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ORIGINAL RESEARCH ARTICLE

Dynamics of the HIV epidemic in southern China: sexual and drug-using behaviours among female sex workers and male clients in Yunnan

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Summary: To examine the HIV/sexually transmitted infection (STI)-related risk behaviours among community-based female sex workers (FSWs) and their clients in Yunnan Province, China, we performed a cross-sectional study of 705 FSWs and 100 male clients. We found that HIV seroprevalence among FSWs was 13.0% and the most prevalent STI was herpes simplex virus type 2 (HSV-2) (71.1%), followed by *Chlamydia trachomatis* (18.1%) and syphilis (8.8%). The 20% of FSWs who reported injection drug use also reported needle-sharing behaviours in the last three months. Drug-using FSWs had substantially higher HIV and HSV-2 prevalence, serviced more clients and had a longer history of sex work than non-using FSWs. In total, 57.0% of male clients did not consistently use condoms with FSWs, 2.0% reported illicit drug use and 17.0% had STI symptoms in the last year. The dual risk behaviours of drug-using FSWs and clients place them at greater risk of HIV infection. Intervention programmes must adopt comprehensive methods.

Keywords: HIV, STI, IDU, female sex workers, male clients, prevalence, drug use, China

INTRODUCTION

By the end of 2007, the number of people living with HIV (PLWH) in China was estimated to be 700,000 (range 550,000–850,000). Of newly reported cases of HIV, 37.9% were thought to be transmitted through unprotected heterosexual contact and 29.4% through needle sharing behaviours among injection drug users (IDUs).[1,2] Between 1996 and 2004, the national prevalence of HIV rose from 0.02% to 0.93% among female sex workers (FSWs) and from 1.95% to 6.48% among IDUs. Public health efforts are now primarily concerned with preventing the secondary transmission of HIV from these core groups to the general population.[3]

Yunnan province was one of the earliest in China to experience an HIV outbreak that was primarily transmitted through unsafe injection of heroin, which is common in the region due to its proximity to the extensive opium producing 'Golden Triangle' region of Southeast Asia. By 2005 average HIV prevalence rates among IDUs in Yunnan ranged between 18.3% and 22.6%,[4] and IDUs accounted for 53.2% of all reported cases in the province in the same year. Reported cases of HIV in Yunnan made up over 45% of all reported cases in China despite the fact that the province represents only 3.4% of the national population.[5]

Recent research has shed light on the bridging role male clients may play in the mass transmission of HIV to the general population,[6–11] particularly in countries where localized HIV epidemics among IDUs are thought to have a 'seeding' effect on sexually driven epidemics.[12] The case of Thailand is illustrative of this in which an epidemic of HIV that originated among mostly male IDUs began to spread to the commercial sex scene through male IDUs who purchased sex or FSWs who injected drugs.[10,13] The 2007 HIV estimates for China reported that sexual transmission has overtaken injection drug use as the dominant route of HIV transmission is therefore a troubling sign that China's HIV epidemic may have progressed from a primarily IDU-driven one to a more generalized one spread through unsafe sex.[2] In light of recent reports of high HIV prevalence rates among Chinese FSWs (as high as 10.3% in some locations[14,15]), evidence of injection drug use among some FSWs and their clients, inconsistent condom use in commercial sex[15,16] and the large proportion of Chinese men who visit FSWs (14.6% of high-income men,[17] 14.2% of miners[18] and 10.0% of migrant workers[19]) who themselves have recorded HIV prevalence rates as high as 1.8%,[20,21] commercial sexual and drug-using behaviours are clearly important loci for further research that can inform targeted interventions.

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This study focuses on the prevalence of HIV/sexually transmitted infections (STIs) and HIV infection-related risk factors among FSWs, including those associated with sexual and drug use-related behaviours. It also analyses the characteristics and risk behaviours of male clients of FSWs in order to examine the links between the two groups and its implications for the changing dynamics of China's HIV epidemic.

