks after specimen collection to receive results of their syphilis, *C. trachomatis*, and *N. gonorrhoeae* tests. Participants who were unable to return to the study site could contact the study coordinator to arrange an alternative location to receive their results. Participants with reactive syphilis, *C. trachomatis*, or *N. gonorrhoeae* results were provided a medical referral letter and information on community-based clinics for treatment. All participants were offered condoms and information on harm reduction and community health resources.

Ethics

All participants provided written informed consent prior to enrollment. The study was approved by the Institutional Review Boards of Yale University and the University of Malaya.

Analysis

Data were analyzed using IBM SPSS Statistics (version 23) and *R*.²⁵ We present sample characteristics stratified by gender identity and interview site. Bivariate analyses between CWSW and TWSW were conducted using independent samples *t*-tests for continuous variables and chi-squared tests for categorical variables. For HIV, syphilis, *C. trachomatis*, and *N. gonorrhoeae* results, we present traditional RDS estimates adjusted for social network size alongside sample means.²⁶ Confidence intervals around the RDS-adjusted estimates were estimated using Salganik's bootstrap, and those around the sample mean were estimated using a conventional non-parametric bootstrap. Point and uncertainty estimates were implemented using the *RDS* package in *R*.²⁷ Given well-documented problems with the validity of commonly used RDS estimation strategies, we focus our discussion on sample means rather than these adjusted estimates.^{17, 19, 28, 29} Similarly, all bivariate analyses are reported using unweighted data. Missing data were excluded from analyses. Seed participants were included in both unadjusted and RDS-adjusted analyses.

RESULTS

Sample characteristics are reported in Table 1. A total of 492 cisgender women (n=299; 60.8%) and transgender women (n=193; 39.2%) sex workers were enrolled from three sites: Kuala Lumpur (n=270, 54.9%); Klang (n=157, 31.9%); and Petaling Jaya (n=65, 13.2%).

HIV and STI Prevalence

HIV and STI pooled prevalence results and RDS estimates are presented in Table 2. Pooled HIV prevalence for the total sample was 11.7% (n=57/489; 95%CI 8.8–14.5), with no significant difference between CWSW (11.1%; 95%CI 7.6–14.7) and TWSW (12.4%; 95%CI 7.8–17.1, $p>0.05$, ns). Among all participants, 4.7% (n=23) had previously been diagnosed with HIV prior to study enrollment (Table 3). Figure 1 shows HIV and STI

prevalence by interview site. Kuala Lumpur had the highest HIV prevalence (15.3%; 95% CI 11.0–19.6), followed by Petaling Jaya (7.7%; 95% CI 1.0–14.3) and Klang (7.1%; 95% CI 3.0–11.1). Overall syphilis prevalence was 25.5% (95% CI 21.6–29.5) and did not differ between CWSW (23.7%; 95% CI 18.6–28.7) and TWSW (28.3%; 95% CI 21.8–34.9, $p>0.05$). Nine participants who met criteria for positive syphilis serology reported a previous syphilis diagnosis, all but one of whom received treatment for their prior diagnosis. Additionally, 53.0% (63/119) of participants who met criteria for syphilis, or 13.5% of the entire sample, had a RPR titer of 1:8. Participants tested at the Kuala Lumpur site had the highest prevalence of syphilis (33.9%; 95% CI 28.0–39.8), followed by Klang (19.3%; 95% CI 12.9–25.7) and Petaling Jaya (7.7%; 95% CI 1.0–14.3). Total prevalence for *C. trachomatis* was 14.8% (95% CI 11.6–18.0) and *N. gonorrhoeae* was 5.8% (95% CI 3.7–7.9). CWSW had higher overall prevalence of *C. trachomatis* (22.5%; 95% CI 17.7–27.3; $p<0.001$) and *N. gonorrhoeae* (8.9%, 95% CI 5.6–12.1, $p<0.001$) compared to TWSW.

