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# Economic vulnerability, violence, and sexual risk factors for HIV among female sex workers in Tijuana, Mexico

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## Abstract

Economic vulnerability is often reported to underlie involvement in sex work among female sex workers (FSW), but may also create urgency in women's work, limiting women's negotiating power with clients and in turn, increasing their vulnerability for violence and HIV. This study assessed economic vulnerability in relation to violence and sexual risk behaviors for HIV among a sample of FSW in Tijuana, Mexico. FSW at least 18 years of age were recruited through venue-based sampling for a survey (n=228) and in-depth interviews (n=50) to investigate HIV risk factors in this region. Using crude and adjusted logistic regression models, we assessed lack of financial support from others as well as reports of financial hardship separately in relation to experiencing sexual violence (e.g. by clients, police, relationship partners, in the past 6 months), physical violence (past 6 months), STI diagnosis, and inconsistent condom use (past 30 days). Qualitative interviews (n=50), conducted with a subsample of the survey participants, were also examined for related themes. FSW who reported no financial support were more likely to report sexual violence (OR=2.1; 95% CI:1.1–4.2). FSW who reported financial hardship were more likely to experience sexual violence (OR=1.9; 95% CI:1.1–3.6) and physical violence (OR=1.9; 95% CI:1.1–3.6), as well as to report past 30-day inconsistent condom use (OR=2.4; 95%CI: 1.3–4.6) and to test positive for an STI (OR=1.9; 95% CI:1.1–3.4). Qualitative data substantiated these findings. Findings suggest that interventions to improve economic well-being may be useful to prevent the intersecting concerns of violence and HIV among FSW.

**Keywords** Female sex workers · Mobility · Sexual risk · HIV

## Background

HIV is a critical concern in the largest U.S.-Mexico border city, Tijuana, particularly among the extensive population of female sex workers (FSW) who live and work at the border. While Mexico has a low overall HIV prevalence (0.3%)

[1], much higher rates of HIV have been documented in key populations along the Mexican border with the United States, which is the result of the combination of a prominent sex work industry and widespread drug use[2–7]. Of note, HIV prevalence has been reported to be as high as 5–10% among female sex workers (FSW) and up to 12% among FSW who inject drugs[4, 7, 8]. Red light districts (tolerance zones) in Tijuana are supported by sex tourism from both the United States and Mexico,[3] with estimates of approximately 9,000 FSW in Tijuana[5, 9], many of whom originally migrated to Tijuana from other parts of Mexico seeking economic opportunity, as well as a number of women who were deported to Tijuana from the US (who maybe from anywhere in Mexico).

Heightened vulnerability to HIV among FSW stems from a range of structural factors that shape the context in which sex work occurs and that drive risk[10, 11]. At both the macro and micro level, the social, physical, policy, and

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economic environment can increase women's vulnerability through processes related to stigmatization and marginalization, the criminalization of sex work, and through unequal distributions of power that can limit the accessibility of health-related resources and increase exposure to violence [10–13]. These factors work individually and in tandem to shape individual risk and impede women's ability to prevent HIV infection. In particular, the pervasiveness of financial hardship among this population, and its relationship to both violence and HIV vulnerability, is an important avenue of research that has yet to be fully explored.

Among FSW in Tijuana, and elsewhere, dire socioeconomic conditions are reported as a primary reason underlying their entry and ongoing involvement in sex work [14–22]. Notably, studies among FSW in South America, sub-Saharan Africa, the US, and South Asia have found that economic vulnerability (e.g. economic debt, financial hardship) is not only a primary reason for women's involvement in sex work, but also creates an urgency in women's work that increases safety risks (e.g. threatening women's ability to avoid potentially violent clients) and reduces women's condom negotiating power, altogether, increasing HIV risk [10, 18, 23–25]. Previous research in South Asia among FSW has also noted the economic challenges faced by FSW who are the primary caretakers of their children, with no other financial support [26]. Recent work in Tijuana indicates that almost half (46%) of FSW agree to condomless sexual transactions in exchange for more money [20], suggesting that economic burdens are a critical issue affecting FSW and increasing their vulnerability to HIV. Yet, little is known regarding the link between economic vulnerability and HIV risk among FSW in Tijuana or other regions in Mexico.

