

## Article

# HIV risk behaviours differ by workplace stability among Mexican female sex workers with truck driver clientele

Nadine E. Chen,<sup>1</sup> Steffanie A. Strathdee,<sup>1</sup> Gudelia Rangel,<sup>2</sup> Thomas L. Patterson,<sup>1</sup> Felipe J. Uribe-Salas,<sup>2</sup> Perth Rosen,<sup>1</sup> Jorge Villalobos,<sup>2</sup> Kimberly C. Brouwer<sup>1</sup>

<sup>1</sup>Department of Medicine, University of California, San Diego, CA, USA; <sup>2</sup>El Colegio de la Frontera Norte, San Antonio del Mar, Tijuana, Baja California, México

## Significance for public health

Due to occupational risks, female sex workers (FSWs) typically have a higher prevalence of both HIV and other sexually transmitted infections (STIs) than the general population. Curbing infection rates among FSWs have been shown to directly affect STI prevention and control among the general population. The physical environment and location of sex work can have a large influence over safer sex behaviours and substance use. The high mobility of truck drivers increases their potential to transmit disease to their sexual partners, who may be both FSWs and non-FSWs, across regions in a short period of time. Understanding the factors that contribute to HIV/STI risk in FSWs who service truck drivers can help curb the spread of these epidemics.

## Abstract

**Background.** In a study of female sex workers (FSWs) servicing truck driver clients in Mexican border cities, we evaluated differences in HIV/STI risk behaviours determined by workplace.

**Design and Methods.** Our study was cross-sectional and its population comprised 100 FSWs from Nuevo Laredo (US border) and 100 FSWs from Ciudad Hidalgo (Guatemalan border). The main outcome was primary place of sex work defined as unstable (street, vehicle, gas station, etc.) vs stable (bar, brothel, and hotel). Logistic regression was used to identify correlates associated with trading sex at unstable workplaces in the last month.

**Results.** Of the FSWs surveyed, 18% reported an unstable workplace. The majority of FSWs surveyed were young (<30 years), single, had <9<sup>th</sup> grade education, and had worked in the sex trade for a median of 4.9 years. After controlling for study site, FSWs with unstable vs stable workplaces were more likely to have a majority/all truck driver clientele, but were less likely to have visited a gynaecologist in the last year (OR 0.1, 95% CI 0.03-0.4) or ever had an HIV test (OR 0.1, 95% CI 0.06-0.3), and there was a trend towards lower condom use self-efficacy scores (OR 0.8 per unit increase, 95% CI 0.7-1.0). On multivariate regression, unstable workplace was associated with having majority/all truck driver clientele, being surveyed in Nuevo Laredo, and decreased odds of ever having an HIV test.

**Conclusions.** Among Mexican FSWs with truck driver clients, providing safe indoor spaces for sex work may help facilitate public health interventions that improve HIV/STI prevention and reproductive health outcomes.

## Introduction

Although the prevalence of HIV and other sexually transmitted infections (STIs) vary geographically, female sex workers (FSWs) typically have a higher prevalence of both HIV and STI than the general population of a region.<sup>1-4</sup> The nature of their occupation exposes them to many HIV/STI risks, including unprotected sex, sex with multiple partners, substance use, and sexual or physical violence.<sup>4,7</sup> A recent review of the HIV prevalence among FSWs in 26 countries found that FSWs were 11.6 times more likely to be infected with HIV than their female counterparts not working with sex in a given region.<sup>8</sup>

Curbing infection rates among FSWs have been shown to directly affect STI prevention and control among the general population. In Thailand, after a government-instituted campaign to regulate condom use in commercial sex establishments, cases of STI dramatically declined among both male and female visiting STI clinics.<sup>9,10</sup> In addition, FSWs can often serve as a bridge population between a localised HIV epidemic, for example among drug users, and the general population.<sup>11</sup> Therefore, understanding the factors that contribute to HIV and STI risk among FSWs is an important step in disease control and prevention.

The physical environment and location of sex work can have a large influence on safer sex behaviours. Street-based FSWs tend to be more vulnerable to engaging in unprotected sex with clients than bar/brothel-based FSWs, due to their relative social isolation and limited support system.<sup>5,12</sup> A Vancouver study found that servicing clients in cars/public places was associated with higher levels of unprotected sex since control over the environment decreases.<sup>7</sup> FSWs associate working in bars or brothels with feeling *safe*, as the presence of bouncers or bar managers decreases the likelihood of violence against them and increases their ability to enforce condom use.<sup>5,13</sup> In a qualitative study of Canadian FSWs in low-barrier supportive public housing, which in effect became quasi-brothels, safer working environments were found to empower the women to stand together and enforce safer working conditions for all residents in the facility.<sup>14</sup> Therefore, the degree of control a FSW has over her environment can often impact her HIV/STI risks.