Lifetime HIV and STI Testing History

Previous HIV and STI testing is reported in Table 3. Over one-third (37.6%) of participants had never been HIV tested. TWSW were significantly more likely to have been previously HIV tested than CWSW (74.6% vs 54.5%, $p<0.001$). Among those who had previously been HIV tested, time since last HIV test was 31.5 months ($SD=35.5$) and only 19.5% had been tested in the last 12 months. HIV testing within the last year was equally low for both CWSW (18.4%) and TWSW (21.1%, $p=0.436$, ns). Previous lifetime STI testing was low for syphilis (14.6%), *C. trachomatis* (9.6%), and *N. gonorrhoeae* (10.6%), with no differences detected between CWSW and TWSW.

Characteristics of Sex Work Involvement

Characteristics of sex work involvement are reported in Table 1. Age at first involvement in sex work was 25.4 years ($SD=8.7$), with TWSW starting at an earlier age ($M=20.4$, $SD=5.1$, $p<0.001$) than CWSW. During the last 30 days, participants worked an average of 16.9 days ($SD=8.2$) in sex work, for 6.1 hours per day ($SD=3.3$), and engaging in sex with 3.0 customers per day ($SD=2.8$). Average monthly income during the last 6 months was MYR 2144.3 ($SD=1839.5$; USD \$715), which is well below the 2014 average monthly household income of MYR 6141.³⁰ Most income (83.1%) was earned through sex work. Compared to CWSW, TWSW reported more total years working in sex work ($p=0.008$), more days per month ($p<0.001$), more hours per day ($p=0.002$), and higher monthly income, including from sex work ($p<0.001$) and other sources ($p=0.05$). CWSW reported using condoms an average of 74.1% ($SD=36.6$) of the time during vaginal sex and TWSW reported using condoms an average of 89.0% ($SD=27.4$) of the time for anal sex during the last 30 days. About one-third (33.5%) reported drug use during sex work in the last 30 days, with no difference between CWSW (33.8%) and TWSW (33.2%, $p>0.05$, ns).

Discussion

To our knowledge, this is the first study to examine HIV and STI prevalence in cisgender and transgender women sex workers in Malaysia. Our results indicate CWSW and TWSW together face an HIV burden 29-fold higher than the 0.4% prevalence of Malaysia's general adult population.¹² Our pooled HIV prevalence of 11.1% for CWSW is one-third higher

than the Ministry of Health's 2014 estimate of 7.3% for female sex workers, which falls outside the lower-bound confidence interval of our pooled HIV estimate for CWSW (95% CI 7.6–14.7). For TWSW, HIV prevalence was 12.4% -- two-fold higher than the 5.6% reported by the Ministry of Health for transgender women. Although Malaysia did not disaggregate sex workers in their sample, 86% of transgender women in their sample reported active sex work involvement.¹² The disparity between our data and surveillance reports may highlight the importance of utilizing network-based sampling strategies, like RDS, for identifying hidden, high-risk individuals who may otherwise go undetected by public health efforts targeting HIV and STI testing and treatment.

High HIV prevalence observed among both CWSW and TWSW indicates a need for novel interventions to reduce new infections. Pre-exposure prophylaxis (PrEP) for HIV prevention is a highly effective biomedical intervention that has been demonstrated to greatly lower HIV transmission among men who have sex with men and serodiscordant partners. A recent unplanned subanalysis of data from the iPrEx study suggests that PrEP may be highly effective among transgender women.³¹ Future research is needed to demonstrate feasibility, acceptability, and efficacy of PrEP for sex workers.

Regarding STI, 28.3% of TWSW and 23.7% of CWSW met criteria for syphilis. High prevalence of *C. trachomatis* (22.5%) and *N. gonorrhoeae* (8.9%) were also observed among CWSW. Unfortunately, the low prevalence of *C. trachomatis* and *N. gonorrhoeae* observed among TWSW is likely because we relied solely on urine testing for TWSW. The high STI burden, especially syphilis, underscores the need for rapid intervention for both individual morbidity and the high potential for onward transmission to clients and other sex partners. Although not presented here, future planned analyses of this data will explore correlates of STI transmission.