Violence (e.g. physical violence/threats and sexual violence perpetrated by clients, police, and male partners), occurring in high proportions among FSW, is also a major contributing factor to HIV (e.g. via forced condomless sex) [10, 26–38], and may be tied to economic vulnerability in ways that compound risk for HIV. For example, FSW who need to obtain funds urgently (e.g. to pay for rent or household essentials) may be more likely to agree to riskier sexual transactions (e.g. condomless sexual transactions for more money) or to work in riskier contexts that increase their vulnerability to violence. However, we know little about the extent to which economic vulnerability influences violence and, in turn, HIV risk among FSW in Mexico.

Thus, the purpose of this study was to assess economic vulnerability in relation to women's experiences of physical and sexual violence as well as other risk factors for HIV among FSW in Tijuana, Mexico. Quantitative data were analyzed in order to provide findings regarding the associations between economic vulnerability and HIV risk

variables. Qualitative data were also presented to further substantiate and provide broader context for these findings. Study findings inform whether HIV prevention approaches may be needed that focus on improving women's economic situation. Such approaches to reducing HIV risk are still important as efforts to increase uptake of PrEP are underway [39].

## Methods

### Study Design and Procedures

The current study used quantitative data from the 6-month follow up surveys and STI testing (2014–2016) conducted by *Mapa de Salud*, a longitudinal cohort study of FSW in Tijuana (National Institutes of Health, R01DA028692). Eligible participants for this study were 18 years of age or older, cisgender women (identified as women and assigned female sex at birth), reported having exchanged sex for money or goods in the past month, agreed to treatment for any STIs, resided in Tijuana, and had no plans to move in the next 18 months. In addition to the survey and STI testing among the full sample of *Mapa de Salud* participants (n=228), qualitative interviews (one-on one) were also conducted with a sub-sample of 50 participants of the *Mapa de Salud* Study. In order to ensure adequate numbers of women reporting drug use and non-use, interview participants were selected based on their reports of drug use in the quantitative survey, including 25 interview participants who reported drug use and 25 participants reporting no drug use in the past 30 days.

Women were recruited for the *Mapa de Salud* study via time-location sampling, based on the time and location they engage in sex work. This method has been successfully employed to recruit hidden samples of FSW, men who have sex with men, and truck drivers in a number of Mexican cities [40–42]. With the help of outreach workers, the paired study developed maps of bars, brothels, hotels, alleys and street corners with sex work activity. All sites were visited to verify their location and days/hours of business, and to estimate the size of the target population present. A maximum number of 15 recruits per establishment and geographical stratification were employed to ensure a diverse sample. Days and times for recruitment were randomly selected based on hours of operation/when target populations are present. Trained outreach workers familiar with these establishments and their clientele approached women. Using a personal digital assistant, the approximate age and reason for refusal/ineligibility was recorded. Women who were eligible and interested in participating were given a study card and asked to present it when they visited the study office.

Informed consent, laboratory testing, surveys, and interviews occurred in the study office. After providing informed consent, women completed a baseline, interviewer-administered survey using computer-assisted personal interviewing (CAPI) and during the same visit, were asked to provide a venous blood sample and vaginal swab to permit testing for syphilis (SD BIOLINE Syphilis 3.0, Standard Diagnostics, Inc.), Chlamydia and gonorrhea (Aptima Combo 2, Genprobe), as well as HIV (SURE CHECK HIV Assay, Chembio) and sent to the San Diego County laboratory for testing. HIV preliminary positive or indeterminate samples were sent to the county laboratory for a confirmatory BioRad Multispot HIV-1/HIV-2 assay and syphilis positivity was assessed with a rapid plasma reagin (RPR) and *Treponema pallidum* hemagglutinin assay (TPHA) to confirm diagnosis. STI/HIV counseling was provided to all participants at the time of testing and upon delivery of results. Those requiring treatment were provided free treatment on-site by study nurses. Those testing positive for HIV were referred to local public health care providers, including offering transportation and actively setting up an appointment for participants.