MATERIALS AND METHODS

The study was conducted in Kaiyuan, a city of about 290,000, located in southwestern Yunnan Province. Like other cities that lie within heroin trafficking routes in China, injection drug use is highly prevalent in Kaiyuan and recorded rates of HIV infection among IDUs have reached as high as 60.4% in 2004.[22] The city also has a growing commercial sex industry that combined with low condom use and drug use among some FSWs and their clients, has driven HIV prevalence rates among FSWs as high as 10.3% in 2006.[23]

Data collection and procedure

A cross-sectional study was conducted during March–July 2007 using census sampling methods for FSWs and convenient sampling methods to enrol clients. Criteria for study eligibility included age over 16, a history of engaging in commercial sex within the past three months (for FSWs) or one year (for clients). The FSWs were recruited through study notices distributed to brothel owners and FSWs themselves, and male clients were approached by outreach staff or brothel owners as they frequented six representative venues in town. Local Center for Disease Control and Prevention (CDC) staff conducted anonymous interviews with willing participants who provided informed consent, and respondents provided information on demographics, sexual behaviours and history of drug use. FSWs also provided blood, urine, and vaginal and cervical samples collected by trained doctors at the study site. All participants were given 50RMB (US$7) as compensation.

Laboratory testing

Serum specimens were screened for HIV antibodies using enzyme-linked immunosorbent assay (ELISA, Organon Teknika, Boxtel, Co., Ltd, Netherlands), and positive tests were confirmed by HIV-1/2 Western blot assay (HIV Blot 2.2 WB; Genelabs Diagnostics, Singapore). Plasma specimens were tested for HSV-2 antibodies using ELISA (HerpeSelect-2 ELISA IgG, Co., Focus Diagnostics, Cypress, CA, USA) and *Treponema pallidum* by rapid plasma reagin (RPR; RPR Diagnosis kit, Co., Xinjiang Xindi, China). Plasma specimen positivity for RPR was confirmed using the *T. pallidum* particle assay (TPPA; Serodia, Fujirebio Inc., Tokyo, Japan). Samples were considered positive for syphilis infection only if test results for both TPPA and RPR were positive. Vaginal swab specimens were classified as positive for *Trichomonas vaginalis* (TV) if motile organisms were identified in initial microscopic examination. Cervical swab specimens were tested for nucleic acid of *Neisseria gonorrhoeae* (NG) and *Chlamydia trachomatis* (CT) using polymerase chain reaction (AMPLICOR, Roche Molecular Systems, Branchburg, NJ, USA). All urine specimens were screened for opiates by morphine-gold-conjugate test strip method (Acon Biotech, Hangzhou, China).

Data management and statistical analysis

Questionnaire and lab test results for FSWs were entered using the DataFax system (Clinical DataFax Systems, Hamilton, Ontario, Canada) and analysed using the SAS 9.1 statistical software package (SAS Institute Inc, Cary, NC, USA). Client interviews were double entered and validated using EpiData 3.02 (EpiData Association, Odense, Denmark). Univariate logistic regression was used to identify risk factors for HIV and STIs for FSWs and clients. Variables found to be statistically significant ($P \leq 0.2$) in univariate analysis for HIV infection among FSWs were included in multivariate logistic regression analysis and those not significant ($P > 0.1$) were removed from the model in a stepwise manner. Chi-square tests were used to compare categorical values between groups and *t*-test or Mann-Whitney *U* tests were used for continuous variables. A *P* value of less than 0.05 in a two-tailed test was considered statistically significant.

RESULTS

Of the total 708 FSWs screened for the study, three were excluded because they were under 16 years of age; all analyses are therefore based on the remaining 705 FSWs. All recruited 100 male clients completed the survey.

Sociodemographic characteristics

The median age for FSWs was 25 (range: 16–54) and 70.9% were of the majority Han ethnicity; 75.5% were not registered residents of Kaiyuan and, of these, 24.2% were from outside of Yunnan Province. The average duration of schooling was 7.3 ± 3.2 years and 48.1% were single while 10% were married. In total, 21.3% of FSWs were classified as drug-using FSWs (DUFSWs) if they reported having used illegal drugs in the past and/or tested positive for opiates in their urine. In total, 84.7% were categorized as 'establishment-based' meaning their primary sex work venue included karaoke halls, salons or bath houses, whereas the 15.3% of FSWs who were classified as 'street-based' approached their clients in the streets or other public spaces and worked primarily out of rented rooms (Table 1).