Of additional concern is the extraordinarily low prior HIV and STI testing. While nearly two-thirds (62.4%) reported lifetime HIV testing, only one-fifth (19.4%) had been tested in the past year. Coupled with low levels of STI testing, these findings indicate a need for expanded HIV and STI integrated screening efforts. Routine HIV and STI screening among sex workers is a WHO recommended practice aimed at identifying acute and asymptomatic infections in order to prevent transmission and improve linkage to care.³²

Sexual transmission of HIV and STI varies based on type of sexual activity, with unprotected receptive anal sex posing a higher risk than insertive or receptive penile-vaginal sex.³³ While we did not collect data on the sex of participants' clients, we report sexual behaviors in Table 1 and see that many TWSW engage in both receptive and insertive anal sex and CWSW report mostly receptive vaginal sex, though some did engage in receptive anal sex, as well. Twenty-one TWSW participants had also undergone vaginoplasty, 20 of whom reported engaging in receptive vaginal sex. Literature on HIV and STI risk associated with various sexual behaviors is limited, particularly for transgender women with a neovagina, and future work should explore this area.³⁴

Inconsistent condom use during sex work was also identified in this sample. TWSW reported not using condoms 11% of the time, on average, while CWSWs reported not using

condoms nearly a quarter of the time on average (24.6%). The validity of self-reported condom use measures is concerning, as multiple studies have detected prostate-specific antigen in cisgender women (a marker for unprotected intercourse) who reported only protected sex or abstinence in the detection period.³⁵ Given this documented social desirability towards condom use, our findings are likely an underestimate of inconsistent condom use but nonetheless demonstrate the need for improved harm reduction measures for sex workers.

Compounding the concern of inconsistent condom use is the issue of drug use, particularly during sex work. Fifty-seven percent of drug use among CWSW and 77% of substance use among TWSW was during sex work, demonstrating that drug use was largely tied to involvement in sex work. As drug use can increase risk taking behaviors, occupationally-driven drug use should be addressed as part of HIV and STI prevention efforts.

The Greater Kuala Lumpur area represents a large, densely populated region of Malaysia. We sought to capture the diversity of sex work across this area by recruiting participants from varying geographic areas: urban (Kuala Lumpur), suburban (Petaling Jaya), and port (Klang). We include our HIV and STI outcomes disaggregated by study location to highlight the geographic variance in prevalence. Recruitment occurred independently at the three study sites, with distinct coupons for each site, and as these sites are a considerable distance from each other, it is unlikely that social networks between participants from each site significantly overlapped. However, it is important to note that these locations are neither isolated nor stagnant because mobility is common: sex workers may work in multiple locations, though most frequently working near to where they live, and customers may solicit sex work across the region, potentially transmitting infections between different geographic locations.

Limitations

Our study has several important limitations. Few sex workers of Chinese ethnicity were recruited despite a substantial proportion of Malaysia's population identifying as ethnic Chinese, particularly in Kuala Lumpur. It is common for ethnically-Chinese Malaysians to speak Malay and/or English, however, it is plausible that our lack of a dedicated Chinese-language recruitment effort may have limited our ability to recruit persons of Chinese ethnicity.

Recruitment of CWSW and TWSW in Kuala Lumpur and Klang occurred steadily for both genders and included intersecting networks. In Petaling Jaya, however, recruitment of CWSW was slow and challenging, despite establishing multiple cisgender seeds. This may be attributed to a higher degree of separation between CWSW, who are largely venue-based (e.g., brothel or bar) in this area, and TWSW, who are mainly street-based. Furthermore, several high-profile police raids targeting sex workers in Malaysia occurred during the time of the study and several participants at the Petaling Jaya site suspected that our study might be an undercover police operation. Given this, the Petaling Jaya CWSW results should be interpreted with caution.