The survey and interviews were administered by Spanish-speaking study staff trained in survey/interview facilitation. Surveys focused on substance use, sexual risk behaviors for HIV, women's reports of violence, as well as other indicators of HIV risk. Referrals and free treatment were provided as needed. Qualitative data conducted among the sub-sample of participants in the *Mapa de Salud* study involved semi-structured life history interviews and focused more broadly on women's lives, including exploration of various aspects of their work and personal life that may be associated with heightened HIV risk. All interviews (n = 50) were recorded, transcribed, and translated. All study activities were approved by the Institutional Review Boards of the University of California, San Diego and El Colegio de la Frontera Norte in Tijuana, Mexico.

## Measures

### Quantitative Survey measures

Demographic variables included: age (in years), years in sex work (< 1 year, between 1 and 5 years, between 6 and 10 years, more than 10 years), years of education (none, primary, incomplete secondary, complete secondary, or higher education), whether they reported having children residing with them (yes/no), relationship status (having a spouse or steady partner versus single), types of sex work in which women worked (street, bar, hotel, massage parlor, home, other location), and substance use (at least weekly use of common drugs including heroin, cocaine, crystal meth, or amphetamines).

Economic vulnerability was measured as: (1) self-perceived financial hardship (i.e. poor/very poor financial situation) and (2) not receiving financial support from anyone else (i.e. being the sole financial provider)[12]. These items were developed based on initial qualitative interviews as well as our previous published work in this area[12]. Not receiving financial support was expected to worsen economic vulnerability among women; in qualitative interviews, women often reported working in sex work as a means to support their children and reported challenges when not receiving child financial support from the child's father.

Violence (past 6 months). We considered two forms of violence. *Sexual violence* was measured by asking participants whether anyone (e.g. clients, police, relationship partners) forced them to have vaginal, anal, or oral sex against their will in the past six months (yes/no). Participants were grouped as experiencing *physical violence* if they responded positively to questions about whether they had experienced either (1) being beaten (e.g. hit, slapped, pushed, kicked, punched, choked, or burned) or (2) being threatened with a knife, gun, or other weapon, or having had a weapon used against them.

STI diagnosis was measured in a private location at the study site via a venous blood sample and vaginal swab to permit testing for syphilis, Chlamydia, gonorrhea, and HIV. Participants who received at least one positive diagnosis from STI laboratory testing (Chlamydia, gonorrhea, active syphilis or HIV) were categorized as having an STI diagnosis. Active syphilis was classified as a titer [1:8].

Inconsistent condom use (past 30 days) was measured by asking participants how often they used condoms with regular and occasional clients in the past 30 days; participants who reported "always" using condoms for each type of client were categorized as consistent condom users.

### Qualitative in-depth interviews

The life history qualitative interviews addressed such topics as family background and childhood; marriage and relationships with male partners; children, livelihood issues, specifically food, housing and financial situation; sex work challenges including experiences with law enforcement; condom use; health care; and leisure time activities.

### Data Analysis

For quantitative analysis, we assessed differences (via chi square tests) in sample characteristics by economic vulnerability. In addition, using crude and adjusted logistic regression models, we assessed economic vulnerability in relation to the following violence and HIV risk outcomes: sexual victimization (past 6 months), physical victimization (past 6

months), STI diagnosis, and inconsistent condom use (past 30 days) (one crude and one adjusted model for each outcome). Sample characteristics associated with any outcome

variables in bivariate analyses at  $p < 0.05$  were included in adjusted models. For logistic regression findings, odds ratios are presented with associated 95% confidence intervals, and