Male clients differed from FSWs in a number of significant ways. They were on average older (35; range: 15–65; $P < 0.05$), were more likely to be of Han ethnicity (85% versus 70.9%; $P < 0.01$), permanent residents of Kaiyuan (100% versus 24.5%; $P < 0.01$), had longer average years of schooling (8.2 versus 7.3) and were more likely to be married (37.0% versus 10%; $P < 0.01$). The three most common forms of employment for male clients were factory worker (34.0%), unemployed (21.0%) or civil servants (7.0%).

Sexual and drug use related patterns among FSWs

The average age at initial intercourse for FSWs was 18.3 ± 2.2 years, and the average amount of earnings for the last sexual service was 100RMB (US$14). In total, 13.8% of FSWs reported inconsistent condom use during vaginal sex with clients in the

Table 1 **Sociodemographic characteristics and HIV/STI prevalence among FSWs and male clients in Kaiyuan, Yunnan Province**

Characteristics	Female sex workers (*N* = 705, %)	Male clients (*N* = 100, %)
Age (years): mean (SD)	26.7 (7.4)	35.4 (10.7)*
Schooling: mean (SD)	7.3 (3.2)	8.2 (3.4)**
Ethnicity		
Han	70.9	85.0**
Others	29.1	15.0
Native place		
Kaiyuan	24.5	100.0**
Non-Kaiyuan	75.5	0.0
Marriage status		
Single	48.1	38.0**
Co-habited	15.5	5.0
Married	10.1	37.0
Divorced/widowed	22.7	18.0
Others	3.7	2.0
Drug-using status of FSWs		
Drug-using FSWs	21.3	NA
Non-drug-using FSWs	78.7	NA
Prevalence of HIV/STIs		
HIV	13.0	–§
HSV-2	71.1	–
Chlamydia trachomatis†	18.1	–
Syphilis	8.8	–
Trichomonas vaginalis†	8.2	–
Neisseria gonorrhoeae†	5.6	–
STIs‡	78.6	–

STI = sexually transmitted infection; HSV = herpes simplex virus; FSW = female sex worker
†Six hundred and ninety-six FSWs participants provided cervical and vaginal secretion swabs, and were tested for *Chlamydia trachomatis*, *Neisseria gonorrhoeae* and *Trichomonas vaginalis*
‡Infected at least on STIs (HSV-2, *Chlamydia trachomatis*, syphilis, *Trichomonas vaginalis* and *Neisseria gonorrhoeae*)
§Prevalence of HIV among male clients was calculated by reported HIV testing history, testing result of each client
*$P < 0.05$
**$P < 0.01$

Table 2 **Risk behaviours and HIV/STIs prevalence among FSWs by drug-using condition**

Variables	Drug-using FSWs (*n* = 150, %)	Non-drug-using FSWs (*n* = 555, %)
Proportion of street-based FSWs	14.0	15.7
Age at first sexual intercourse (year): mean (SD)	18.4 (2.3)	18.0 (2.2)
Age at first commercial sex (year): median (IQR)	23 (20–26)	21 (18–27)*
Years of engaging in commercial sex: median (IQR)	5.9 (2.3–9.4)	1.7 (0.7–3.2)***
Number of clients in the last week: median (IQR)	4 (2–7)	2 (1–5)***
Inconsistent condom use with clients in the last week	15.3	13.3
No condom use with the last client	5.3	7.0
Having regular sex partners	58.7	52.1
Consistent condom use with regular sex partners	17.0	19.4
Vaginal douching behaviours	77.3	78.7
Alcohol consumption	49.3	66.5***
Prevalence of HIV/STIs		
HIV	43.3	4.9***
Syphilis	12.0	7.9
Trichomonas vaginalis	9.5	7.8
Neisseria gonorrhoeae	6.1	5.5
Chlamydia trachomatis	10.1	20.3**
HSV-2	86.7	66.8***