Screening for *N. gonorrhoeae* and *C. trachomatis* in TWSW was assessed using only urine samples, which detect urethral infections but not rectal or pharyngeal infections. While many TWSW reported insertive anal sex, the prevalences reported for *N. gonorrhoeae* and *C. trachomatis* are likely underestimated.

RDS studies run the risk of recruiting “imposter” participants who may not be from the population of interest or repeat recruits who have already participated, especially when eligibility is based on self-reported information. Participants in this study were asked to confirm with each staff member to confirm their last date of sex work. As previously stated, our study staff did not change for the duration of the study and, as such, we did not encounter any participants attempting to “repeat” their participation at other sites. Semi-unique codes were also generated, which had very limited overlap in codes and those that do overlap report different demographic variables. While there is potential for “imposter” participants, the aforementioned measures attempted to minimize this risk.

Conclusion

This study documents high burden of HIV and STI among CWSW and TWSW in Greater Kuala Lumpur and describes these concerns in geographic and gender subgroups. High rates of inconsistent condom use and drug use during sex work, as well as low rates of regular HIV and STI screening, amplify HIV and STI concerns. We recommend a two-pronged approach to addressing these concerns, including enhanced efforts to detect and treat active infections and a bolstering of harm reduction efforts through education, increased access to condom use, and access to PrEP for HIV prevention.

Acknowledgments

Funding: This research was supported by grants from the National Institute on Drug Abuse for Career Development (K01 DA038529 for JAW, K23 DA033858 for JPM and K24 DA017072 for FLA), research (R01 DA025943 and R01 DA041271 for FLA), training (F30 DA039716 for ARB and T32 GM07205 for ARB), and a University Malaya High Impact Research Grant (AK: E-000001-20001).

We are grateful for contributions made by the following individuals to study implementation and administration: Cynthia Selvianna Sridevi, Chella Sri, Elly Azryn, Rusli Ismail, Jayanthi Venugopal, and Maria Theresa Anthony. We also would like to acknowledge the contribution made by our non-governmental organization partners in Kuala Lumpur that provided valuable support throughout the research process: PT Foundation, Pertubuhan Advokasi Masyarakat Terpinggir (PAMT), and Pertubuhan Wanita dan Kesihatan, Kuala Lumpur (WAKE).

References

1. Baral S, Beyrer C, Muessig K, et al. Burden of HIV among female sex workers in low-income and middle-income countries: a systematic review and meta-analysis. *Lancet Infect Dis.* 2012; 12(7): 538–49. [PubMed: 22424777]
2. Beyrer C, Crago A-L, Bekker L-G, et al. An action agenda for HIV and sex workers. *Lancet.* 2015; 385(9964):287–301. [PubMed: 25059950]
3. Shannon K, Strathdee SA, Goldenberg SM, et al. Global epidemiology of HIV among female sex workers: influence of structural determinants. *Lancet.* 2015; 385(9962):55–71. [PubMed: 25059947]
4. Winter S, Diamond M, Green J, et al. Transgender people: health at the margins of society. *Lancet.* 2016

