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The longitudinal association of venue stability with consistent condom use among female sex workers in two Mexico–USA border cities

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Summary

We examined the relationship between venue stability and consistent condom use (CCU) among female sex workers who inject drugs (FSW-IDUs; $n = 584$) and were enrolled in a behavioural intervention in two Mexico–USA border cities. Using a generalized estimating equation approach stratified by client type and city, we found venue stability affected CCU. In Tijuana, operating primarily indoors was significantly associated with a four-fold increase in the odds of CCU among regular clients (odds ratio [OR]: 3.77, 95% confidence interval [CI]: 1.44, 9.89), and a seven-fold increase among casual clients (OR: 7.18, 95% CI: 2.32, 22.21), relative to FSW-IDUs spending equal time between indoor and outdoor sex work venues. In Ciudad Juarez, the trajectory of CCU increased over time and was highest among those operating primarily indoors. Results from this analysis highlight the importance of considering local mobility, including venue type and venue stability, as these characteristics jointly influence HIV risk behaviours.

Keywords

HIV; AIDS; sexually transmitted infections; sexual risk behaviours; prevention; injection drug use; venue stability; mobility; condom use; female sex workers; longitudinal analysis; Mexico

INTRODUCTION

A considerable amount of research has focused on the role of mobility in the spread of HIV/AIDS, especially among high-risk groups such as female sex workers (FSWs).^{1–3} In several countries, mobility among FSWs has been associated with elevated HIV risk behaviours including inconsistent condom use with clientele, illicit drug use, and lower health-care utilization.^{4–7} However, the relationship between mobility and HIV has typically been examined with a broad lens, quantifying movement patterns such as international migration,

rural-to-urban migration and movement along truck stops.^{8–13} Less empirical attention has been devoted to unique forms of local mobility within urban environments and how these relate to HIV risk behaviours.

The organization of sex work can vary immensely within urban cities, impacting the mobility of FSWs. For example, in Moscow, Russia, there is a distinct segregation of sex work reflective of police presence, and movement between locations is often the result of police activity.¹⁴ In addition, the location of sex work can affect the risk of acquiring and transmitting HIV, as demonstrated in Vancouver, Canada, where FSWs operating in the city's perimeter were more likely to be pressured into unprotected sex with their clients than FSWs operating within centralized areas.¹⁵ Similarly in Tijuana, Mexico, HIV/STI prevalence was higher among FSWs soliciting sex from the periphery of a red-light district, compared with those within centralized areas, and these FSWs were more likely to experience harassment and exploitation that increased their risk for unsafe sex.^{16,17} Mobility may also affect access to HIV prevention and harm reduction services within urban settings.^{13,18}

In many cities across Mexico, sex work is quasi-legal in specific urban neighbourhoods, sometimes designated as red-light districts. An estimated 10,000 FSWs operate in two of the largest cities along the Mexico–USA border: Tijuana, BC, Mexico (adjacent to San Diego, CA, USA) and Ciudad Juarez, CH, Mexico (adjacent to El Paso, TX, USA).¹⁹ In Tijuana, the red-light district is characterized by a clustering of commercial sex establishments including bars, nightclubs, hotels and street corners that cater to Mexican and foreign tourists.^{20,21} Sex work is more dispersed in Ciudad Juarez, after a central red-light district was gentrified.²²

Tijuana and Ciudad Juarez are also situated on major trafficking routes for heroin, cocaine and methamphetamine.²³ As a result, these cities have experienced increased drug consumption, including a rise in the number of injection drug users (IDUs), and a growing HIV epidemic.^{24,25} Nearly one in five FSWs enrolled in a previous intervention study conducted by our group reported lifetime injection drug use in Tijuana and Ciudad Juarez.²⁶ Furthermore, HIV prevalence was 6% among FSWs and 12% among FSWs that injected drugs (FSW-IDUs) in these cities.²⁷

Recently, our team reported an increase in HIV-related risk behaviours among mobile male IDUs travelling within Tijuana city limits.²⁸ Furthermore, several studies have demonstrated the workplace environment as an important HIV risk factor among FSWs.^{29–33} However, to our knowledge, no studies have examined the effect of workplace stability on HIV risk over time among a highly vulnerable population of FSW-IDUs, who may be exposed to new clients, social networks and working environments as a result of changing venues. In this study, we explore how movement between working environments affected condom use over a one-year period among FSW-IDUs enrolled in a behavioural intervention to reduce HIV risk behaviours.^{22,34} We hypothesized the following: (1) FSW-IDUs operating from indoor work venues would have the highest likelihood of consistent condom use (CCU) and (2) FSW-IDUs with lower venue stability (e.g. working concurrently in more than one venue type during a 1-year period) would have a lower likelihood of CCU.