IQR = interquartile range; SD = standard deviation; FSW = female sex worker; STI = sexually transmitted infection; HSV = herpes simplex virus
*$P < 0.05$
**$P < 0.01$
***$P < 0.001$

last week, and had an average of three clients in the past week. A total of 93.3% reported condom use for sexual intercourse with their last male client. In all, 53.5% had regular partners (defined as non-paying sexual partners such as a husband or boyfriend), with whom 46.7% reported that they never used condoms.

A total of 131 (18.6%) of FSWs self-reported ever having used illicit drugs, and an additional 19 (2.6%) were identified as DUFSWs due to positive urine opiate test results. Of the 150 DUFSWs, 79.4% reported having injected drugs at least once – 42.0% having done so in the previous three months – and among them 20% had shared injection equipment when doing so.

Overall HIV prevalence in FSWs was 13.0% (92/705, 95% CI 10.7–15.8%), but among DUFSWs this rate was 43.4% (65/150) and 4.9% among non-DUFSWs (27/555). Of all FSWs tested, 71.1% were positive for HSV-2, followed by CT (18.1%), syphilis (8.8%), TV (8.2%) and NG (5.6%). Table 2 contrasts the prevalence rates and risk behaviours of DUFSWs and non-DUFSWs, which shows that DUFSWs tended to be older when they initiated commercial sex (23 versus 21 years, $P < 0.05$), had worked in commercial sex for more years (5.9 versus 1.7 years, $P < 0.001$), had more clients in the previous week (4 versus 2, $P < 0.001$) and had less consistent condom use with both clients and regular partners in the last week (84.7% versus 86.7%; 17.0% versus 19.4%; both $P > 0.05$). As with HIV prevalence, HSV-2 prevalence rates were significantly higher among DUFSWs (86.7% versus 66.8%, $P < 0.001$) as well as for syphilis, TV and NG though they were not statistically different. Rates of CT infection were significantly lower in DUFSWs ($P < 0.01$).

Including only those variables found to be statistically significant in univariate analysis, multivariate regression found that a history of illegal drug use (adjusted odds ratio [aOR] 9.8, 95% CI 5.7–16.9) ≥3 years spent in commercial sex (aOR = 3.7, 95% CI 2.1–6.5), HSV-2 positivity (aOR = 2.3, 95% CI 1.0–5.0), receiving ≥3 clients in last week (aOR = 1.8, 95% CI 1.0–3.0) and age at first intercourse ≤17 years (aOR = 0.6, 95% CI 0.3–0.9) were all independent risk factors for HIV infection. Among DUFSWs, HIV infection was independently associated with receiving ≥3 clients in last week (aOR = 2.2, 95% CI, 1.1–4.7) and having spent ≥3 years in commercial sex (aOR = 4.2, 95% CI, 1.9–9.2). Among non-DUFSWs HSV-2 positivity (aOR = 4.9, 95% CI 1.1–21.2), ≥3 years spent in commercial sex (aOR = 3.2, 95% CI, 1.4–7.2) and inconsistent used condoms with clients in the last week (aOR = 2.5, 95% CI, 1.0–6.2) were independently associated with HIV (Table 3).

Sexual behaviours and drug use patterns among clients

Among the 42 male clients with regular sexual partners, only 11.9% (5/42) reported consistent condom use with these

Table 3 **Predictors for HIV infection among FSWs in Kaiyuan City, Yunnan Province**

