Associations between migrant status and sexually transmitted infections among female sex workers in Tijuana, Mexico

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ABSTRACT

Objective: To examine associations between migration and sexually transmitted infection (STI) prevalence among Mexican female sex workers (FSW).

Methods: FSW aged 18 years and older in Tijuana, Baja California (BC) underwent interviews and testing for HIV, syphilis, gonorrhoea and chlamydia. Multivariate logistic regressions identified correlates of STI.

Results: Of 471 FSW, 79% were migrants to BC. Among migrant FSW, prevalence of HIV, syphilis, gonorrhoea, chlamydia and any STI was 6.6%, 13.2%, 7.8%, 16.3% and 31.1% compared with 10.9%, 18.2%, 13.0%, 19.0% and 42.4% among FSW born in BC. A greater proportion of migrant FSW were registered with local health services and were ever tested for HIV. Migrant status was protective for any STI in unadjusted models (unadjusted odds ratio 0.61, 95% CI 0.39 to 0.97). In multivariate models controlling for confounders, migrant status was not associated with an elevated odds of STI acquisition and trended towards a protective association.

Conclusions: Unexpectedly, migrant status (vs native-born status) appeared protective for any STI acquisition. It is unclear which social or economic conditions may protect against STI and whether these erode over time in migrants. Additional research is needed to inform our understanding of whether or how geography, variations in health capital, or social network composition and information-sharing attributes can contribute to health protective behaviours in migrant FSW. By capitalising on such mechanisms, efforts to preserve protective health behaviours in migrant FSW will help control STI in the population and may lead to the identification of strategies that are generalisable to other FSW.

Sexually transmitted infections (STI) are highly prevalent among female sex workers (FSW) residing in Tijuana and Ciudad Juarez, cities on the USA–Mexico border that permit prostitution.[1 2] In Tijuana, 5000–9000 women are registered FSW.[1 3] In a study of 924 FSW in Tijuana and Ciudad Juarez, 6% tested positive for HIV antibodies, 13% for chlamydia, 6% for gonorrhoea, 14% for syphilis titres 1 : 8 and greater, and 27% for any STI.[2] Those findings are in stark contrast to those from earlier studies of Mexican FSW, which reported HIV prevalence estimates below 1%.[4] HIV prevalence is increasing in Tijuana; in 2005 as many as one per 125 individuals in the 15–49 years age group was estimated to be HIV infected.[5]

Migrants may experience economic, physical and sexual vulnerabilities related to separation from social networks; isolation may result in increased and risky sexual and substance use behaviours.[6] In the USA, migrant men are at risk of HIV;[6 7] similar studies on migrant women in either Mexico or the USA are largely absent. Mexico has a long history of domestic and international migration;[8 9] little is known about the relationship between migration and STI prevalence among FSW residing in border communities.

We focus on Tijuana because Baja California (BC) borders California; it is a popular destination for Mexican migrants.[10] Tijuana and San Diego are the largest sister cities in the Southern California region with more than 5.9 million residents; they host the busiest international border crossing in the world.[11–13] San Diego's tourists often visit Tijuana, some consuming quasilegal sexual services. More than 42 000 Tijuana residents visit the USA daily for work or pleasure.[14] Infectious disease epidemics have significant public health impacts for both countries.

In Mexico, AIDS is becoming a feminised condition; women accounted for 21% of newly reported AIDS cases in 2006 (vs 16% between 1983 and 2006).[15] We examined migration as a correlate of four STI in a sample of FSW residing in Tijuana. We hypothesised that migration to Tijuana, a potentially high-risk social process, would increase the likelihood that migrant FSW would test positive for HIV, gonorrhoea, chlamydia and syphilis compared with FSW born in BC.

METHODS

Study sample

We analysed baseline data collected between January 2004 and March 2005 from one site of a multisite behavioural intervention that trained participating FSW on methods to reduce HIV/STI. Data were restricted to Mexican FSW interviewed in Tijuana (n = 471). We selected Tijuana based on the state's historically high annual rate of growth (2.4% in 2005 vs 1.1% for the other study site, Chihuahua). Study methods have been described elsewhere.[16] Eligibility requirements included being 18 years or older, giving informed consent, having traded sex for drugs, money, or other material benefits in the previous 2 months, having had unprotected vaginal sex with at least one client in the previous 2 months. HIV-positive women were excluded, because HIV incidence was a primary outcome of the behavioural intervention. Recruitment occurred at municipal and community health clinics, via street outreach and by referrals from other FSW.