METHODS

Study population

From October 2008–2009, outreach workers in Tijuana and Ciudad Juarez enrolled 584 FSW-IDUs for a 12-month behavioural intervention to reduce high risk sexual and drug injection behaviours (see Vera and colleagues^{22,34} for description of the intervention). FSWs were approached by outreach workers to determine their interest and eligibility for study enrollment. Eligibility criteria included being 18 years; having unprotected vaginal or anal sex with a male client in the previous month; injecting illicit drugs and sharing syringes and/or other injection equipment in the last month; speaking Spanish or English; no plans to move out of the city for a 12-month period; providing informed consent; and accepting free STI testing and treatment.

Data collection

Participants were administered face-to-face interviews and biological testing for HIV/STIs at baseline with three follow-up visits occurring approximately at four, eight and 12 months after enrolment. Interviews covered a range of topics including sociodemographics and sexual and drug use behaviours. The study was approved by the Institutional Review Boards at the University of California San Diego, the General Hospital in Tijuana and the Universidad Autonoma de Ciudad Juarez.

HIV and STI testing

Trained nurses obtained a blood sample and cervical swab from participants at each visit. HIV antibody was detected using the ‘Determine®’ rapid HIV antibody test (Abbott Pharmaceuticals, Boston, MA, USA), with confirmatory testing by EIA and Western blot. Participants with positive HIV tests were referred to municipal health clinics in Tijuana and Ciudad Juarez for monitoring and care. *Neisseria gonorrhoeae* (GC) and *Chlamydia trachomatis* (CT) were detected from vaginal swabs using a rapid test kit (BioStar® OIA® GC and CHLAMYDIA, Inverness Medical-Biostar Inc., Louisville, CO, USA). Positive samples were confirmed on urine samples using transcription-mediated amplification assay (TMA; Gen-Probe, San Diego, CA, USA). However, the BioStar GC rapid test was discontinued due to concern regarding its sensitivity and the GC/CT protocol was modified to request urine samples from all participants to accommodate screening using the TMA assay.²² Participants with a positive GC/CT test or symptoms were treated free onsite.

Measures

Independent variables

Venue Stability: Participants identified their primary sex work location in the last month at each visit. Responses were dichotomized as indoor (bar, hotel and brothel) or outdoor (street, customer's vehicle, shooting gallery and other public spaces). Prior research on the association of sex work venue and HIV risk supported aggregation into these two categories.^{33,35–37} Since this question was asked at each quarterly visit, we created a three-category time-invariant predictor reflective of movement between venues during the study period as: (1) all/majority outdoors ($n = 458$), (2) all/majority indoors ($n = 46$) and (3) equal

time between outdoor and indoor venues ($n = 63$). Majority was conceptualized as spending over two-thirds of the study period in one venue type (indoor or outdoor).

Risk behaviours: Additional measures assessed at each study visit included having clientele living in the USA (all/majority versus some/few/none), drug or alcohol use before sex (yes versus no), access to free condoms (always/often versus sometimes/never), and testing positive for HIV, chlamydia and/or gonorrhoea.^{30,31,38} In addition, FSW-IDUs reported frequency of injection drug use, type of illicit drugs consumed and weekly consumption of alcohol over the last month.

Dependent variable

Consistent condom use (CCU): The outcome was measured as 100% condom use for vaginal and anal sex with clients in the last month; assessed at each visit and stratified by regular and casual clients. Regular clients were defined as men who came back for repeat visits or with whom participants had an ongoing relationship over time. Participants were asked to enumerate, separately, the total number of times they had vaginal and/or anal sex with their regular and casual clients in the last month, and the total number of times they used condoms with these clients. We constructed the proportion of sex acts involving condom use by client type and then created a binary variable for CCU (100% versus <100% condom use).