Variables	Total FSWs (n = 705)			Drug-using FSWs* (n = 150)			None-drug-using FSWs (n = 555)		
	OR (95% CI)	aOR (95% CI)	*P*	OR (95% CI)	aOR (95% CI)	*P*	OR (95% CI)	aOR (95% CI)	*P*
Ages (26–55 versus 16–25 years)	3.4 (2.1–5.6)	–	–	3.2 (1.4–7.4)	–	–	0.9 (0.4–2.0)	–	–
Schooling (7–15 versus ≤6 years)	1.1 (0.7–1.8)	–	–	1.4 (0.7–3.0)	–	–	1.1 (0.5–2.4)	–	–
Street-based FSWs (versus establishment-based FSWs)	1.4 (0.8–2.5)	–	–	1.2 (0.5–3.1)	–	–	5.2 (1.8–15.1)	–	–
Living in Kaiyuan ≥5 years (versus <5 years)	4.1 (2.6–6.4)	–	–	1.6 (0.8–3.1)	–	–	0.7 (0.3–1.6)	–	–
HSV-2	4.3 (2.1–8.7)	2.3 (1.0–5.0)	0.041	1.5 (0.6–4.0)	–	–	6.6 (1.5–28.1)	4.9 (1.1–21.2)	0.034
Syphilis	1.5 (0.8–3.0)	–	–	0.5 (0.2–1.4)	–	–	3.7 (1.4–9.7)	–	–
Neisseria gonorrhoeae	1.0 (0.4–2.6)	–	–	0.3 (0.1–1.7)	–	–	2.4 (0.7–8.5)	–	–
Chlamydia trachomatis	0.5 (0.3–1.0)	–	–	0.2 (0.0–0.8)	–	–	1.8 (0.8–4.3)	–	–
Trichomonas vaginalis	1.5 (0.7–3.0)	–	–	1.3 (0.4–3.9)	–	–	1.6 (0.5–5.5)	–	–
Age at first intercourse ≤17 years (versus >17 years)	0.8 (0.5–1.2)	0.6 (0.3–0.9)	0.042	0.5 (0.3–1.1)			0.6 (0.2–1.4)	–	–
Duration of commercial sex work ≥3 years (versus <3 years)	6.9 (4.2–11.5)	3.7 (2.1–6.5)	<0.001	3.9 (1.8–8.4)	4.2 (1.9–9.2)	<0.001	4.0 (1.8–8.9)	3.2 (1.4–7.2)	0.004
Vaginal douching	0.8 (0.5–1.3)	–	–	0.4 (0.2–1.0)	–	–	1.3 (0.5–3.5)	–	–
Number of clients in the last week ≥3 (versus <3)	2.1 (1.3–3.3)	1.8 (1.0–3.0)	0.044	1.9 (0.9–3.8)	2.2 (1.1–4.7)	0.033	1.2 (0.5–2.5)	–	–
Inconsistent condom use with clients in past week	1.4 (0.8–2.5)	–	–	0.7 (0.3–1.7)	–	–	2.9 (1.2–7.0)	2.5 (1.0–6.2)	0.040
Inconsistent condom use with regular sexual partners	1.3 (0.6–2.7)	–		1.4 (0.4–4.5)	–	–	1.5 (0.5–4.7)	–	–
History of dental procedures	2.2 (1.4–3.7)	–	–	2.6 (1.2–5.8)	–	–	1.5 (0.6–3.9)	–	–
Alcohol consumption	0.6 (0.4–0.9)	–	–	0.6 (0.3–1.1)	–	–	0.6 (0.2–1.4)	–	–
Drug-using FSWs* (versus non-drug-using FSWs)	15.0 (9.0–24.8)	9.8 (5.7–16.9)	<0.001	–	–	–	–	–	–

aOR = adjusted odds ratio; OR = odds ratio; FSW = female sex worker
*Self-reporting illegal drug-using history or be tested positive in urine opiates

partners in the past month. The types of sex work venues most frequently patronized by clients included karaoke halls/nightclubs (43.0%), hair salons (34.0%) and streets/plazas (20.0%). Clients reported that they purchased sex about 12 times a year (interquartile range [IQR] 2–130), paying an average of 100RMB per sexual service. In all, 41.0% reported that they had not used a condom in their last paid sexual encounter. Regarding condom use in the last year, 8.0% reported that they never used condoms with FSWs, while other reported that they 'seldom' used (30%) or used them 'most of the time' in paid sexual encounters (19.0%). The remaining 43.0% reported consistent condom use with FSWs. Two clients reported having ever used illicit drugs, but none reported having ever injected drugs. Fourteen clients reported having ever been tested for HIV but all 14 said to have received negative test results. Seventeen percent reported having STI symptoms in the last year.