**Table 1** Sample characteristics: Total Sample and by Economic Vulnerability (n=228)

Socio-demographic factors	Total Sample (n = 228) % (n)	No financial support (65.8%; n = 150) % (n)	Financial support (34.2%; n = 78) % (n)	Poor/Very Poor Financial Situation (42.1%; n = 96) % (n)	No reported poor/very poor financial situation (57.9%; n = 132) % (n)
Age	21.9 (50)	21.3 (32)	23.1 (18)	14.6 (14)	27.3 (36)
18–24	12.7 (29)	14.0 (21)	10.3 (8)	10.4 (10)	14.4 (19)
25–29	21.9 (50)	20.7 (31)	24.4 (19)	20.8 (20)	22.7 (30)
30–34	15.4 (35)	18.0 (27)	10.3 (8)	17.7 (17)	13.6 (18)
35–39	28.1 (64)	26.0 (39)	32.1 (25)	36.5 (35)	22.0 (29)
40 or older					
		$\chi^2 = -0.19; p = 0.46$		$\chi^2 = 3.09; p = 0.05$	
Years in Sex work	22.1 (50)	22.1 (33)	22.1 (17)	15.8 (15)	26.7 (35)
<1 year	19.9 (45)	21.5 (32)	16.9 (13)	10.5 (10)	26.7 (35)
1–5 years	19.9 (45)	20.1 (30)	19.5 (15)	13.7 (13)	24.4 (32)
6–10 years	38.1 (86)	36.2 (54)	41.6 (32)	60.0 (57)	22.1 (29)
>10 years					
		$\chi^2 = -0.88; p = 0.82$		$\chi^2 = 12.62; p = 0.001$	
Sex Work Venues	28.1 (54)	26.6 (40)	17.9 (47)	20.8 (20)	25.7 (34)
Street/car	17.2 (33)	15.3 (23)	12.8 (10)	8.3 (8)	28.9 (25)
Bar/dance hall	29.7 (57)	24.4 (19)	29.5 (23)	31.2 (30)	20.5 (27)
Hotel	7.3 (14)	5.3 (8)	7.6 (6)	6.2 (6)	6.1 (8)
Massage parlor	2.2 (5)	0.6 (1)	5.1 (4)	2.1 (2)	2.3 (3)
Private home	2.2 (5)	3.3 (5)	0 (0)	0 (0)	3.8 (5)
Other venue	12.5 (24)	11.3 (17)	8.9 (7)	13.5 (13)	8.3 (11)
>1 location					
		$\chi^2 = 0.46; p = 0.14$		$\chi^2 = 2.08; p = 0.06$	
Relationship status	60.1 (137)	73.3 (110)	34.6 (27)	63.5 (62)	57.6 (76)
Single	39.9 (92)	26.7 (40)	65.4 (51)	36.5 (35)	42.4 (56)
Married or steady partner					
		$\chi^2 = 10.21; p = 0.001$		$\chi^2 = 2.22; p = 0.36$	
Education	3.9 (9)	4.7 (7)	2.6 (2)	6.3 (6)	2.3 (3)
No formal ed.	32.5 (74)	32 (48)	33.3 (26)	39.6 (38)	27.3 (36)
Primary Ed	22.8 (52)	22.7 (34)	23.1 (18)	22.9 (22)	22.7 (30)
Incomplete secondary	21.5 (49)	21.3 (32)	21.8 (17)	12.5 (12)	28 (37)
Complete Secondary	19.3 (44)	19.3 (29)	19.2 (15)	18.8 (18)	19.7 (26)
> Secondary					
		$\chi^2 = 0.01; p = 0.96$		$\chi^2 = 4.53; p = 0.03$	
Children	91.2 (208)	90 (135)	93.6 (73)	91.7 (88)	90.9 (120)
Yes	8.8 (20)	10 (15)	6.4 (5)	8.3 (8)	9.1 (12)
No					
		$\chi^2 = 0.04; p = 0.36$		$\chi^2 = 0.13; p = 0.84$	
Has children < 18 residing with them in the same household	55.3 (126)	54 (81)	57.7 (45)	45.8 (44)	62.1 (82)
Yes	44.7 (102)	46 (69)	42.3 (33)	54.2 (52)	37.9 (50)
No					
		$\chi^2 = 0.05; p = 0.59$		$\chi^2 = 9.83; p = 0.016$	
Drug Use					
>Once/week	59.6(92)	60.1(91)	42.3(33)	57.3(55)	28.1(37)
<Once/week	40.4(136)	39.3(59)	57.7(45)	42.7 (41)	71.9(95)
		$\chi^2 = 0.07; p = 0.66$		$\chi^2 = 12.62; p < 0.001$	