Statistical analysis—We compared the distribution of demographic and risk behaviours at baseline using descriptive statistics and Fisher's exact tests, where appropriate. To estimate the odds ratio of CCU over the study period, we performed a longitudinal analysis using generalized estimating equations (GEE) for binary outcomes with a logit link function and an unstructured correlation structure.^{39,40} Since our goal was to examine the effect of venue stability on CCU, we excluded participants with no follow-up visits ($n = 17$). Missing data on condom use and sex work venue occurred since some participants stopped engaging in sex work for 30 days or longer between follow-up visits. However, the follow-up rate remained consistently high and the GEE approach has been shown to be robust in the presence of missing data.⁴¹ Therefore, we adjusted for covariates associated with stopping sex work (e.g. daily injection of drugs and alcohol consumption). The multivariable model was manually built by considering all variables with a P value <0.10 in the bivariate analysis while controlling for venue stability, time and assignment to the behavioural intervention. The models were stratified by city and client type. We also graphed the predicted probability of CCU as implied by the multivariable models to illustrate differences in the population trajectory of CCU by venue stability. Statistical analysis was performed using STATA version 10 (StataCorp, LP, College Station, TX, USA). All P values are two-sided with a 0.05 significance level.

RESULTS

Of 584 enrolled participants, 2.9% ($n = 17$) completed a baseline interview only, reducing our sample to 567 FSW-IDUs for longitudinal analysis. Follow-up rates were 89.4% at four-month, 87.8% at eight-month and 87.7% at 12-month visits. Approximately half of FSW-

IDUs ($n = 282$) stopped engaging in sex work for 30 days or longer at least one follow-up visit.

By design, the sample was split between participants recruited in Tijuana ($n = 277$) and Ciudad Juarez ($n = 290$) and several baseline characteristics differed significantly by site (Table 1). Compared with Ciudad Juarez, FSW-IDUs in Tijuana were more likely to rate themselves in a bad financial situation (68% versus 46%; $P < 0.01$) and use methamphetamine (76% versus 1%; $P < 0.01$) but were also more likely to have greater access to free condoms (30% versus 11%; $P < 0.01$) and report 100% condom use with casual clients (19% versus 5%; $P < 0.01$). Compared with Tijuana, FSW-IDUs in Ciudad Juarez were more likely to report alcohol use before sex (24% versus 14%; $P < 0.01$), consume alcohol on a weekly basis (60% versus 27%; $P < 0.01$) and use cocaine in the last month (46% versus 22%; $P < 0.01$).

Overall, the average age of FSW-IDUs was 33 years (inter-quartile range 27, 40), over one-third were married/living together (37%), nearly 13% tested positive for chlamydia and/or gonorrhoea and the majority reported heroin use in the past month (97%). To avoid problems with collinearity, we did not adjust for both the frequency of injection and heroin use since heroin was primarily injected.

Table 2 shows bivariate and multivariable models examining the odds of CCU in Tijuana. In the unadjusted analysis, factors negatively and significantly associated with CCU, for both client types, were perceived poor financial situation, drug or alcohol use before sex, daily injection of drugs, monthly methamphetamine use and, weekly alcohol consumption; whereas primarily operating indoors was positively associated with CCU. Venue stability remained an independent correlate after controlling for time, intervention group, demographics and risk behaviours since FSW-IDUs operating primarily indoors were significantly more likely to report CCU with both client types compared with those operating equally from indoor and outdoor venues (adjusted odds ratio [AOR] regular client: 3.77, 95% confidence interval [CI]: 1.44, 9.89; AOR casual client: 7.18, 95% CI: 2.32, 22.21).

Table 3 shows the bivariate and multivariable analyses of CCU in Ciudad Juarez. Venue stability was a significant predictor of condom use among regular clients, where FSW-IDUs primarily remaining indoors had a three-fold increase in the odds of CCU compared with those spending equal time between both venue types (AOR: 2.69, 95% CI: 1.28, 5.65). Venue stability did not affect CCU among casual clients in the bivariate or multivariable models.