Substance use and sex work often co-occur as women who use drugs are more likely to sell sex and, in turn, these women may rely on substance use as a coping mechanism.<sup>13</sup> One study of exotic dance clubs located at the Block – the adult entertainment area in Baltimore city – found that FSWs perceived substance use as inevitable due to the pervasive drug use in that environment.<sup>13</sup> In several settings, street-based FSWs have been found to be more likely to use drugs or ever inject drugs, while bar-based FSWs are more

likely to use alcohol.<sup>5,12,13</sup> Moreover, substance use has been strongly associated with increased HIV/STI risk, as women are less able to negotiate condom use, and higher prevalence of HIV/STI has been associated with drug use.<sup>3,15,16</sup> However, increased HIV/STI risk may regard bar-based FSWs as well. Indeed, commonality of substance use, especially alcohol, may result in decreased safer sex practices despite the safer structural environment.

Long-distance truck drivers have been implicated in the early spread of HIV in Africa, India, and Asia.<sup>17-20</sup> Much less is known about the risk behaviours and STI/HIV prevalence of truck drivers and their FSW acquaintances in the Americas, although reports suggest a high transmission potential.<sup>21,22</sup> The high mobility of truck drivers increases their potential to transmit disease to their sexual partners, who may be both FSWs and non-FSWs, across regions in a short period of time. Understanding the factors that contribute to HIV/STI risk in the FSWs who service truck drivers can help curb the spread of these epidemics. The objective of this study was to evaluate differences in HIV/STI risk behaviours determined by workplace location in a sample of FSWs with truck driver clients in two Mexican border cities.

---

## Design and methods

### Study population and setting

Proyecto Salud Sin Fronteras is an international collaborative pilot study in which cross-sectional surveys were conducted from August 2009 to January 2010 among 200 FSWs. One hundred FSWs were recruited from Nuevo Laredo at the northern Mexican border with the US and other 100 FSWs were recruited from Ciudad Hidalgo at the southern border with Guatemala. Both cities are situated along major freight corridors. Participants were selected through modified venue-based sampling<sup>23</sup> in which no more than ten participants were enrolled from any particular site. FSWs were eligible for the study if they were  $\geq 18$  years old, spoke either English or Spanish, and worked at a truck stop or had at least one truck driver client in the past month. In Nuevo Laredo, sex work is tolerated in a walled-off area known as *boystown*. Within the walls of *boystown* are several brothels, bars, rooms for rent, as well as a public health HIV/STI testing facility. As sampling focused on venues frequented by truck drivers, most participants were recruited outside *boystown*, although a number reportedly worked both in and outside its walls. Ciudad Hidalgo is a much smaller town and there is no such regulation of sex work.

### Data collection

Trained female outreach workers administered quantitative surveys in Spanish to collect information on demographics, socioeconomic factors, working conditions, access to care, sexual risk behaviours, and substance use. Participants were compensated US\$15 for their time. The study was approved by the University of California at San Diego Human Research Protections Program and by the Ethics Committee of El Colegio de la Frontera Norte in Tijuana, Mexico.

### Variable definitions

The primary variable of interest was main place of work, which was defined as *stable* for a bar, brothel, hotel, house or rented room *versus unstable* for street, gas station, restroom, customer's vehicle, shooting gallery, truck stop, cafeteria, or other public place.

Sociodemographic factors included education level. This variable was dichotomised at the 9<sup>th</sup> grade, which is last year of middle school (*secundaria*) and of compulsory education in Mexico. Age and income were evaluated both as continuous variables and as dichotomous variables with the median value as the cut-off.