\*Numbers may not add up to 100% due to missing data

\*\*p values represent differences in sample characteristics by economic vulnerability

significance of individual variables was evaluated using Wald Chi-square tests. All analyses were conducted using SAS version 9.1 (SAS Institute Inc, Cary, North Carolina).

For the qualitative analyses, trained research staff coded the interviews according to themes. The coding team created an initial list of codes based on key domains and used these to code discussions. To enhance coding agreement, data were individually coded by two researchers, and coding procedures and definitions were discussed and compared for agreement. Additions of new codes or changes in code definitions were determined via consensus among the research team. No new codes emerged after two-thirds of the focus groups were coded, suggesting that content saturation was achieved. For this particular analysis, we retrieved coded text regarding economic vulnerability experienced among women generally as well as how it affected decisions at work and across other aspects of their lives.

## Results

### Sample characteristics

Almost one-third of the sample (28%) were 40 years or older in age, with 37% in their 30s, 13% between 25 and 29 years of age, and 22% younger than 25 years of age. Over half (60%) of women were single, and 40% were married or had a steady partner. The majority of women (59%) reported completing less than secondary education, 22% reported

completing secondary education, and 19% reported having greater than secondary education. Greater than half of women (55%) reported having children 18 or younger living with them. In terms of the types of sex work women reported, 28% worked on the street or in a car, 17% worked in a bar or dance hall, 30% worked in a hotel, 7% worked in massage parlors, 2% worked in private homes, and 2% reported other types of sex work. These categories were not mutually exclusive and 13% of participants reported working in more than one location. Under half (40%) reported not using drugs or using drugs infrequently (less than once per week). (Table I)

Over one-quarter (26%) reported experiencing sexual violence and 25% experienced physical violence in the previous 6 months. Over one-third (36%) tested positive for an STI during the 6 month follow-up testing. Over one-half (68%) reported inconsistent condom use (past 30 days). (Table II).

### Economic vulnerability: quantitative and qualitative findings

In terms of economic vulnerability, over two-thirds of the sample (66%) reported no financial support, while slightly less than half (42%) of participants reported financial hardship (e.g., poor or very poor financial situation). Women who reported no financial support were more likely to be single compared to women who received financial support from others (73% vs. 35%,  $\chi^2 = 10.21$ ;  $p = 0.001$ ), however,

**Table II** Economic Vulnerability & Relation to Violence, Inconsistent Condom Use, and STI: Crude and Adjusted Logistic Regression Findings (n = 228)

Dependent Variable	Total Sample % (n)	No financial support/ Solely supports herself 66% (n = 150)		Financial Hardship: Poor/Very Poor Financial Situation 42% (n = 96)	
		Crude Odds Ratio (95% CI)	Adjusted Odds Ratio* (95% CI)	Crude Odds Ratio (95% CI)	Adjusted Odds Ratio* (95% CI)
<b>Physical Violence (past 6 months)</b>	25.4 (58)	1.7 (0.9–3.3)	1.7 (0.9–3.4)	1.5 (0.8–2.8)	1.9
Yes	74.6 (170)	1.0 Referent	1.0 Referent	1.0 Referent	1.0 Referent
No	26.3 (60)	2.02 (1.1–3.9)	2.1 (1.1–4.2)	2.2 (1.2–4.1)	p = 0.07
<b>Sexual Violence (past 6 months)</b>	73.7 (168)	1.0 Referent	1.0 Referent	1.0 Referent	1.9
Yes	67.5 (154)	p = 0.04	p = 0.03	p = 0.0085	(1.1–3.6)
No	67.5 (154)	0.7 (0.4–1.3)	0.7 (0.4–1.4)	2.2 (1.2–3.9)	1.0 Referent
<b>Inconsistent Condom Use (past 30 days)</b>	32.5 (74)	1.0 Referent	1.0 Referent	1.0 Referent	p = 0.03
Yes	36.4 (83)	p = 0.32	p = 0.33	p = 0.0094	2.4
No	63.6 (145)	1.0 (0.6–1.7)	1.0 (0.5–1.7)	2.2 (1.3–3.8)	(1.3–4.6)
<b>STI</b>		1.0 Referent	1.0 Referent	1.0 Referent	1.0 Referent
Yes		p = 0.93	p = 0.91	p = 0.0059	p = 0.0055
No					1.9
					(1.1–3.4)
					1.0 Referent
					p = 0.0197