Overall, CCU increased over time, which was expected given that participants were enrolled in a behavioural intervention study. However, these trajectories were highly affected by venue stability. In Tijuana, FSW-IDUs operating equally from indoor and outdoor venues had the lowest probability of CCU over time compared with more stable FSW-IDUs (Figure 1). In Ciudad Juarez, the trajectories for CCU were markedly different by client types (Figure 2). Among regular clients, there was a steep incline that leveled off after four months and those spending equal time between both venue types were the least likely to

consistently use condoms. However, among casual clients, the trajectory of condom use was nearly identical across follow-up, regardless of venue stability.

DISCUSSION

In this longitudinal analysis, FSW-IDUs with lower venue stability were the least likely to report CCU with their clients compared with FSW-IDUs remaining within the same venue type for the majority of a one-year period. Furthermore, FSW-IDUs operating primarily indoors had the highest trajectory of 100% condom use over time. These findings were independent of participation in a behavioural intervention to reduce high-risk sexual and drug injection behaviours and therefore have important implications for programmes addressing HIV/STI prevention among FSWs moving between venues within urban settings.

Previous studies have demonstrated individual sexual and substance using behaviours as independent correlates of condom use.^{31,38,42} However, to our knowledge this is the first longitudinal analysis to empirically address the role of venue stability on CCU. In Tijuana, the model predicted a greater probability of CCU with casual compared with regular clients at study enrolment, which increased over time with both client types. In contrast, 100% condom use in Ciudad Juarez was much higher among regular than casual clients, which conflicts with other studies demonstrating that FSWs are less likely to use condoms with their regular partners.^{5,38,43}

The results in Ciudad Juarez are likely due to specific contextual risks that introduced considerable variation in condom use by client type. First, there was an effort to gentrify and disperse the red-light district in Ciudad Juarez. Second, research staff reported that increased drug trafficking-related violence closed down several businesses, including sex work venues. As a result, FSWs were displaced to more isolated settings such as truck stops or caused FSWs to work out of their homes. Such displacement may have increased women's risk of violence and reduced their ability to practice risk reduction as previously shown in Canada.⁴⁴ Although the behavioural intervention was effective at increasing CCU over time, its decreased impact among casual clients in Ciudad Juarez may reflect new and potentially riskier client profiles, such as truck drivers. For example, a study in Uganda found that less than a quarter of truck drivers reported CCU with FSWs.⁴⁵

Consistent with other studies, FSWs operating from outdoor venues were less likely to report CCU than those operating indoors.^{29–31,37} Street-based FSWs may have reduced access to condoms and HIV prevention services than their indoor counterparts.^{46–48} However, our results indicate that FSWs moving between indoor and outdoor venues were the most risky group since they were the least likely to report CCU during follow-up, suggesting that venue stability is also important.

Studies of migrant FSWs have shown large-scale mobility to be associated with substance use, reduced condom use and violence,^{2,6,9,12,13} but few have examined mobility localized to an urban area. Within cities, FSWs' movement between venues may reflect a combination of contextual factors in the social or structural environment, most notably exposure to violence and policing.^{15,44,49} Our results extend this body of literature by demonstrating the

need to consider the joint impacts of venue type and venue stability when analysing the effects of certain forms of local mobility within urban environments.

Although we did not assess mobility in terms of distance travelled between venues, prior studies have demonstrated that increased mobility among IDUs may be associated with both increased and decreased risk for HIV, depending on the underlying motivating factors.^{50–53} However, the situations motivating intra-urban mobility and the resulting implications on HIV vulnerabilities differ from the motivations and consequences of broad geographic movements. For example, our research team recently concluded that mobile IDUs within Tijuana's city limits (e.g. individuals injecting 3 km from their residence) engaged in riskier injection behaviours and had less knowledge of HIV transmission routes than other IDUs.²⁸ Conflicting findings regarding the association between studies linking mobility and HIV highlight the need to understand the specific contexts relating to patterns of movement and their effects on HIV risk and prevention.⁶

Our study was limited by the proportion of missing data on venue type since nearly two-thirds of participants did not provide this information on at least one follow-up visit. Participants with missing venue type were likely to have temporarily stopped engaging in sex work, although several of these participants responded to questions regarding condom use with their clients during that time period. We controlled for missing data by including variables associated with stopping sex work in the longitudinal models. Furthermore, the small number of FSW-IDUs that primarily operated from indoor venues decreased the precision of our estimates. In addition, reports of CCU may be subject to social desirability response bias due to the purpose of the intervention. However, any differential bias specifically due to the intervention was accounted for by adjusting for this effect in the longitudinal models. Lastly, we cannot conclude that venue instability led to decreased condom use since this study was designed to evaluate the efficacy of a behavioural intervention. Therefore, data were not collected in a manner designed to capture the temporality of changing venue types on condom use. Despite this, the prospective nature of these data strengthens their validity providing important insights for future interventions that address the effect of workplace mobility on HIV risk.