Table 1 Sociodemographic characteristics, sexual behaviours, client traits and STI, Mexico-born FSW by migrant status, Tijuana, BC

Characteristics	Overall sample (n = 471)	BC native (n = 101) 21%	Migrant to BC (n = 370) 79%	p Value
Individual traits				
Age, years				
18–34	59.9	66.3	58.1	
35–64	40.1	33.7	41.9	0.14
Has spouse/common-law partner	32.3	37.6	30.8	0.19
Has dependent children	92.4	91.1	92.7	0.59
Educational attainment, years				
0–6	50.5	39.6	53.5	
7–20	49.5	60.4	46.5	0.01
Owns home	17.8	15.8	18.4	0.56
Speaks any English	32.9	46.5	29.2	<0.01
Mean no of years worked as FSW (SD)	4.87 (6.3)	5.1 (5.9)	4.8 (6.4)	0.68
Current work situation				
Street worker	42.3	57.4	38.1	<0.01
Dance host	31.6	23.8	33.8	0.06
Bar maid	17.8	12.9	19.2	0.14
Registered with Tijuana MHS	28.0	15.8	31.4	<0.01
Ever use illegal drugs before/during sex	34.3	47.0	30.8	<0.01
Client traits				
Mean no of regular male clients past month (SD)	5.3 (10.6)	5.8 (10.9)	5.2 (10.5)	0.63
Mean no of casual male clients past month (SD)	15.4 (25.3)	12.6 (15.7)	16.2 (27.3)	0.22
Male clients use drugs				
None	18.5	17.8	18.7	
Any	81.5	82.2	81.4	0.85
Male clients inject drugs				
None	49.3	56.4	47.3	
Any	50.7	43.6	52.7	0.10
Financial reliance on male clients				
None	42.7	45.5	41.9	
Any	57.3	54.5	58.1	0.51
Has US clients	77.5	83.2	76.0	0.12
Sexual behaviours				
Number of condoms carried at baseline interview				
None	88.8	94.1	87.3	
Any	11.3	5.9	12.7	0.06
Access to free condoms				
Never	57.3	53.5	58.4	
Sometimes	31.6	40.6	29.2	
Often/always	11.0	5.9	12.4	0.04
Unprotected vaginal sex with regular or casual clients, past month	97.7	100	97.0	0.08
Unprotected anal sex with regular or casual clients, past month	16.8	21.8	15.4	0.13
Unprotected oral sex with regular or casual clients, past month	47.1	54.5	45.1	0.10
Unprotected vaginal sex with spouse/common law partner*	73.7	65.8	76.3	0.20
Unprotected anal sex with spouse/common law partner*	21.7	29.0	19.3	0.22
Unprotected oral sex with spouse/common law partner*	51.3	55.3	50.0	0.57
Condom use during anal sex, past 6 months				
Never/sometimes	21.7	32.7	18.7	
Often/always/do not have anal sex	78.3	67.3	81.4	<0.01
Condom use during oral sex, past 6 months				
Never/sometimes	47.8	53.5	46.2	
Often/always/do not have oral sex	52.2	46.5	53.8	0.20
Spouse/common law partner has other sexual partner*†	47.3	50.0	46.4	0.74
Ever tested for HIV	65.8	56.4	68.4	0.03
STI				
Tested HIV positive				
No	92.5	89.1	93.4	
Yes	7.5	10.9	6.6	0.15

Continued

Table 1 Continued

Characteristics	Overall sample (n = 471)	BC native (n = 101) 21%	Migrant to BC (n = 370) 79%	p Value
Test positive for chlamydia				
No	83.2	81.0	83.8	
Yes	16.9	19.0	16.3	0.52
Test positive for gonorrhoea				
No	91.0	87.0	92.2	
Yes	9.0	13.0	7.8	0.11
Syphilis titre ⩾1 : 8				
No	85.8	81.8	86.8	
Yes	14.3	18.2	13.2	0.21
Tested positive for any of above STI				
No	66.5	57.6	68.9	
Yes	33.6	42.4	31.1	0.03

Comparisons were made between Baja California (BC) migrants and BC natives. Estimates may not add to 100% due to rounding. *Restricted to women with a spouse/common law partner. †During the duration of the relationship. FSW, female sex worker; MHS, municipal health service; STI, sexually transmitted infection.