5. Baral S, Beyrer C, Muessig K, et al. Burden of HIV among female sex workers in low-income and middle-income countries: a systematic review and meta-analysis. *Lancet Infect Dis.* 2012; 12(7): 538–49. [PubMed: 22424777]
6. Baral SD, Poteat T, Strömdahl S, et al. Worldwide burden of HIV in transgender women: a systematic review and meta-analysis. *Lancet Infect Dis.* 2013; 13(3):214–22. [PubMed: 23260128]
7. Operario D, Soma T, Underhill K. Sex work and HIV status among transgender women: systematic review and meta-analysis. *J Acquir Immune Defic Syndr.* 2008; 48(1):97–103. [PubMed: 18344875]
8. Couture M-C, Sansothy N, Sapphon V, et al. Young women engaged in sex work in Phnom Penh, Cambodia, have high incidence of HIV and sexually transmitted infections, and amphetamine-type stimulant use: new challenges to HIV prevention and risk. *Sex Transm Dis.* 2011; 38(1):3.
9. Manopaiboon C, Prybylski D, Subhachaturas W, et al. Unexpectedly high HIV prevalence among female sex workers in Bangkok, Thailand in a respondent-driven sampling survey. *Int J STD AIDS.* 2013; (1):34–8. [PubMed: 23512512]
10. Colby D, Nguyen NA, Le B, et al. HIV and Syphilis Prevalence Among Transgender Women in Ho Chi Minh City, Vietnam. *AIDS Behav.* 2016; 20(Suppl 3):379–85. [PubMed: 27435074]
11. Prabawanti C, Bollen L, Palupy R, et al. HIV, sexually transmitted infections, and sexual risk behavior among transgenders in Indonesia. *AIDS Behav.* 2011; 15(3):663–73. [PubMed: 20811771]
12. Malaysia Ministry of Health. The Global AIDS Response Progress, 2015. Malaysia: UNAIDS; 2015.
13. Singh D, Chawarski MC, Schottenfeld R, et al. Substance Abuse and the HIV Situation in Malaysia. *J Food Drug Anal.* 2013; 21(4):S46–s51. [PubMed: 25278737]
14. Reid G, Kamarulzaman A, Sran SK. Malaysia and harm reduction: the challenges and responses. *Int J Drug Policy.* 2007; 18(2):136–40. [PubMed: 17689356]
15. Decker MR, Crago A-L, Chu SKH, et al. Human rights violations against sex workers: burden and effect on HIV. *Lancet.* 2015; 385(9963):186–99. [PubMed: 25059943]
16. Human Rights Watch. [Accessed on December 10, 2016] “I’m scared to be a woman”: Human rights abuses against transgender people in Malaysia. 2014. from https://www.hrw.org/sites/default/files/reports/malaysia0914_ForUpload.pdf
17. McCreesh N, Frost SD, Seeley J, et al. Evaluation of respondent-driven sampling. *Epidemiology.* 2012; 23(1):138–47. [PubMed: 22157309]
18. Salganik MJ. Variance estimation, design effects, and sample size calculations for respondent-driven sampling. *J Urban Health.* 2006; 83(6 Suppl):i98–112. [PubMed: 16937083]
19. Goel S, Salganik MJ. Assessing respondent-driven sampling. *Proc Natl Acad Sci U S A.* 2010; 107(15):6743–7. [PubMed: 20351258]
20. Johnston L, Chen Y, Silva-Santisteban A, et al. An Empirical Examination of Respondent Driven Sampling Design Effects Among HIV Risk Groups from Studies Conducted Around the World. *AIDS Behav.* 2013
21. World Health Organization. Consolidated guidelines on HIV testing services. Geneva: World Health Organization; 2015.
22. Larsen SA, Steiner BM, Rudolph AH. Laboratory diagnosis and interpretation of tests for syphilis. *Clin Microbiol Rev.* 1995; 8(1):1–21. [PubMed: 7704889]
23. Pizzicato LN, Vagenas P, Gonzales P, et al. Active syphilis and its association with HIV and sexual risk behaviours in a multicity sample of men who have sex with men and transgender women in Peru. *Sexual Health.* In press.
24. Kakchapati S, Singh DR, Rawal BB, et al. Sexual risk behaviors, HIV, and syphilis among female sex workers in Nepal. *HIV/AIDS (Auckland, N.Z.).* 2017; 9:9–18.
25. R Core Team. R: A Language and Environment for Statistical Computing. online]. R Foundation for Statistical Computing; Vienna, Austria: 2016.
26. Volz E, Heckathorn DD. Probability based estimation theory for respondent driven sampling. *J Off Stat.* 2008; 24(1):79–97.
27. Handcock, MS., Fellows, IE., Gile, KJ. 2015. Accessed at <http://CRAN.R-project.org/package=RDS>