Univariate logistic regression showed that lower education, a history of patronizing FSWs on the street as opposed to other establishments, inconsistent condom use with FSWs in the past year, and not using a condom during last intercourse with a FSWs were all significantly associated with reported STI symptoms among male clients (each $P < 0.05$). Multivariate logistic regression showed that a history of patronizing FSWs on the street (aOR = 2.4, 95% CI, 1.3–13.4, $P = 0.030$) and inconsistent condom use with FSWs in recent year (aOR = 4.2, 95% CI, 1.8–25.1, $P = 0.042$) were all independently associated with STI symptoms among male clients (Table 4).

DISCUSSION

The primary findings of this study were that drug use and/or risky sexual behaviours (defined as multiple partners and/or inconsistent condom use) were common among FSWs in our sample, which places them and their sexual and drug-using partners at high risk for HIV infection. In addition, male clients in our sample were found to have unsafe sexual behaviours that similarly place them and their sexual partners at risk for HIV infection. Both findings highlight the possibility for these groups to act as a bridge for transmission of HIV to the lower-risk, general population through unsafe sexual contact; however, further research into the sexual behaviours of the regular sexual partners of both FSW and clients are needed to better understand the nature of the link between these populations.

The HIV prevalence rate of 13% found in this sample of Kaiyuan FSWs is far higher than the national average as measured in 2004 (0.93%),[24] and was about eight times the average prevalence rate among FSWs in Yunnan in 2006 (1.7%).[4] This prevalence rate may also be the highest recorded HIV prevalence rate among studies of FSWs in China. More troubling is that HIV prevalence in the same population 12 months prior was found to be 10.3%, suggesting that the epidemic is still in a stage of rapid transmission.[16] Our findings also indicate that unsafe injection practices play a critical role in the transmission of HIV among DUFSWs, and that the overlap of injection drug use and the sex trade is of primary concern for HIV control within this population. For one, rates of drug use among Kaiyuan FSWs (21.3%) appear to be unusually high: not only are use rates 15 times higher than estimated national averages (1.4%),[24] but local prevalence of drug use among FSW also appears to be rising (a 2006 study in the same city found 16.3% of sampled FSWs used illicit drugs).[14] Second, the relatively high HIV prevalence rates among injecting FSWs and non-FSW IDUs in Kaiyuan studies as compared with past studies of IDUs in other parts of Asia[13] suggest that

Table 4 **Factors associated with STI symptoms in male clients of FSWs, Kaiyuan ($n = 100$)**

Variables	STI symptoms		OR (95% CI)	aOR (95% CI)	*P*
	Yes	No			
Age (year)					
30–65*	14	50			
15–29	3	33	3.1 (0.8–11.6)	–	–
Ethnicity					
Non-Han*	4	11			
Han	13	72	2.0 (0.6–7.3)	–	–
Marriage status					
Divorced/widower*	5	13			
Others	12	70	2.2 (0.7–7.4)	–	–
Years of schooling					
≤6*	11	21			
≥7	6	62	5.4 (1.8–16.4)	–	–
HIV knowledge score					
0–4*	7	21			
5–7	10	62	2.1 (0.7–6.1)	–	–
Usual place for patronized FSWs					
Others*	10	70			
Street	7	13	3.8 (1.2–11.7)	2.4 (1.3–13.4)	0.03
Usual price paid per commercial sex service					
≥100 Yuan*	6	45			
<100 Yuan	11	38	2.2 (0.7–6.4)	–	–
No. of sex acts with FSWs in the last year					
2–24*	13	70			
≥25	4	13	1.7 (0.5–5.9)	–	–
Condom use with FSWs in the last year					
Always use*	15	42			
Occasionally/never use	2	41	7.3 (1.6–34.0)	4.2 (1.8–25.1)	0.042
Condom use with regular sexual partners in the last month					
Always use*	14	69			
Occasionally/never use	4	13	3.2 (1.1–9.6)	–	–