Dependent variables: laboratory testing for STI

Participants provided blood samples and a cervical swab at baseline to test for STI. HIV antibody was initially assessed via the "Determine" rapid HIV antibody test using plasma (Abbot Pharmaceuticals, Boston, Massachusetts, USA); further testing was conducted for all reactive samples using the HIV-1 antibody by enzyme immunoassay and Western blot. Blood samples were also initially tested for syphilis antibody using the rapid plasma reagin test and confirmatory testing relied on the *Treponema pallidum* haemagglutinin assay (Fujirebio, Wilmington, Delaware, USA). Rapid plasma reagin titres 1 : 8 and greater were considered to be reflective of active infection. *Neisseria gonorrhoeae* and *Chlamydia trachomatis* were identified with vaginal swabs collected by trained nurses who used the Aptima Combo 2 collection device (Genprobe, San Diego, California, USA), as it allows for a direct target-amplified nucleic probe test. Specimens were shipped to the San Diego County Department of Health. Women testing positive were provided with pre and post-test counselling and referred to local municipal health clinics for free medical care.

Independent variables

Participants responded to a 45-minute interviewer-administered survey in Spanish in a private location to ensure confidentiality.[16] We examined characteristics of FSW, disaggregating data for women born in BC (ie, natives) and women born in any other Mexican state (excluding BC; ie, migrants to BC). Dichotomous variables were: current age, currently partnered, dependent children, educational attainment, homeowner, English language skills, current work situation (street worker, dance host, bar maid), registered with municipal health services (MHS), male clients use/inject drugs, financial reliance on male clients (eg, women's receipt of money for meals, transportation, shelter and clothing beyond funds received for sexual interactions), has US clients, condoms carried at baseline interview, access to free condoms, unprotected vaginal or anal or oral sex with clients in the previous month, condom use during anal or oral sex during previous 6 months, unprotected vaginal, anal, or oral sex with spouse/common law partner, ever tested for HIV and ever used illegal drugs before/during sex. Continuous variables were mean number of years worked as FSW and mean number of regular and casual clients. Variables were selected based on the extant literature; individual and client factors contribute to STI prevalence in FSW.[17 18]

Statistical methods

The relationship between migrant status, sociodemographic characteristics, sexual behaviours and the presence of HIV or STI were examined separately and in aggregate as any STI, via contingency tables. Differences in categorical data were assessed using χ^2 tests. Univariate and multivariate logistic regression models were constructed to test associations between migrant status and HIV and other STI positivity. Multivariate logistic regression models were developed using a manual procedure; variables attaining significance at $p \leqslant 0.10$ in at least one univariate model were considered in multivariate models that adjusted for other covariates.

RESULTS

Sociodemographic characteristics

Of 471 Mexican-born FSW, 79% migrated to BC (referred to hereafter as "migrant FSW"); the remaining 21% were natives to BC (referred to as "native FSW"; table 1). A similar proportion of migrants originated from northern and central Mexico (41.4% vs 48.7%, respectively); southern states were underrepresented (10%; data not shown). Low educational attainment was prevalent among migrant FSW; nearly one-half of BC natives spoke some English. Women worked approximately 5 years as FSW and reported approximately five male clients in the previous month. Native FSW were more likely to report working on the street and to have ever used illicit drugs before/during sex compared with migrants. Migrant FSW were more likely to report using a condom if engaging in anal sex during the previous 6 months. Significantly, nearly three-quarters of migrant FSW (72%) and two-thirds of BC natives (62%) ($p = 0.004$, data not shown) indicated not engaging in anal sex during the previous 6 months.

Prevalence of STI and HIV

Migrant FSW were less likely than native FSW to test positive for any STI (31.1% vs 42.4%, respectively, $p = 0.01$; table 1). Migrant and native FSW did not differ significantly in terms of the prevalence of HIV (6.6% and 10.9%, respectively), chlamydia, or gonorrhoea. Migrant FSW were more likely than BC

Table 2 Univariate logistic regressions: factors associated with STI, among FSW aged 18 years and older, Tijuana, BC