Migration factors included place of birth and time spent in the current city. This temporal variable was dichotomised at five years to differentiate recent from more established migrants. We also included deportation status. *Heavy alcohol use* was defined as having  $>4$  drinks, as four or more drinks within a two-hour period suggests binge drinking for women.<sup>24</sup> Participants were also asked about lifetime drug use and drug use in the past six months. The drugs asked about were marijuana, cocaine, heroin, methamphetamines, amphetamines, barbiturates, tranquilizers, and inhalants. We also formed two composite drug use variable: *illicit drug use* which included all of the previously mentioned drugs, and *hard drug use* which included only cocaine, heroin, amphetamine, and methamphetamine. Participants were asked how much they earned per vaginal sexual act, and we dichotomised the monetary cut-off at \$30 per sexual act, on the basis of values from a previous study in a similar population.<sup>25</sup> Recent STI symptoms encompassed genital/anal warts, genital ulcers or sores, genital itching, or abnormal vaginal discharge in the last 6 months. Participants were also asked if they had ever been diagnosed with a sexually transmitted infection or disease, specifically chlamydia, genital warts, syphilis, gonorrhea, trichomoniasis, or an unknown STI. Health care access and behaviours were assessed through health insurance status, history of ever having an HIV test, gynaecologic visits in the past 12 months, and condom use. Condom use self-efficacy was based on a nine-item scale adapted from a previous study of FSWs in Mexico (Project Mujer Segura).<sup>26</sup> Participants were presented a series of statements on condom use which they answered according to Likert scale (from 1: strongly disagree, to 4: strongly agree). The statements described condom use in different situations, such as *I can use a condom every time I have vaginal or anal sex* and *I can use a condom for sex while under the influence of drugs or alcohol*. A condom use self-efficacy scale was then created from nine questions ranging from 0 to 9 with higher scores indicating greater condom self-efficacy (alpha 0.83).

### Statistical analysis

The primary dependent variable was stable *vs* unstable workplace. To examine the differences between the two workplaces, we used the  $\chi^2$  test for dichotomous variables and the Wilcoxon Rank Sum test for non-normally distributed continuous variables or the Student's t-test for normally distributed continuous variables. We then performed univariate logistic regression with unstable workplace as the outcome. We performed a bivariate analysis using all the same variables, but controlling for study site. Finally, using manual backward stepwise regression for all variables with  $P < 0.10$  on univariate analysis, we performed a multivariate logistic regression analysis. Only variables achieving a  $P < 0.05$  significance level were retained in the final model. All statistical analysis was done using Stata version 10.0 (StataCorp LP, College Station, TX, USA).

---

## Results

Of the 200 FSWs surveyed, 36 (18%) reported an unstable main place of work (Table 1). Of these, the most common location was a truck stop (40%), followed by gas station (38%), the street (10%), and customer's vehicle (3%), shooting gallery (3%), public restroom (3%), and cafeteria (3%). Three quarters of all participants were single, 87% had  $<9^{\text{th}}$  grade education, 92% financially supported others, and 80% had no health insurance.

Compared to FSWs working in stable locations, FSWs in unstable locations were slightly older (42% were  $<30$  years old compared to 60%), had a higher median income (66% earned  $>4000$  pesos per

**Table 1. Sociodemographic characteristics and risk behaviours of female sex workers working in stable and unstable locations.**