28. Wejnert C. An empirical test of respondent-driven sampling: point estimates, variance, degree measures, and out-of-equilibrium data. *Sociol Methodol.* 2009; 39(1):73–116. [PubMed: 20161130]
29. White RG, Lansky A, Goel S, et al. Respondent driven sampling--where we are and where should we be going? *Sex Transm Infect.* 2012; 88(6):397–9. [PubMed: 23012492]
30. Malaysia Department of Statistics. Report of household income and basic amenities survey 2014. 2015. Accessed from: <https://www.statistics.gov.my/index.php?r=column/pdfPrev&id=aHhtTHVWNVYzTFBua2dSUIBRL1Rjdz09>
31. Deutsch MB, Glidden DV, Sevelius J, et al. HIV pre-exposure prophylaxis in transgender women: a subgroup analysis of the iPrEx trial. *The Lancet HIV.* 2015; 2(12):e512–e9. [PubMed: 26614965]
32. World Health Organization. WHO Department of HIV/AIDS. Prevention and treatment of HIV and other sexually transmitted infections for sex workers in low- and middle-income countries: Recommendations for a public health approach. 2012.
33. Patel P, Borkowf CB, Brooks JT, et al. Estimating per-act HIV transmission risk: a systematic review. *AIDS.* 2014; 28(10):1509–19. [PubMed: 24809629]
34. Wylie K, Knudson G, Khan SI, et al. Serving transgender people: clinical care considerations and service delivery models in transgender health. *The Lancet.* 2016
35. Gallo MF, Behets FM, Steiner MJ, et al. Prostate-specific antigen to ascertain reliability of self-reported coital exposure to semen. *Sex Transm Dis.* 2006; 33(8):476–9. [PubMed: 16865047]

Figure 1.
Pooled HIV and STI prevalence for total sample and stratified by site

Figure 2.
Pooled HIV and STI prevalence by gender

Table 1

Characteristics of the sample and between-group differences for CWSW and TWSW

	Total Sample (N=492)	CWSW 60.8% (n=299)	TWSW 39.2% (n=193)	p-value
Age, years (Mean, SD)	37.4 (10.8) Range: 18–74	39.4 (10.5) Range: 19–74	34.3 (10.5) Range: 18–70	<0.001
Years lived in Malaysia (Mean, SD)	31.4 (16.1)	30.0 (18.4)	31.7 (13.2)	0.251
Ethnicity				
Malay	54.9 (270)	52.5 (157)	58.5 (113)	<0.001
Indian	22.6 (111)	18.1 (54)	29.5 (57)	
Indonesian	19.7 (97)	25.8 (77)	10.4 (20)	
Chinese	1.8 (9)	2.7 (8)	0.5 (1)	
Other	1.0 (5)	1.0 (3)	1.0 (2)	
Religion				
Muslim	74.6 (367)	79.9 (239)	66.3 (128)	<0.005
Hindu	20.1 (99)	15.1 (45)	28.0 (54)	
Christian	3.5 (17)	2.7 (8)	4.7 (9)	
Other or none	1.8 (9)	2.3 (7)	1.0 (2)	
Country of birth				
Malaysia	78.0 (384)	70.6 (211)	89.6 (173)	<0.001
Indonesia	19.3 (95)	26.1 (78)	8.8 (17)	
Other	2.7 (13)	3.3 (10)	1.6 (3)	
Number of children (Mean, SD)	1.4 (1.8)	2.2 (1.9)	0.1 (0.4)	<0.001
Relationship Status				
Single	56.7 (279)	55.5 (166)	58.5 (113)	0.508
In a relationship	43.3 (213)	44.5 (133)	41.5 (80)	
Housing situation				
Private house (Roommates)	80.5 (396)	84.3 (252)	74.6 (144)	<0.010
Private house (Alone)	8.5 (42)	5.0 (15)	14.0 (27)	
Hotel / motel	6.7 (33)	7.0 (21)	6.2 (12)	