	Any STI	HIV	Syphilis titre ⩾1 : 8	Gonorrhoea	Chlamydia
	UOR (95% CI)	UOR (95% CI)	UOR (95% CI)	UOR (95% CI)	UOR (95% CI)
Individual traits					
Migrant to BC	0.61** (0.39 to 0.97)	0.58 (0.27 to 1.22)	0.68 (0.38 to 1.24)	0.57 (0.28 to 1.15)	0.83 (0.47 to 1.47)
Age 35–64 years	0.68* (0.45 to 1.03)	0.89 (0.43 to 1.81)	0.95 (0.55 to 1.63)	0.86 (0.44 to 1.67)	0.51** (0.30 to 0.88)
Has spouse/steady partner	1.23 (0.82 to 1.86)	0.70 (0.32 to 1.54)	1.17 (0.67 to 2.02)	1.08 (0.55 to 2.12)	1.22 (0.73 to 2.04)
Has dependent children	1.11 (0.53 to 2.33)	0.89 (0.26 to 3.05)	0.79 (0.31 to 1.98)	0.74 (0.25 to 2.23)	2.27 (0.68 to 7.60)
7–20 Years of schooling	1.03 (0.70 to 1.53)	0.50* (0.24 to 1.04)	1.10 (0.65 to 1.86)	0.86 (0.45 to 1.63)	1.18 (0.72 to 1.92)
Owns home	0.28*** (0.15 to 0.53)	0.12** (0.02 to 0.93)	0.41** (0.17 to 1.00)	0.10** (0.01 to 0.75)	0.27*** (0.11 to 0.69)
Speaks any English	1.37 (0.91 to 2.06)	1.08 (0.52 to 2.23)	2.30*** (1.35 to 3.92)	1.54 (0.80 to 2.97)	0.81 (0.47 to 1.38)
No of years worked as FSW	1.00 (0.97 to 1.03)	1.02 (0.98 to 1.07)	1.03 (0.99 to 1.07)	0.94 (0.88 to 1.02)	0.97 (0.93 to 1.02)
Current work situation					
Street worker	1.32 (0.89 to 1.96)	1.29 (0.65 to 2.57)	2.14*** (1.26 to 3.65)	3.68*** (1.82 to 7.41)	1.02 (0.62 to 1.67)
Dance host	0.66* (0.43 to 1.02)	0.75 (0.34 to 1.64)	0.56* (0.30 to 1.04)	0.22*** (0.08 to 0.62)	0.86 (0.50 to 1.47)
Bar maid	0.99 (0.59 to 1.65)	1.43 (0.62 to 3.26)	0.61 (0.28 to 1.34)	0.62 (0.24 to 1.64)	0.93 (0.49 to 1.79)
Registered with Tijuana MHS	0.59** (0.38 to 0.39)	0.31** (0.11 to 0.90)	0.47** (0.24 to 0.92)	0.18*** (0.06 to 0.60)	0.87 (0.50 to 1.52)
Ever used illegal drugs before/during sex	2.80*** (1.86 to 4.21)	3.16** (1.56 to 6.41)	2.83*** (1.66 to 4.82)	4.18*** (2.12 to 8.24)	1.52* (0.92 to 2.51)
Client traits					
No of regular male clients, past month	1.00 (0.98 to 1.02)	0.96 (0.88 to 1.05)	1.01 (0.99 to 1.03)	1.00 (0.97 to 1.03)	0.98 (0.94 to 1.02)
No of casual male clients, past month	0.99 (0.98 to 1.00)	0.98 (0.95 to 1.01)	0.99 (0.98 to 1.01)	0.99 (0.97 to 1.01)	1.00 (0.98 to 1.01)
Male clients use drugs	1.04 (0.62 to 1.72)	1.80 (0.62 to 5.24)	1.09 (0.54 to 2.19)	2.17 (0.75 to 6.26)	1.24 (0.64 to 2.43)
Male clients inject drugs	0.81 (0.55 to 1.20)	0.91 (0.46 to 1.81)	0.40*** (0.23 to 0.70)	1.73* (0.89 to 3.37)	0.97 (0.60 to 1.59)
Financial reliance on any male clients	1.21 (0.82 to 1.81)	3.17*** (1.35 to 7.41)	1.04 (0.61 to 1.77)	0.91 (0.48 to 1.74)	1.15 (0.70 to 1.90)
Has US clients	1.83 (1.10 to 3.04)	0.94 (0.42 to 2.15)	5.03 (1.78 to 14.20)	2.81* (0.98 to 8.09)	1.48 (0.78 to 2.82)
Sexual behaviours					
Any condoms carried at baseline interview	1.32 (0.72 to 2.40)	0.21 (0.03 to 1.59)	0.95 (0.41 to 2.21)	1.70 (0.71 to 4.05)	1.20 (0.57 to 2.51)
Access to free condoms					
Never	0.99 (0.67 to 1.47)	1.13 (0.56 to 2.29)	0.87 (0.51 to 1.47)	0.87 (0.45 to 1.65)	1.31 (0.79 to 2.17)
Sometimes	1.11 (0.73 to 1.69)	0.98 (0.47 to 2.06)	1.62 (0.95 to 2.78)	1.41 (0.73 to 2.73)	0.89 (0.52 to 1.52)
Never/sometimes use condoms during anal sex, past 6 months	1.07 (0.67 to 1.71)	0.88 (0.37 to 2.08)	1.00 (0.53 to 1.90)	1.56 (0.77 to 3.19)	1.34 (0.76 to 2.36)
Never/sometimes use condoms during oral sex, past 6 months	1.02 (0.69 to 1.51)	1.30 (0.65 to 2.60)	1.09 (0.65 to 1.84)	1.46 (0.77 to 2.79)	0.97 (0.59 to 1.58)
Any unprotected vaginal sex with regular or casual client, past month	2.03 (0.23 to 18.35)	0.32 (0.03 to 2.94)	NA	NA	NA
Any unprotected anal sex with regular or casual client, past month	0.88 (0.52 to 1.49)	1.01 (0.41 to 2.52)	0.88 (0.43 to 1.81)	1.02 (0.43 to 2.39)	1.12 (0.59 to 2.12)
Any unprotected oral sex with regular or casual clients, past month	1.38* (0.94 to 2.05)	1.17 (0.59 to 2.34)	1.34 (0.79 to 2.27)	2.59*** (1.30 to 5.13)	1.50 (0.91 to 2.45)
Unprotected vaginal sex with spouse/common law partner,† past month	0.81 (0.38 to 1.73)	1.23 (0.25 to 6.20)	1.24 (0.43 to 3.61)	0.41 (0.13 to 1.28)	0.54 (0.22 to 1.31)
Unprotected anal sex with spouse/common law partner,† past month	1.16 (0.52 to 2.57)	1.02 (0.20 to 5.18)	2.13 (0.81 to 5.59)	NA	0.95 (0.35 to 2.58)
Unprotected oral sex with spouse/common law partner,† past month	0.86 (0.44 to 1.68)	0.74 (0.19 to 2.86)	1.85 (0.73 to 4.66)	1.28 (0.42 to 3.87)	0.65 (0.28 to 1.48)
Spouse/common law partner has other sexual partner†‡	0.71 (0.32 to 1.57)	1.1 (0.21 to 5.70)	0.45 (0.15 to 1.41)	1.73 (0.46 to 6.50)	1.26 (0.49 to 3.27)
Ever tested for HIV	0.92 (0.61 to 1.38)	0.47** (0.24 to 0.94)	0.72 (0.42 to 1.23)	0.82 (0.42 to 1.58)	1.06 (0.63 to 1.77)