<sup>a</sup> Models were adjusted for years in sex work, relationship status, education level, drug use, and having children

there were no significant differences in receiving financial support between women reporting children and those without children. Women reporting financial hardship were more likely to report working in sex work for more years ( $\chi^2 = 12.62$ ;  $p = 0.001$ ), lower levels of education ( $\chi^2 = 4.53$ ;  $p < 0.03$ ), and having children < 18 years of age residing with them ( $\chi^2 = 9.83$ ;  $p = 0.016$ ). (Table I).

Qualitative interviews substantiated quantitative data findings and revealed that financial hardship was a primary factor underlying women's involvement in sex work as a way to support themselves and their family. Specifically, women noted that not having child financial support was a primary challenge, and as part of this, many women reported being abandoned by the child's father and suddenly and unexpectedly needing to pay for the entire household on their own.

The husband leaves them. And at a factory they pay us nothing. ...and that's why we come to the decision to... do trabajo fácil (easy work). And it is not easy but well it can be called that. Because you just go ... do what you got to do and well that's it... you make money. I mean... what you earn in a factory all week, you earn here in a night...

I didn't have anything to eat. God gave me my daughter. ...my food was a pancake and a little gallon of milk so that I wouldn't get hungry, because I didn't have [any money]. I gave birth to her. The father said that she wasn't his. He came and threw my clothes here. Just like that and since then, I have gotten ahead by myself...

Notably, given that many women had very little education, there were less opportunities for them in the formal sector in Tijuana. Also, since many women migrated to Tijuana from other places in Mexico, many also did not have paperwork or identification to be able to work in the formal sector. Nonetheless, women reported being able to make more money in sex work compared to the formal sector.

### Economic vulnerability, violence and sexual risk for HIV: qualitative and quantitative findings

In logistic regression models (adjusted for significant sample characteristics), FSW who reported no financial support were more likely to report sexual victimization (OR = 2.1; 95% CI: 1.1–4.2). FSW who reported financial hardship were more likely to experience sexual victimization (OR = 1.9; 95% CI: 1.1–3.6) and physical victimization (OR = 1.9; 95% CI: 1.1–3.6), as well as to report past 30-day inconsistent condom use (OR = 2.4; 95% CI: 1.3–4.6) and to test positive for an STI (OR = 1.9; 95% CI: 1.1–3.4). (Table II).

Qualitative findings substantiate the quantitative results as well, highlighting how women's economic urgency affected sexual risk behaviors with clients. Women reported that when they faced dire economic situations, they had less negotiating power with clients, feeling like they might lose the client if they did not comply, and in turn, reported agreeing (against their will) to condomless sexual transactions with clients.

I am a sex worker... I have to earn a living... day by day... sometimes taking risks, other times not... It's very difficult... It's day by day...

Until now, I always used... a condom... but, there were a few streaks where... well I really needed the money and I didn't, didn't use it. And I got sick....I got... Syphilis.

Sometimes there are very difficult clients... to work with because... they don't want to pay what you ask and... sometimes they don't want to use condoms... they want sex... of all types... and... well sometimes, one is forced to comply because of the need to earn a few pesos, well... you have to accept their requests... risking yourself, even though you know that you may catch some disease, right? ... What more can I do?