In summary, FSW-IDUs experience several HIV risk behaviours, which may be further exacerbated by movement between sex work venues. Such mobility, in turn, may increase risk behaviours by exposing FSWs to new clients, social networks and unsafe working environments. By examining venue stability as it relates to CCU our work demonstrates a specific and unique pattern of mobility within this complex phenomenon. These results highlight the potential impact of both the venue type (indoor versus outdoor) and the movement between these types of venues, further contributing to the literature on mobility and HIV epidemiology, while highlighting the need for 'location-specific' prevention efforts that focus on the social and structural context shaping mobility.⁵⁴

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Figure 1.
Predicted probability of 100% condom use by client type in Tijuana

Figure 2.
Predicted probability of 100% condom use by client type in Ciudad Juarez

Table 1Baseline characteristics of females sex workers that inject drugs (FSW-IDUs) in Tijuana and Ciudad Juarez^{*}

Variable	Overall (n = 567)	Tijuana (n = 277)	Cd. Juarez (n = 290)	P value
Demographics	%	%	%	
Education ≥ 6 years	73.7	80.2	67.2	<0.01
Married/living together	37.0	38.6	35.5	0.49
Self-rated bad financial situation	57.0	68.2	46.2	<0.01
Age, median (IQR)	33 (27–40)	34 (28–41)	33 (27–39)	0.04
Sexual behaviours				
All/majority US clients	7.0	13.1	1.4	<0.01
Often/always use drugs before sex	59.2	63.8	54.8	0.03
Often/always use alcohol before sex	18.9	13.8	23.8	<0.01
Access to free condoms	20.3	30.1	11.0	<0.01
Tested positive for chlamydia and/or gonorrhoea	13.1	10.5	15.5	0.08
Drug use in the last month				
Heroin	97.2	96.8	97.6	0.62
Methamphetamine	37.9	76.2	1.4	<0.01
Cocaine	34.4	22.4	45.9	<0.01
Weekly alcohol consumption	43.7	26.7	60.0	<0.01
Venue stability				
Equal	11.1	9.4	12.8	0.15
All /mostly outdoor	80.8	84.1	77.6	
All /mostly indoor	8.1	6.5	9.7	
100% condom use				
Regular clients	14.9	13.8	16.0	0.54
Casual clients	11.7	18.8	5.4	<0.01

IQR = interquartile range

^{*} Excludes FSW-IDUs with baseline visit only (n = 17)

Table 2

Unadjusted and adjusted odds ratio of consistent condom use over time in Tijuana by client type