*p ⩽ 0.10; **p ⩽ 0.05; ***p ⩽ 0.01. †Restricted to women with a spouse/common law partner. ‡During the duration of the relationship. BC, Baja California; FSW, female sex worker; MHS, municipal health service; STI, sexually transmitted infection; UOR, unadjusted odds ratio.

natives to report ever being tested for HIV (68.4% vs 56.4%, respectively).

Correlates of HIV and other STI

In univariate logistic regressions, migrant status was protective against any STI (table 2). Migrant FSW were approximately two-thirds as likely to be infected with any STI (unadjusted odds ratio (OR) 0.61, 95% CI 0.39 to 0.97). Migrant FSW were not significantly different from natives in their odds of being infected with HIV, gonorrhoea, active syphilis, or chlamydia.

The relationship between other factors and STI infection varied. Street workers were more likely to test positive for active syphilis and gonorrhoea, whereas dance hosts were less likely to test positive for any STI, syphilis and gonorrhoea. Registration with the city's MHS was significantly protective against any STI, active syphilis and gonorrhoea. Financial reliance on male clients raised women's odds of testing positive for HIV (unadjusted OR 3.17, 95% CI 1.35 to 7.41). A history of illicit drug use before or during sexual activities was significantly associated with each infection except chlamydia; odds ratios ranged from 2.80 for any STI, 3.16 for HIV, to 4.18 for gonorrhoea (all $p<0.05$). Having ever been tested for HIV was associated with reduced odds of testing positive for HIV (OR 0.47).

