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Risk behaviours for HIV infection among traveling Mexican migrants: The Mexico-US border as a contextual risk factor

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Abstract

The Mexico-US border region is a transit point in the trajectory of Mexican migrants traveling to and from the U.S. and a final destination for domestic migrants from other regions in Mexico. This region also represents a high-risk environment that may increase risk for HIV among migrants and the communities they connect. We conducted a cross-sectional, population-based survey, in Tijuana, Mexico, and compared Mexican migrants with a recent stay on the Mexico-US border region (Border, n=553) with migrants arriving at the border from Mexican sending communities (Northbound, n=1077). After controlling for demographics and migration history, border migrants were more likely to perceive their risk for HIV infection as high in this region and regard this area as a liberal place for sexual behaviours compared to Northbound migrants reporting on their perceptions of the sending communities ($p<0.05$). Male border migrants were more likely to engage in sex, and have unprotected sex, with female sex workers during their recent stay on the border compared to other contexts (rate ratio= 3.0 and 6.6, respectively, $p<0.05$). Binational and intensified interventions targeting Mexican migrants should be deployed in the Mexican border region to address migration related HIV transmission in Mexico and the U.S.

Keywords

Mexican migrants; Mexico-US border region; HIV infection; risk behaviours; social norm

Introduction

Mexican migrants are often regarded as a vulnerable population to HIV infection that may serve as a bridge connecting high-risk groups in the U.S. and low-risk populations in

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while others reach the border temporarily as a transit point to their destination in the continental United States. Large international and domestic migration flows have created precarious social and economic conditions for both residents and migrants along the Mexico-US border including higher prevalence of poverty and uninsurance, widened disparities in health conditions, and increased opportunities for and vulnerability to infectious disease transmission (United States-Mexico Border Health Commission, n.d.). In addition to large transient populations, the border region hosts quasi-legal commercial sex and attracts many sex tourists from both countries (Strathdee et al., 2008; United States Agency for International Development, 2010). Increased access to illicit drugs including methamphetamines and cocaine due to cross-border trafficking, and drug related violence are also observed on the border (Brouwer et al., 2006; Molzahn, Rios, & Shirk, 2012; Ramos et al., 2009). These factors together help create a unique border culture that is more open to sexual promiscuity and drug use, and might contribute to the higher HIV/AIDS prevalence estimated for the border region compared to other Mexican areas (Magis-Rodriguez, Reyes, & Garcia, n.d.). Within the border region, the highest prevalence of infection have been estimated among injection drug users (IDUs, male 4%, female 10%) (Strathdee et al., 2008) and female sex workers (FSWs, 6%) (Patterson et al., 2008), two at-risk populations who partially overlap and often interact with the transient migrant population.

A previous study examined the prevalence of HIV infection and last 12-month HIV risk behaviours among Mexican migrant flows traveling through the Mexican border region. The findings indicated that male migrants who arrived in Tijuana from other Mexican northern border regions (border migrants) had higher prevalence of HIV infection (3.98%) relative to their peers from other flows (ranging from 0.18% to 0.80%), although there was no HIV positive case among females (Martinez-Donate et al., 2015). For both male and female border migrants, risk behaviours for HIV infection, including last 12-month multiple sex partners, unprotected sex with casual partners or sex partners, and sex under the influence of alcohol, were found to be common among this migration flow. In contrast, the HIV testing prevalence was low, particularly among males, with only 12.5% reporting HIV testing during the past 12 months (Martinez-Donate et al., 2015). This figure contrasts with current recommendations for HIV testing every 3–9 months for moderate-high risk individuals (Lucas & Armbruster, 2013), who may include labour migrants, considering their mobility, socioeconomic status, and social vulnerability. Such findings suggest that border migrants may be subject to greater risk while they travel along or stay on the border area. However, the previous study did not distinguish between behaviours in and outside the border region, thus making it difficult to determine whether the increased prevalence of HIV infection among migrants traveling along the Mexican border region is associated with greater prevalence of risk behaviours in this particular migration context.

This study expands upon previous work and focuses specifically on HIV risk factors in the border region. The aim was to characterize border migrants' risk behaviours of HIV infection and perceived social norms with regard to sexual behaviours in the Mexico-US border region. We also aimed to test the hypothesis that migrants are more likely to engage in risk behaviours and perceive riskier social norms while in the Mexican border region compared to other migration contexts.