Variable	Regular clients		Casual Clients	
	Unadjusted odds ratio (95% CI)	Adjusted odds ratio (95% CI)	Unadjusted odds ratio (95% CI)	Adjusted odds ratio (95% CI)
Demographics				
Age (5-year increment)	1.01 (0.92, 1.11)		1.08 (0.98, 1.20)	
Education 6 years	0.75 (0.32, 1.78)		1.39 (0.58, 3.63)	
Married/living together vs. other (ref.)	0.77 (0.56, 1.01)	0.76 (0.54, 1.08)	0.71 (0.59, 0.98)	0.69 (0.47, 0.99)
Self-rated bad financial situation	0.56 (0.42, 0.74)	0.55 (0.39, 0.77)	0.53 (0.39, 0.73)	0.59 (0.41, 0.84)
Sexual behaviours				
All/majority US clients	1.37 (0.84, 2.56)		1.12 (0.65, 1.92)	
Drug use before sex	0.20 (0.15, 0.28)	0.34 (0.24, 0.49)	0.20 (0.14, 0.28)	0.32 (0.22, 0.47)
Alcohol use before sex	0.19 (0.10, 0.33)	0.36 (0.19, 0.69)	0.18 (0.10, 0.34)	0.37 (0.18, 0.75)
Access to free condoms	1.08 (0.81, 1.44)		1.53 (1.12, 2.08)	1.49 (1.03, 2.15)
Tested positive for HIV or STI *	1.01 (0.59, 1.73)		0.72 (0.41, 1.29)	
Drug/alcohol use in the last month				
Inject daily	0.12 (0.08, 0.20)	0.22 (0.12, 0.41)	0.21 (0.13, 0.33)	0.43 (0.24, 0.78)
Methamphetamine	0.46 (0.34, 0.63)	0.68 (0.47, 0.97)	0.42 (0.30, 0.59)	0.65 (0.44, 0.96)
Cocaine	0.65 (0.34, 1.24)		0.46 (0.22, 0.95)	0.83 (0.38, 1.82)
Weekly alcohol consumption	0.48 (0.33, 0.71)	0.79 (0.50, 1.23)	0.52 (0.35, 0.78)	0.86 (0.53, 1.39)
Venue stability				
Equal (ref.)	1.00		1.00	1.00
All/mostly outdoor	1.32 (0.78, 2.23)	1.62 (0.87, 3.04)	1.15 (0.64, 2.05)	1.48 (0.74, 2.94)
All/mostly indoor	2.93 (1.30, 6.58)	3.77 (1.44, 9.89)	3.89 (1.57, 9.63)	7.18 (2.32, 22.21)

Time and intervention group was controlled for in all adjusted models

* STI = chlamydia or gonorrhoea; CI = confidence interval

Table 3

Unadjusted and adjusted odds ratio of consistent condom use overtime in Ciudad Juarez by Client Type

Variable	Regular clients		Casual clients	
	Unadjusted odds ratio (95% CI)	Adjusted odds ratio (95% CI)	Unadjusted odds ratio (95% CI)	Adjusted odds ratio (95% CI)
Demographics				
Age (5-year increment)	1.03 (0.93, 1.13)		1.06 (0.96, 1.17)	
Education 6 years	1.17 (0.53, 2.58)		0.45 (0.14, 1.44)	
Married/living together vs. other (ref)	1.20 (0.91, 1.60)		1.19 (0.88, 1.61)	
Self-rated bad financial situation	0.74 (0.56, 0.98)	0.77 (0.57, 1.03)	0.69 (0.51, 0.93)	0.77 (0.56, 1.07)
Sexual behaviours				
All/majority US Clients	1.14 (0.43, 3.04)		2.16 (0.72, 6.21)	
Drug use before sex	0.57 (0.43, 0.77)	0.70 (0.51, 0.95)	0.52 (0.38, 0.72)	0.67 (0.47, 0.96)
Alcohol use before sex	0.82 (0.56, 1.20)		0.68 (0.44, 1.06)	0.77(0.48, 1.23)
Access to free condoms	1.87 (1.30, 2.68)	2.04 (1.38, 3.00)	1.72 (1.17, 2.54)	1.75 (1.14, 2.68)
Tested positive for HIV or STI *	0.68 (0.43, 1.08)		0.44 (0.24, 0.80)	0.47 (0.25, 0.89)
Drug / alcohol use in past month				
Inject daily	0.35 (0.25, 0.48)	0.39 (0.28, 0.56)	0.32 (0.23, 0.45)	0.37 (0.26, 0.54)
Methamphetamine	1.62 (0.59, 4.46)		1.73 (0.50, 5.95)	
Cocaine	0.83 (0.59, 1.17)		0.67 (0.45, 0.99)	0.74 (0.49, 1.12)
Weekly alcohol consumption	0.69 (0.52, 0.92)	0.71 (0.52, 0.96)	0.90 (0.67, 1.21)	
Venue stability				
Equal (ref.)	1.00	1.00	1.00	1.00
All/mostly outdoor	1.36 (0.81, 2.29)	1.58 (0.91, 2.73)	0.80 (0.49, 1.31)	0.80 (0.48, 1.34)
All/mostly indoor	2.25 (1.11, 4.56)	2.69 (1.28, 5.65)	1.03 (0.52, 2.05)	1.06 (0.50, 2.24)

Time and intervention group was controlled for in all adjusted models

* STI = chlamydia or gonorrhoea; CI = confidence interval