Variable	Stable, n=164	Unstable, n=36	Total, n=200	P-value*
<b>Demographics</b>				
Civil status: Single/divorced/separated/widowed	74.4%	72.2%	74.0%	0.79
Education: <9 <sup>th</sup> grade	86.6%	86.1%	86.5%	0.94
Age: <30	60.0%	41.7%	56.5%	00.05
Income: <4000 pesos/month (US\$300)	50.0%	34.3%	47.2%	00.09
Reports financial situation as				
Good/very good	18.9%	47.2%	24.0%	<0.001
Neutral/bad/very bad	81.1%	52.8%	76.0%	
Financially supports others	92.7%	86.1%	91.5%	00.20
Has children	90.9%	77.8%	88.4%	00.03
Study site				
Nuevo Laredo	45.1%	72.2%	50.0%	0.003
Ciudad Hidalgo	54.9%	27.8%	50.0%	
<b>Migration factors</b>				
Birthplace				
Mexico	53.1%	72.2%	56.5%	00.04
Guatemala	20.7%	16.7%	20.0%	
Honduras	10.4%	11.1%	10.5%	
El Salvador	13.4%	0	11.0%	
Other	2.4%	0	2.0%	
Time spent in current city: <5 years	51.8%	37.1%	49.2%	00.12
Ever been deported	18.9%	2.8%	16.0%	00.02
Deported from				
US	14	1	15	
Guatemala	2	0	2	
Mexico	14	0	14	
Costa Rica	1	0	1	
<b>Substance use and incarceration</b>				
Heavy alcohol use: >4 drinks in one occasion on a typical drinking day (n=174)	86.6%	65.6%	82.8%	0.005
Lifetime drug use				
Any illicit drug use	54.3%	44.4%	52.5%	00.29
Hard drug use <sup>o</sup> (n=197)	45.7%	34.3%	43.7%	00.22
Marijuana use (n=199)	33.7%	30.6%	33.2%	0.71
Cocaine	40.9%	33.3%	39.5%	00.40
Heroin	4.9%	2.8%	4.5%	00.59
Methamphetamine	1.8%	0	1.5%	00.41
Amphetamine	6.2%	2.9%	5.6%	00.44
Drug use in the last 6 months				
Marijuana	12.8%	11.1%	12.5%	0.78
Cocaine	21.3%	19.4%	21.0%	0.80
Heroin	2.4%	0	2.0%	00.34
Methamphetamine	0	0	0	
Amphetamine	3.7%	2.8%	3.5%	0.80
Ever arrested (n=199)	30.7%	19.4%	28.6%	00.16
<b>Sexual behaviours and risks</b>				
Reports having an STI symptom# in the last 6 months	14.6%	25.0%	16.5%	00.13
Ever diagnosed with an STI	12.8%	19.4%	14.0%	00.30
Number of sex partners in the last 6 months (median, IQR)	30 (10, 97.5)	55 (20, 300)	35 (10, 100)	00.01
>10 different sex partners in the last 6 months	70.6%	91.7%	74.5%	00.01
Can afford to buy own condoms	90.2%	86.1%	89.5%	00.46
Earns <\$30 per protected vaginal sex, n=191	49.4%	34.3%	46.6%	00.11
Earns <\$30 per unprotected vaginal sex act, n=27	56.5%	0	48.2%	00.04
Lives and works in the same location	49.4%	18.4%	44.0%	00.01
Has a manager/pimp	24.4%	19.4%	23.5%	00.53
Has worked >5 years as a FSW	46.3%	62.9%	49.3%	00.08
Majority/all clients were truck drivers in the last 6 months	51.8%	86.1%	58.0%	<0.001
Often/always used alcohol before sex work in the last month (n=199)	21.5%	22.2%	21.6%	0.91
Used drugs before/during sex at least once in the last month (n=198)	13.0%	19.4%	14.1%	0.30
In the last 6 months, had clients from				
Us	30.0%	38.9%	31.6%	00.37
Guatemala	45.6%	22.2%	41.3%	00.01
Has ever been forced to have sex (n=199)	19.6%	16.7%	19.1%	0.64
<b>Health care access and health behaviours</b>				
No health insurance	79.3%	83.3%	80.0%	00.58
At least one gynaecologic visit in the last year (n=182)	95.3%	79.4%	92.3%	0.002
Personally knows someone with HIV	38.0%	38.9%	38.2%	0.92
Ever HIV tested	82.9%	36.1%	74.5%	<0.001
Condom efficacy scale, median (IQR)	5 (2, 6)	1 (0, 4)	4 (1, 6)	0.001

\*Chi-squared P-value for dichotomous variables, Wilcoxon Rank-sum P-value for continuous variables; <sup>o</sup>hard drug use: includes only use of cocaine, heroin, methamphetamines, and amphetamines; #STI symptoms: genital itching, discharge, ulcers, warts, or other lesion. STI, sexually transmitted infections; IQR, interquartile range; FSW, female sex worker.

month *vs* 50%), and fewer had children (78% *vs* 91%). A greater proportion of those who reported an unstable location were surveyed in Nuevo Laredo rather than Ciudad Hidalgo. Other notable differences between FSWs with unstable *vs* stable workplaces were that unstable FSWs were more likely to be born in Mexico, have lived in the current city for >5 years, and less likely to have ever been deported.

FSWs reporting an unstable workplace location were less likely to report heavy alcohol use (66% *vs* 87%). There were no significant differences in drug use between the two groups. Although FSWs with an unstable workplace had more sex partners and scored lower on the condom use self-efficacy scale, there were no differences in lifetime diagnosis of an STI or report of recent STI symptoms. FSWs with unstable workplace location were less likely to have ever been tested for HIV (36% *vs* 83%), and also less likely to have had a gynaecologic visit in the last year (79% *vs* 95%).