Qualitative findings also provide context to the survey findings that highlight the association between economic vulnerability and women's risk for experiencing violence.

Sometimes I'm afraid of going, "let's go to a hotel [because they might become violent]", I tell them, yes, right? But... with all the pain in my heart. [I go] because I need the money.

"He [client] was asking me for oral sex. Right? And um... I told him how much I charged... 150 [for] oral sex. And he told me he would give me 500 pesos [if I came with him]. And I was so stupid, well I got into the car. And from there he took me ...[participant names a location]... he put the door next to a tree so that I couldn't open the car door... because the tree was there. ... I told him that first he should pay me. Then he took out a gun. He took out a gun and he started to threaten me.... I had to do it... he wasn't, wasn't going to pay me. "You even think I'm going to pay you", he said, "You have to do it".

## Discussion

The current study documents the high proportion of FSW reporting economic vulnerability and how economic

vulnerability often underlies women's involvement in sex work. Findings further indicate that economic vulnerability is associated with greater risk for HIV and violence, particularly sexual violence, among FSW in Tijuana. Findings are consistent with previous, but limited work in other regions of Latin America as well as South Asia documenting the association between economic vulnerability, violence, and HIV risk among FSW [25, 43]. Current study findings build upon this previous work by highlighting the types of economic vulnerability (e.g. no financial support, general reports of financial hardship) and role of economic vulnerability on risk for violence and HIV/STI among FSW in Mexico. The types of economic factors associated with HIV risk appear to vary by context. For example, informal debts were associated with HIV risk in South Asia [12]. However, similar to our study findings, research in Brazil found that more general reports of economic hardship were most salient for determining HIV risk among women working in sex work [25]. Future studies will be needed to further understand the major contributing factors to financial hardship in women's lives (e.g. financially supporting children on their own [44], challenges in securing stable employment) to inform the development of intervention efforts.

Study findings revealed that economic vulnerability, particularly financial hardship, was associated with physical and sexual violence among FSW. While the association between violence from paying and non-paying partners and HIV/STI risk has been well documented among FSW globally [45–47], less has been documented on economic vulnerability and association with violence and related HIV/STI risk. Prior studies have found FSW experience high levels of physical and sexual violence from both clients and non-commercial partners [45] and women who report engaging in riskier sexual transactions (e.g. sex without a condom) if offered more money are at heightened risk for experiencing violence [48]. Altogether, these findings suggest that reducing economic vulnerability among FSW may also reduce physical and sexual violence and related HIV risk. Programmatic efforts are needed that consider women's economic situation as primary in affecting risk and health behaviors; economic interventions (e.g., economic empowerment programs) that reduce women's economic reliance on sex work as well as efforts reducing financial urgency that restricts women's options (e.g. ability to refuse certain clients or unsafe situations) while working in sex work may be particularly beneficial.

Interestingly, while participants in the current study reported lack of financial support more frequently than financial hardship (66% vs. 42% respectively), only financial hardship was associated with greater STI symptom/diagnosis. More work is needed to understand this finding; measures may need to be more specific in assessing when

lack of child support leads to economic urgency. Qualitative data indicated that financial support was largely absent, with women reporting the need to engage in risky behaviors in order to make more money. Experiencing financial hardship likely impedes women's ability to negotiate condom use or other risk behaviors with clients (e.g., substance use), as prior work has found that FSW report making more money for having condomless sex or using drugs/alcohol with clients [12, 18]. Therefore, while lack of financial support (particularly for children) is one factor that may underlie women's initial involvement in sex work, as indicated in the qualitative data, experiencing financial hardship, regardless of financial support, may increase the likelihood of engaging in behaviors that increase HIV/STI risk. More work is needed, however, to understand the underlying mechanisms that contribute to FSW's perception of financial hardship, and how this uniquely contributes to HIV risk.