	Total Sample (N=492)	CWSW 60.8% (n=299)	TWSW 39.2% (n=193)	p-value
Homeless	2.6 (13)	2.7 (8)	2.6 (5)	
Brothel	0.2 (1)	0.0 (0)	0.5 (1)	
Other	1.4 (7)	1.0 (3)	2.1 (4)	
Housing Status				
Stable	89.0 (438)	89.3 (267)	88.6 (171)	0.809
Unstable	11.0 (54)	10.7 (32)	11.4 (22)	
Highest Education Completed				
Less than primary	10.4 (51)	14.0 (42)	4.7 (9)	<0.001
Primary only	53.5 (263)	61.5 (184)	40.9 (79)	
High school or greater	36.2 (178)	24.4 (73)	54.4 (105)	
Sex Work Involvement				
Age at entry to sex work (Mean, SD) Range: 10–59	25.4 (8.7)	28.7 (9.1)	20.4 (5.1)	<0.001
Total years working in sex work (Mean, SD) Range: 1–50	12.6 (10.3)	11.6 (10.2)	14.1 (10.2)	0.008
Total monthly income during last 6 months in MYR (Mean, SD) Range: 100–10000	2144.3 (1839.5)	1787.3 (1554.3)	2692.6 (2095.5)	<0.001
Total monthly income from sex work during last 6 months in MYR (Mean, SD) Range: 100–10000	1769.9 (1720.2)	1477.3 (1472.1)	2219.43 (1964.1)	<0.001
Days since last sexual encounter with customer (Mean, SD)	7.8 (55.4)	8.6 (67.2)	6.5 (29.1)	0.672
Days engaged in sex work during last 30 days (Mean, SD)	16.9 (8.2)	15.4 (7.9)	19.1 (8.1)	<0.001
Customers seen per day during last 30 days (Mean, SD)	3.0 (2.8)	2.7 (2.2)	3.5 (3.4)	0.002
Hours per day working in sex work during last 30 days (Mean, SD)	6.1 (3.3)	5.8 (3.1)	6.4 (3.5)	0.002
Used drugs during sex work in last 30 days	33.5 (165)	33.8 (101)	33.2 (64)	0.887
Sexual Behaviors with Customers				
Receptive vaginal sex	63.8 (314)	98.3 (294)	10.4 (20)	<0.001
Insertive anal sex	20.5 (101)	-	52.3 (101)	-
Receptive anal sex	39.0 (192)	8.7 (26)	86.0 (166)	<0.001
Oral sex	80.3 (395)	69.2 (204)	99.0 (191)	<0.001
Condom use during sex work				
Percent of time condom used for vaginal sex during last 30 days (Mean, SD)	75.4 (36.4) N=324	74.1 (36.6) N=297	88.9 (31.0) N=27	0.044

	Total Sample (N=492)	CWSW 60.8% (n=299) N=25	TWSW 39.2% (n=193) N=168	p-value
Percent of time condoms used for anal sex during last 30 days (Mean, SD)	85.4 (31.3) N=192	61.6 (43.9) N=25	89.0 (27.4) N=168	<0.001
Criminal Justice Involvement				
Ever in jail	49.2 (242)	48.5 (145)	50.3 (97)	0.702
Ever in prison	32.7 (161)	36.5 (109)	26.9 (52)	<0.005
Ever in CDDC	10.6 (52)	16.0 (47)	2.6 (5)	<0.001
Reason for previous jail or prison:				
Sex work	38.4 (189)	35.2 (105)	43.3 (84)	0.072
Using drugs	23.2 (114)	26.2 (78)	18.6 (36)	0.050
Selling drugs	2.6 (13)	3.0 (9)	2.1 (4)	0.517

CWSW=cisgender women sex worker; TWSW=transgender women sex worker

Table 2

Sample mean for HIV and STI for the total sample, stratified by gender identity and interview location, including RDS Estimates for the total sample and stratified by gender identity.