Variables with  $P < 0.10$  on univariate logistic regression analysis are shown in Table 2. After controlling for study site, migration factors and heavy alcohol use were no longer significantly associated with workplace. Reporting an unstable main place of work was associated with having more than 10 clients in the last six months and having a majority/all truck driver clientele. Moreover, FSWs with unstable workplaces were less likely to have had a gynaecologic visit in the last year, less likely to have ever been HIV tested and there was a trend towards scoring lower on the condom self-efficacy scale. On multivariate regression, FSWs who reported an unstable location as their main place of work were more likely to report that all or a majority of their clientele was composed by truck drivers, but were less likely to have ever been tested for HIV or to have been surveyed in Ciudad Hidalgo.

## Discussion

Previous research showing the elevated HIV/STI risk among FSWs, coupled with the potential of these women to serve as a bridge population between localised epidemics and the general population, highlights the importance of understanding methods of HIV/STI prevention among FSWs. In this study, FSWs with an unstable main workplace had more sexual partners, fewer gynaecologic visits, were less likely to have ever had an HIV test, and had lower self-efficacy scores for using condoms. The increased odds of beneficial health behaviours among FSWs with stable workplaces suggest that more stable environments for sex work may help facilitate interventions that improve HIV/STI and reproductive health outcomes.

Regional differences in regulation of sex work can result in differences in health behaviours and HIV/STI risk. In the Mexico-US border city of Tijuana, where sex work is quasi-legal, registered sex workers were more likely to have ever been tested for HIV than non-registered sex workers.<sup>27</sup> In Nuevo Laredo, although study sampling about venues most often frequented by truck drivers occurred mainly outside boystown, a number of FSWs who were recruited and surveyed outside boystown reportedly worked in boystown too within the last month. Due to this structural regulation of sex work, we expected Nuevo Laredo FSWs to have greater access to health care and public health programmes, regardless of work location stability. Nevertheless, despite the structural regulation of sex work in Nuevo Laredo, FSWs at unstable locations were still less likely to access the health care system (HIV testing and gynaecologic visits), even after

**Table 2. Correlates of unstable workplace among female sex workers servicing truck driver clients in two border cities in Mexico (n=200).**

Variable odds ratio (95% CI)	Univariate odds ratio (95% CI)	Controlling for city adjusted odds ratio (95% CI)	Multivariate
<b>Demographics</b>			
Age, <30 years <i>vs</i> >30 years-old	0.48 (0.23, 1.00)	0.52 (0.24, 1.09)	-
Income, <4000 pesos <i>vs</i> >4000 pesos	0.52 (0.24, 1.12)	0.87 (0.27, 2.06)	-
Reports financial situation as			-
Good/very good	Referent	Referent	
Neutral/bad/very bad	0.26 (0.12, 0.56)*	0.34 (0.15, 0.78)*	
Has child/children	0.35 (0.14, 0.92)*	0.39 (0.15, 1.03)	-
Study site			
Nuevo Laredo	Referent	Referent	Referent
Ciudad Hidalgo	0.32 (0.14, 0.70)*	0.32 (0.14, 0.70)*	0.30 (0.12, 0.76)*
<b>Migration factors</b>			
Birthplace: born in Mexico <i>vs</i> outside Mexico	2.30 (1.04, 5.08)*	0.49 (0.08, 2.93)	-
Ever been deported	0.12 (0.17, 0.93)*	0.15 (0.02, 1.14)	-
<b>Substance use and incarceration</b>			
Heavy alcohol use, >4 drinks in one occasion on a typical drinking day	0.29 (0.12, 0.71)*	0.42 (0.17, 1.05)	-
<b>Sexual behaviours and risks</b>			
Reports having an STI symptom in the last 6 months (itching, discharge, ulcers, warts, <i>etc.</i> )	1.94 (0.81, 4.64)	1.41 (0.57, 3.49)	-
>10 sex partners in the last 6 months	4.58 (1.34, 15.7)*	3.94 (1.13, 13.7)*	-
Lives and works in the same location	0.25 (0.10, 0.60)*	0.33 (0.13, 0.83)*	-
Worked ≥5 years as a FSW	1.96 (0.92, 4.15)	1.38 (0.62, 3.06)	-
Majority/all clients were truck drivers in the last 6 months	5.76 (2.13, 15.6)*	9.60 (3.36, 27.4)*	6.99 (2.38, 20.5)*
Had clients from Guatemala in the last 6 months (n=196)	0.34 (0.15, 0.79)*	0.67 (0.21, 2.14)	-
<b>Health care access and health behaviours</b>			
At least one gynaecologic visit in the last year (n=182)	0.19 (0.06, 0.59)*	0.12 (0.03, 0.43)*	-
Ever HIV tested	0.12 (0.05, 0.26)*	0.13 (0.06, 0.30)*	0.17 (0.07, 0.40)*
Condom efficacy scale, median (SD)	0.79 (0.69, 0.92)*	0.84 (0.71, 1.00)	-