In multivariate logistic regressions that controlled for other covariates, although the migrant status indicator remained protective against HIV, gonorrhoea, chlamydia and any STI,

Table 3 Factors independently associated with STI, FSW aged 18 years and older, Tijuana, BC

	Any STI	HIV	Syphilis titre ⩾1 : 8	Gonorrhoea	Chlamydia
	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
Individual traits					
Migrant to BC (vs BC native)	0.72 (0.44 to 1.17)	0.74 (0.32 to 1.74)	1.10 (0.57 to 2.11)	0.72 (0.35 to 1.49)	0.87 (0.48 to 1.55)
Age 35–64 years (vs age 18–34 years)	NS	–	–	–	0.53* (0.31 to 0.91)
7–20 Years of schooling (vs 0–6 years)	–	0.42* (0.19 to 0.90)	–	–	–
Own home (vs not homeowner)	0.32** (0.16 to 0.62)	NS	–	0.13* (0.02 to 0.99)	0.28* (0.11 to 0.71)
Speaks English (vs does not speak English)	–	–	1.87* (1.03 to 3.41)	–	–
Currently employed as a dance host (vs not employed as a dance host)	–	–	–	0.30* (0.10 to 0.86)	–
Currently employed as a bar maid (vs not employed as a bar maid)	–	–	–	–	–
Currently employed as a streetwalker (vs not employed as a streetwalker)	–	–	NS	–	–
Registered with MHS (vs not registered)	–	–	–	–	–
Client traits					
Has US clients (vs no US clients)	NS	–	4.33** (1.48 to 12.62)	–	–
Male clients inject drugs (vs no male clients who inject drugs)	–	–	0.28** (0.16 to 0.52)	–	–
Financial reliance on male clients (vs not financially reliant on male clients)	–	3.71** (1.46 to 9.40)	–	–	–
Sexual behaviours					
Any unprotected oral sex with regular or casual clients, past month (vs protected oral sex/no oral sex)	–	–	–	–	–
Syphilis titre ⩾1 : 8 (vs no syphilis titre ⩾1 : 8)	–	NS	–	–	–
Ever had HIV test (vs never had HIV test)	–	–	NS	–	–
Drug use					
Ever use illegal drugs before/during sex (vs never used illegal drugs before/during sex)	2.42** (1.58 to 3.70)	2.53* (1.18 to 5.43)	2.24** (1.25 to 4.03)	3.04* (1.51 to 6.11)	–

*$p \leqslant 0.05$; **$p \leqslant 0.01$. Dashes (–) refer to variable not included in model. AOR, adjusted odds ratio; BC, Baja California; FSW, female sex worker; MHS, municipal health service; NS, not significant; STI, sexually transmitted infection.

this variable lost statistical significance after adjustment (table 3). This finding was partly explained by the significant role of illicit drug use before or during sexual encounters. FSW who had ever used illicit drugs before or during sex were at significantly higher risk of testing positive for any STI (adjusted OR 2.42), HIV (adjusted OR 2.53), active syphilis (adjusted OR 2.24) and gonorrhoea (adjusted OR 3.04) (all $p<0.05$).

The relationships between other covariates and all STI varied (table 3). Older age was protective against chlamydia, greater education was protective against HIV, and homeownership was protective against any STI, gonorrhoea and chlamydia. English language was associated with an increased odds of active syphilis as was having an American client. Working as a dance host was associated with reduced odds of gonorrhoea. Financial dependence was significantly associated with increased odds of HIV infection.

DISCUSSION

Mexican-born migrant FSW presented a strikingly different profile of STI and associated risks compared with BC native FSW. Surprisingly, migration was not associated with a higher prevalence of STI among our sample of high-risk FSW and trended towards a protective effect, which was contrary to our hypothesis. Our findings may signal changes in migration patterns among Mexican FSW not observed in the extant literature[19] or differences between FSW and other migrants, because studies of Mexican migrants have underrepresented women. Our findings have important implications for HIV/STI prevention and programme planning in this resource-constrained setting.

The finding that migration was not associated with higher STI prevalence in our study was unexpected. Indeed, our findings suggested that migration may contribute to protective mechanisms against STI infections beyond those factors that were accounted for in the study. We may have lacked statistical power in our sample to detect significant associations between migrant status and individual STI. Nevertheless, 11% and 7% of natives and migrant FSW, respectively, were infected with HIV, and BC natives exhibited significantly higher levels of any STI compared with migrants (42% vs 31%). Notably as well, a greater proportion of migrant FSW were ever tested for HIV (vs BC natives). Additional study in a larger sample is needed to understand better the role of migration on STI acquisition in FSW residing in Mexico–US border communities.