FSW = female sex worker; STI = sexually transmitted infection; aOR = adjusted odds ratio; OR = odds ratio
*Reference group

there is a strong link between IDU-driven and sexual transmission of HIV in Kaiyuan.[20,22] Lastly, the fact that inconsistent condom use among non-DUFSWs is a strong predictor of HIV infection (2.5 times greater likelihood of infection) and that as many as 80% of surveyed FSWs were infected with at least one type of genital ulcer disease which can facilitate HIV infection,[25–28] all show that HIV transmission in Kaiyuan has reached epidemic proportions.

This study also provides rare insight into the characteristics and risk behaviours of male clients of FSWs, a traditionally difficult group to access given their transient nature and the illegality of commercial sex in China. Reported rates of condom use among clients surveyed in this study (41% had not used a condom in last intercourse with an FSW) while lower than those among clients in Lima, Peru (95.6%)[29] or the Ivory Coast (95.4%),[30] still fall far below the 70% target rate as stated in China's most recent Five Year Plan.[31] Although reported rates of HIV infection (0%) were relatively low among male clients compared with the FSWs in this study, various prospective cohort studies had proved that STIs can increase HIV infection risk by 2–5 times,[25,32] so relative high levels of STI symptoms (17%) among male clients might indicate that they are in high risk for HIV infection. Additionally, considering the fact that all HIV/STI rates were self-reported, and HIV prevalence among male STI clinic patients in Yunnan ranged from 1.7% to 2.6%,[4] actual rates may be far higher among male clients. Furthermore, about 40% of male clients reported having a regular sexual partner (wives or girlfriends) among whom 90% reported inconsistent condom use in previous week.

These patterns all point to the important role that clients may play in the sexual transmission of HIV in high-prevalence areas of China where drug use is prevalent. There is an urgent need for further research in this area, particularly regarding HIV/STI rates, drug use behaviours and sexual partnering patterns among male clients. This study demonstrates the feasibility of accessing client populations, although more information about the population is necessary to determine ideal sampling methods to optimize coverage and representativeness of a survey sample. The findings of this study also provide compelling evidence that the much lower client reported condom use rates (59% versus 93.3% of FSWs reported condom use at last commercial sex) may be used as a verification method to evaluate bias in self-reported condom use rates by FSWs due to social desirability bias after repeated interventions.[14,16]

This study faces several limitations. First, given that 23.5% of the FSWs who tested opiate positive had not reported drug-using behaviours, there is a strong likelihood that this study underestimated actual rates of drug use, especially because testing can only detect opiates taken within the last four days. Second, the small sample size and methods used to recruit clients may have resulted in sampling bias, compromising the representativeness of this population and reducing the statistical power of the regression analysis. Furthermore, statistics on clients relied entirely on self-reported behaviours, which are subject to recall bias and social desirability bias, particularly in the case of drug-using behaviours for which clients were not drug tested. Finally, as a cross-sectional survey this study can only observe associations but cannot

provide substantial explanations as to causality, particularly in cases such as the significantly lower prevalence of CT among DUFSWs.

The primary findings of this study contribute to a better understanding of the nature of HIV-1 and other STI epidemics among FSWs and their clients in regions where commercial sex and injection drug use are prevalent. Given the dual risk behaviours of a significant proportion of DUFSWs, there is a critical need for intervention programmes that simultaneously address both types of risk behaviours.[33] In addition, the risk behaviours of clients underscore the need for targeted interventions within this population as well, particularly in light of the fact that over 40% have wives or girlfriends with whom condom use is seldom, this group represents a portion of the general population at risk for infection from their client partners. Finally, programmes tackling the spread of HIV must also address the spread of curable STIs[34–36] to decrease their facilitative role in the rapid heterosexual transmission of HIV in this area.

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