CI, confidence interval; FSW, female sex worker; SD, standard deviation. \* $P < 0.05$ .



controlling for city. This is especially concerning because FSWs from Nuevo Laredo were more likely to report an unstable place of work than those from Ciudad Hidalgo. Thus, although overall prevalence of HIV testing was high and most FSWs had a gynaecologic visit in the last year, the discrepancy in workplace location indicates that improved public health interventions to reach FSWs mainly working in unstable workplaces are still needed.

In this study, stable workplaces were, by definition, confined to a specific venue, such as a bar, brothel or hotel. Localisation can facilitate public health interventions by delivering public health educational messages or resources (condom distribution or HIV testing) to a group of people. Our results support this hypothesis as we found that FSWs at stable locations were more likely to report ever having an HIV test. In addition, they were marginally more likely to have visited a gynaecologist in the last year and had higher levels of self-efficacy for using condoms. Not only does a stable location provide a centralised area to deliver public health messages, but related peer support can normalise or aid in enforcement of condom use or regular STI/HIV testing.<sup>12,28,29</sup> Several studies have found that the presence of bar managers or bouncers may also empower FSWs to demand condom use with their clients.<sup>5,13,28</sup> Safer indoor environments have also been found to promote informal peer support mechanisms, which thereby empower FSWs to enforce safer working conditions for themselves and their co-workers.<sup>14</sup> Thus, a stable place of sex work facilitates beneficial behavioural change through both localising public health services and relying on social support or conforming to peer norms that can increase the likelihood of these behaviours being adopted.

Despite differences in risk behaviours, FSWs working at unstable sites were not statistically more likely to report STI diagnosis or have STI symptoms than FSWs at stable workplaces. As this was a pilot study, it was not powered to detect a difference in recent STI symptoms or STI diagnosis between FSWs at stable and unstable workplaces. Indeed, to detect a 10% difference in STI symptoms or diagnosis, we would have required a sample size of 500 FSWs with 50% working at unstable locations (alpha 0.05, power 0.80). After controlling for study site, many of the variables are likely significant, but the study sample size may have precluded the detection of additional variables on multivariate analysis due to low power.

Substance use is often pervasive among FSWs, as some women turned to substances to cope with the mental and emotional stress from sex work, while others may have turned to sex work as a way to support their substance use habits.<sup>5,12,13</sup> Though the prevalence of substance use was high, with over 50% admitting to lifetime drug use, we did not find any difference in illicit drug use as for different workplaces. As mentioned, the small sample size may have hindered our ability to detect a difference, but many different factors can influence substance use. For instance, pervasiveness of drug use in a given area, such as a red-light district, can lead to highly prevalent drug use among women working inside clubs.<sup>13</sup> FSWs working in stable or unstable locations that are close may have similar patterns of drug use. In addition, we found that working at stable or unstable locations frequently crossed over. Indeed, regardless of the main reported place of work, FSWs stated working at both unstable and stable sites: approximately 40% of FSWs with a stable main place of work reported working at an unstable location in the last month. Yet, FSWs mainly working at unstable locations were more likely to report working at the same locations in the last month. The significant crossover with FSWs working at both types of sites may have resulted in similar patterns of substance use.

Differences in sexual networks can also influence risk behaviours and HIV/STI risk. In a study of FSWs in two Mexico-US border cities, FSWs with US clients were more likely to inject drugs and have high syphilis titres than those without US clients in the past two months.<sup>25</sup> The HIV/STI prevalence in a given sexual network will influence

transmission risk to FSWs. Mexico is bordered by countries which have a higher prevalence of HIV.<sup>30</sup> In this study, over one-third of FSWs reported having clients from either the US or Guatemala, and FSWs at unstable workplaces were almost seven times more likely to report having a majority or all truck driver clientele. This is a worrying picture as truck drivers have been implicated in the spread of HIV and other STIs<sup>17,31</sup> and their mobility facilitates the mixing of sexual networks of high HIV/STI prevalence with those of low prevalence.<sup>32</sup> Hence, as FSWs at unstable locations were more likely to have majority/all truck driver clients, extending public health programmes to educate truck drivers on safer sex practices and HIV/STI testing may be an effective method to decrease HIV/STI risk among FSWs at unstable locations.