Our findings suggest that migrant Mexican FSW may migrate with a history of protective health behaviours or experience migration-related situations that we did not measure (eg, fewer total lifetime sexual partners or the quality/nature of social networks) that may contribute to a lower prevalence of STI. For example, in migrant sending states such as Jalisco and Michoacan, gender-based sexual roles are strictly prescribed for women and reinforced by social networks.[20] These conditions may foster behaviours that may reduce women's exposure to STI over the lifecourse or may instill health-promoting behaviours in FSW that are maintained post-migration. A study of Mexican male migrants in the USA found that health-damaging behaviours (ie, substance use) were related to the absence of traditional living arrangements and separation from family and community social

Key messages

- Migration, HIV and other STI are highly prevalent among female sex workers (FSW) in Tijuana.
- Migrant FSW report a greater proportion of HIV protective behaviours compared with non-migrant FSW.
- Migrant FSW may be at lower risk of testing positive for any STI, although a larger sample is needed to confirm our results.
- Efforts to retain healthy behaviours in migrant FSW are needed to prevent HIV and other STI.
- Efforts are needed to identify mechanisms in migrants that can be incorporated into HIV/STI interventions for sending communities.
- Intensive STI screening and treatment services are urgently needed to contain the HIV epidemic in the USA–Mexico border region.

norms that typically sanctioned adverse behaviours, among other factors.[21] The study by Garcia[21] provides evidence that social contexts may contribute to migrants' participation in unsafe behaviours. However, our current understanding of the nature of social norms and sexual roles in border communities is very limited. Investigating whether social norms, gender-based sex and social roles or risk-taking behaviours differ in border communities will inform our understanding of how social and cultural factors vary within one nation to impact STI risks among Mexican FSW.

Our findings suggest that further investigation of a "healthy migrant" effect, whereby migrants display health-protective behaviours, is warranted and may occur not only in US Latinos[22 23] but potentially within national boundaries in the country of origin. Identifying the role of environment, including geography, on sexual or other risk-taking behaviours in FSW is important as is assessing how protective behaviours change over time as individuals "acculturate" to local customs and social and economic climates. Implementing a long-term study with a large migrant sample will permit us to assess the changes in interactions between individuals and their physical and social environments, and to conduct a detailed examination of longitudinal changes in knowledge, attitudes, beliefs or behaviours in FSW residing on the USA–Mexico border region.

The high prevalence of STI in our sample indicates that regular testing for HIV and other STI is critically needed to stem the HIV epidemic and its generalisation to other border populations. Registering with Tijuana's MHS is one potential avenue for women to obtain access to regular STI testing, counselling and treatment services, all of which are beneficial to FSW and the community. Registering with MHS also provides FSW with a permit to engage in sex work in the Zona Roja (red light zone), which can confer some level of protection against police harassment for practising sex work. However, unpublished focus group data indicate that barriers to registering with MHS include high costs for the permit and STI screening and lengthy wait times for accessing services. Reducing administrative and financial barriers to the MHS may improve participation in the programme by locals, and enable migrants to continue their involvement with MHS. Formal studies on the volume or quality of services or access to or completion of treatment by infected individuals delivered by MHS may provide insight into community benefits of MHS.

As we relied on cross-sectional self-reported baseline data; we cannot establish causality between individual correlates and the STI examined. However, standardised STI testing enabled us to identify more precisely the prevalence of infection among FSW. Our sample may not be representative of all FSW in the region or their behaviours because high-risk women were enrolled in the intervention study. Lack of data limited us from identifying risk behaviours in US migrants. Information-sharing attributes of migrant FSW networks were unmeasured, although network factors may have contributed to the differential risk of STI by migrant status.

Contrary to outcomes observed in migrant men,[24] migrant FSW appear to have some protection against STI overall. State and programmatic efforts to ensure continued engagement in protective behaviours (eg, regular STI screenings, consistent use of condoms, and low participation in risky behaviours including unprotected sex and illicit drug use) can help maintain a reduced risk of STI in migrant FSW. Additional research is needed to identify conditions that contribute to the endurance of protective behaviours, the conditions under which healthy behaviours erode, and factors amenable to health interventions for both native and migrant FSW.

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