Also noteworthy, the current study did not find an association between economic vulnerability and inconsistent condom use, yet prior work has found economic vulnerability is associated with inconsistent condom use [49]. However, in the current study, financial hardship was associated with STI, suggesting that women who experience economic vulnerability may be more willing to engage in behaviors that increase HIV/STI risk. For example, items may be needed to better understand which clients women may be more likely to agree to more money for condomless sexual transactions – and whether certain types of clients present greater risk for STI/HIV. Prior qualitative work among FSW in Mexico has found women are more likely to engage in risky behaviors, such as inconsistent condom use, with financially lucrative male clients [48]. In addition, given that we found heightened risk for sexual violence among FSW reporting economic vulnerability, violence may also be increasing STI risk. While recent work has started to examine other risk behaviors in addition to inconsistent condom use (e.g., substance use with clients), more work is needed to understand the unique role of economic vulnerability in women's decision (or lack thereof) to engage in specific behaviors that increase their risk for violence and HIV/STI risk in order to design comprehensive social and structural intervention programs to reduce HIV risk among FSW.

Financial hardship rather than financial support was found to be associated with demographic characteristics commonly linked to economic vulnerability and HIV risk (e.g. years in sex work, venue of sex work, education level, children living in the home, and drug use). Financial support was found to be associated only with marital status, suggesting that women not married have less financial support, and in turn, may be more vulnerable to risk behaviors for HIV. While financial support can provide a method for measuring women's financial independence, it may also mean



that women are not receiving support for children, which can result in severe financial hardship. The majority (91%) of women in our sample reported having children. Previous research has indicated that financial support is critical when a woman has children to support [12]. Our study did not find that women with children were less likely to report financial support compared to those not reporting children. More work may be needed to better understand the sources of financial support that are most important. Additionally, more work is needed to better understand the influence that financial support has on a woman's risk for economic vulnerability especially when there are children in the home.

Our findings must be considered with recognition of several study limitations. This cross-sectional study does not provide information regarding the temporality of associations. Additionally, the items used for analyses rely on self-reported responses; stigma can often result in underreporting of sensitive issues or socially undesirable behaviors [38, 51]. However, such underreporting would decrease power to detect an association between economic vulnerability and violence or other self-reported outcomes; the current study found various strong associations between these factors. While we developed items on economic vulnerability based on our previous work with this population, more research is needed to continue to refine these measures and identify more specific sources of economic vulnerability (e.g. items specifically asking about child support or housing expenses) affecting women's HIV risk. Additionally, it is not known whether the sample, recruited by venue-based sampling, is truly representative of the underlying population of FSW in this geographic location. The sampling strategy could introduce bias if selection of participants is based on some factor relevant to our study outcomes. Current study findings are most applicable to populations of FSW working in Tijuana, Mexico and may not be generalizable to other populations of sex workers from other contexts in Mexico or elsewhere.

These limitations notwithstanding, study findings highlight the violence and HIV related vulnerability of FSW who report economic vulnerability. Programs that increase economic opportunities for women have often been theorized as a way to decrease women's reliance on and entry into sex work. There is expanding evidence supporting economic interventions (e.g. those promoting savings and vocational training) as promising in reducing HIV risk among FSW [23, 24]. Our findings further highlight the potential utility for economic interventions to prevent the intersecting concerns of violence and HIV among women while working in sex work. Findings also have implications for the potential adverse effects of larger societal economic downturns (such as during the COVID-19 pandemic) that exacerbate experiences of economic vulnerability, and in turn, further

compromise health and safety among women working in sex work.

**Authors' contributions** Reed led the conceptual design, writing, and analysis. All other authors contributed to writing the manuscript. Additionally, Drs. Urada and Salazar assisted with qualitative data collection and analysis. The quantitative data used were from Dr. Brouwer's Mapa de Salus longitudinal study.

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**Availability of data and material (data transparency)** Data available upon request.

**Code Availability (software application or custom code)** n/a.

## Declarations

**Conflicts of interest/Competing interests (include appropriate disclosures)** none.

**Ethics approval (include appropriate approvals or waivers)** All study activities were approved by the Institutional Review Boards of the University of California, San Diego and El Colegio de la Frontera Norte in Tijuana, Mexico.

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