Some significant limitations of this study can be pointed out. As previously mentioned, the small study sample of this international pilot study may have limited our ability to detect associations. In addition, due to the cross-sectional nature of the study, causality cannot be inferred. Assessment of main place of sex work was by self-report, and there was significant crossover as FSWs often reported working at both unstable and stable locations in the last month. Despite these limitations, the study provides a glimpse into the differences in HIV/STI vulnerability determined by the workplace stability of FSWs servicing truck driving clients in two border cities in Mexico.

Our findings indicate that providing a stable, safe location for sex work may improve health behaviours including HIV/STI testing and condom use for FSWs servicing truck driver clients along the Mexican borders. Public health programmes that target truck driver clients may also be an effective way to reach FSWs working at unstable locations.

Correspondence: Nadine E. Chen, Department of Medicine, University of California, San Diego, 9500 Gilman Drive, San Diego, CA 92122, USA.

Tel. +1.858.822.0578. E-mail: nadinechen@ucsd.edu

Key words: female sex workers, HIV, sexually transmitted infection, risk behaviour, work environment.

Acknowledgements: Proyecto Salud Sin Fronteras was made possible through funding by National Institute on Drug Abuse (NIDA) (grants R21DA025438 and 5R01DA029899-02) and a UCSD Center for AIDS Research International Pilot Grant (P30 AI-36214). Funding for this research was also provided through a diversity supplement from NIDA (R01DA028692-02S1, NEC).

Contributions: GR, FJU, PR, JV, SAS, TLP, KCB design of the parent study along with data acquisition; NEC, data analysis, first manuscript drafting under the guidance of KCB, SAS, TLP, final manuscript preparation; NEC, KCB, SAS, TLP drafts revision and editing. The final manuscript was approved by all authors.

Conflict of interests: the authors declare no conflict of interests.

Received for publication: 25 April 2012.

Accepted for publication: 4 October 2012.

©Copyright N.E. Chen et al., 2012

Licensee PAGEPress, Italy

*Journal of Public Health Research* 2012; 1:e32

doi:10.4081/jphr.2012.e32

This work is licensed under a Creative Commons Attribution NonCommercial 3.0 License (CC BY-NC 3.0).