	Total Sample	CWSW				TWSW			
		CWSW (n=299) % (95%CI)	Kuala Lumpur (n=194)	Petaling Jaya (n=11)	Klang (n=94)	TWSW (n=193) % (95%CI)	Kuala Lumpur (n=76)	Petaling Jaya (n=54)	Klang (n=63)
Sample mean	All SW (N=492) % (95%CI)								
HIV	11.7 (8.8–14.5) 57/489	11.1 (7.6–14.7) 33/296	12.9 25/192	0.0 0/11	8.5 8/93	12.4 (7.8–17.1) 24/193	21.1 16/76	9.3 5/54	4.8 3/63
Syphilis*	25.5 (21.6–29.5) 119/466	23.7 (18.6–28.7) 66/279	29.4 52/177	0.0 0/11	15.4 14/91	28.3 (21.8–34.9) 53/187	44.6 33/74	9.3 5/54	25.4 15/59
Chlamydia	14.8 (11.6–18.0) 71/479	22.5 (17.7–27.3) 66/293	21.5 41/191	11.1 1/9	25.8 24/93	2.7 (0.4–5.0) 5/186	4.1 3/74	2.0 1/50	1.6 1/62
N gonorrhoeae	5.8 (3.7–7.9) 28/479	8.9 (5.6–12.1) 26/293	11.3 22/191	0.0 0/9	4.3 4/93	1.1 (0.0–2.6) 2/186	2.7 2/74	0.0 0/50	0.0 0/62
RDS Estimate†									
HIV	9.8 (5.4–14.2)	9.6 (3.3–15.9)	--	--	--	10.5 (3.9–17.0)	--	--	--
Syphilis*	16.6 (12.5–20.7)	11.8 (8.4–15.1)	--	--	--	31.1 (23.3–38.9)	--	--	--
Chlamydia	13.9 (8.2–19.6)	17.9 (9.7–26.1)	--	--	--	1.2 (0.0–4.6)	--	--	--
N gonorrhoeae	4.2 (1.7–6.6)	5.4 (2.5–8.2)	--	--	--	0.4 (0.1–0.7)	--	--	--

* Rapid plasma reagin and *Treponema pallidum* particle agglutination positive;

† RDS estimates are provided for the total sample and by gender identity only;

-- Sample size too small to estimate

Previous Testing and Diagnosis History for HIV and Sexually Transmitted Infections

Table 3

	Total Sample (N=492)	CWSW 60.8% (n=299)	TWSW 39.2% (n=193)	p-value
Previous HIV and STI Testing (Lifetime)				
HIV	62.4 (307)	54.5 (163)	74.6 (144)	<0.001
Syphilis	14.6 (72)	13.4 (40)	16.6 (32)	0.326
<i>C. trachomatis</i>	9.6 (47)	8.0 (24)	11.9 (23)	0.152
<i>N. gonorrhoeae</i>	10.6 (52)	9.0 (27)	13.0 (25)	0.167
Previous HIV and STI Diagnosis (Lifetime)				
HIV	4.7 (23)	5.4 (16)	3.6 (7)	0.376
Syphilis	3.0 (15)	3.7 (11)	2.1 (4)	0.312
<i>C. trachomatis</i>	0.0 (0)	0.0 (0)	0.0 (0)	-
<i>N. gonorrhoeae</i>	0.8 (4)	0.3 (1)	1.6 (3)	0.141
Median months since last HIV test (n=307)	24.0 Range: 2 months – 22 years Interquartile Range: 7.0–37.0	24.0	24.0	-