## References

1. Morison L, Weiss HA, Buve A, et al. Commercial sex and the spread of HIV in four cities in sub-Saharan Africa. *AIDS* 2001;15:S61-9.
2. Chen L, Jha P, Stirling B, et al. Sexual risk factors for HIV infection in early and advanced HIV epidemics in sub-Saharan Africa: systematic overview of 68 epidemiological studies. *PLoS One* 2007; 2:e1001.
3. Patterson TL, Semple SJ, Staines H, et al. Prevalence and correlates of HIV infection among female sex workers in 2 Mexico-US border cities. *J Infect Dis* 2008;197:728-32.
4. Scorgie F, Chersich MF, Ntaganira I, et al. Socio-demographic characteristics and behavioural risk factors of female sex workers in sub-Saharan Africa: a systematic review. *AIDS Behav* 2012;16:920-33.
5. Pyett PM, Warr DJ. Vulnerability on the streets: female sex workers and HIV risk. *AIDS Care* 1997;9:539-47.
6. Rusch ML, Brouwer KC, Lozada R, et al. Distribution of sexually transmitted diseases and risk factors by work locations among female sex workers in Tijuana, Mexico. *Sex Transm Dis* 2010;37:608-14.
7. Shannon K, Strathdee SA, Shoveller J, et al. Structural and environmental barriers to condom use negotiation with clients among female sex workers: implications for HIV-prevention strategies and policy. *Am J Public Health* 2009;99:659-65.
8. 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;12:538-49.
9. Celentano DD, Nelson KE, Lyles CM, et al. Decreasing incidence of HIV and sexually transmitted diseases in young Thai men: evidence for success of the HIV/AIDS control and prevention program. *AIDS* 1998;12:29-36.
10. Hanenberg RS, Rojanapithayakorn W, Kunasol P, et al. Impact of Thailand's HIV-control programme as indicated by the decline of sexually transmitted diseases. *Lancet* 1994;344:243-5.
11. Strathdee SA, Lozada R, Martinez G, et al. Social and structural factors associated with HIV infection among female sex workers who inject drugs in the Mexico-US border region. *PLoS One* 2011;6: e19048.
12. Larios SE, Lozada R, Strathdee SA, et al. An exploration of contextual factors that influence HIV risk in female sex workers in Mexico: the social ecological model applied to HIV risk behaviours. *AIDS Care* 2009;21:1335-42.
13. Sherman SG, Lilleston P, Reuben J. More than a dance: the production of sexual health risk in the exotic dance clubs in Baltimore, USA. *Soc Sci Med* 2011;73:475-81.
14. Krusi A, Chettiar J, Ridgway A, et al. Negotiating safety and sexual risk reduction with clients in unsanctioned safer indoor sex work environments: a qualitative study. *Am J Public Health* 2012;102:1154-9.
15. Browne FA, Wechsberg WM. The intersecting risks of substance use and HIV risk among substance-using South African men and women. *Curr Opin Psychiatr* 2010;23:205-9.
16. Kalichman SC, Simbayi LC, Vermaak R, et al. HIV/AIDS risks among men and women who drink at informal alcohol serving establishments (Shebeens) in Cape Town, South Africa. *Prev Sci* 2008;9:55-62.
17. Beyrer C, Razak MH, Lisam K, et al. Overland heroin trafficking routes and HIV-1 spread in south and south-east Asia. *AIDS* 2000;14:75-83.
18. Morris CN, Ferguson AG. Estimation of the sexual transmission of HIV in Kenya and Uganda on the trans-Africa highway: the continuing role for prevention in high risk groups. *Sex Transm Infect* 2006;82:368-71.
19. Parfitt T. Drug addiction and HIV infection on rise in Tajikistan. *Lancet* 2003;362:1206.
20. Celikbas A, Ergonul O, Baykam N, et al. Epidemiologic and clinical characteristics of HIV/AIDS patients in Turkey, where the prevalence is the lowest in the region. *JIAPAC* 2007;7:7.
21. Villarinho L, Bezerra I, Lacerda R, et al. [Vulnerability to HIV and AIDS of short route truck drivers, Brazil]. [Article in Spanish]. *Rev Saude Publ* 2002;36:S61-7.
22. Schifter J. Latino truck driver trade: sex and HIV in Central America. Haworth Hispanic/Latino Press, New York, 2001.
23. MacKellar DA, Gallagher KM, Finlayson T, et al. Surveillance of HIV risk and prevention behaviours of men who have sex with men—a national application of venue-based, time-space sampling. *Public Health Rep* 2007;122:S39-47.
24. Dawson DA. Defining risk drinking. *Alcohol Res Health* 2011;34: 144-56.
25. Strathdee SA, Lozada R, Semple SJ, et al. Characteristics of female sex workers with US clients in two Mexico-US border cities. *Sex Transm Dis* 2008;35:263-8.
26. Patterson TL, Semple S, Fraga M, et al. A sexual risk reduction intervention for female sex workers in Mexico: design and baseline characteristics. *J HIV AIDS Soc Serv* 2006;5:115.
27. Sirotnin N, Strathdee SA, Lozada R, et al. A comparison of registered and unregistered female sex workers in Tijuana, Mexico. *Public Health Rep* 2010;125:S101-9.
28. Morisky DE, Pena M, Tiglaio TV, et al. The impact of the work environment on condom use among female bar workers in the Philippines. *Health Educ Behav* 2002;29:461-72.
29. Rhodes T, Singer M, Bourgois P, et al. The social structural production of HIV risk among injecting drug users. *Soc Sci Med* 2005; 61:1026-44.
30. UNAIDS. Global Report: UNAIDS report on the global AIDS epidemic: Joint United Nations Programme on HIV/AIDS. UNAIDS Publ., Geneva, 2010.
31. Celikbas A, Ergonul O, Baykam N, et al. Epidemiologic and clinical characteristics of HIV/AIDS patients in Turkey, where the prevalence is the lowest in the region. *JIAPAC* 2008;7:42-5.
32. Deane KD, Parkhurst JO, Johnston D. Linking migration, mobility and HIV. *Trop Med Int Health* 2010;15:1458-63.