Methods

Sampling frame and study population

We used data from Project Migrante, a series of surveys on HIV and access to health care among Mexican migrant flows traveling through the Mexico-U.S. border (www.migrante.weebly.com). Specifically, we used data from the Migrante 2009–2010 HIV Survey, a cross-sectional, population-based survey conducted from July 2009 to April 2010 in Tijuana, Mexico. The sampling strategy replicated that utilized by the Mexican government-funded Migration Survey on the North Border of Mexico (EMIF, its acronym in Spanish) to monitor the Mexican labour migrant population travelling between Mexico and the U.S. It is estimated that 90% of Mexican migrants cross the border back and forth through eight Mexican border towns, depending on available transportation means, like bus, airplane, etc. (Secretaria de Gobernación, 2009). Tijuana, is the busiest border crossing area and concentrates approximately 40% of the migration flow entering or returning from the U.S. (Secretaria de Gobernación, 2009). Following the EMIF, four migration flows are identified, including 1) migrants returning from the U.S. voluntarily, 2) migrants returning via deportation, 3) migrants from Mexican sending communities, and 4) migrants returning from the Mexico-US border to other Mexican regions. The border region was defined as Mexico's six northern states bordering the U.S., including Baja California, Sonora, Chihuahua, Coahuila, Nuevo Leon, and Tamaulipas. Sampling sites included the main deportation station in Tijuana, the Tijuana International Airport and the Tijuana Central bus station. Individuals were considered eligible if they met all the following conditions: 18 years and older, born in Mexico or other Latin American countries, fluent in Spanish, not Tijuana residents (except for deported migrants), travelling for labour reasons or change of residence, and not having participated in the survey before. Additional details on the Project Migrante methodology have been presented elsewhere (Martinez-Donate et al., 2015). For this study, our analysis is restricted to Mexican migrants traveling from Tijuana after a recent stay in the Mexican border region (Border flow) and migrants arriving in Tijuana from Mexican sending communities (Northbound flow). The former is our group of interest, and the latter is used as a comparison group and represents the source population from which border migrants originate. The study was reviewed and approved by the authors' institutional review boards.

Measures

The respondents completed the survey using QDS™ Questionnaire Development System computer-assisted personal interview (CAPI).

Socio-demographic and migration characteristics—The questionnaire included questions on socio-demographic factors (age, gender, marital status, education level, ethnicity, and place of residence in Mexico), and migration history (a migration history to the U.S., a deportation history from the U.S., and plan to enter the U.S. in the future). Questions also covered last 12-month migration related experiences in key context (i.e. the migration environment represented by each flow- sending communities for northbound and Mexican border region for border migrants), including main reason for visiting and time

spent in the border region, incarceration, and employment status and occupation in key context.

Last 12-month HIV risk behaviours in key context—Respondents were asked about the number of partners they had vaginal or anal sex with while in key context. Those who reported at least one partner were further asked how many of those partners were stable partners, casual partners, and sex workers, and with how many partners within each category they had sex without using a condom. Males were asked about their sex history with female and male partners. Females were only inquired about male partners. The survey also included questions about the number of partners who had other partners, partners who used intravenous drugs, and people who forced them to have sex against their will during the previous year while in key context. Moreover, individuals reported whether they had sex in exchange for money or other goods, used any substance (including cocaine, heroin/smack, marijuana, crystal meth, inhalants, ecstasy and other), and had sex under the influence of illicit drugs and alcohol in key context. These survey items were used to generate a series of dichotomous variables as displayed in Table 2.

Last 12-month HIV risk behaviours outside the border region—In addition to behaviours specific to the border region, border migrants reported the number of stable partners, casual partners and sex workers they had sex and unprotected sex with during the last 12 months in general regardless of region. It is assumed that unstable partners, including casual partners and sex workers, were unlikely to travel with the migrants. Following this assumption, we computed the number of casual partners and sex workers in places other than the border region by subtracting the number of partners reported in the border region from the total number of partners. The computed numbers were recoded into several binary variables: having sex and unprotected sex with casual partners and/or sex workers in other places during the past 12 months.

Last 12-month HIV testing and access to healthcare in key context—Participants were asked to classify their level of perceived risk for HIV/AIDS when in the key context. Afterward, they were inquired about whether they had been tested for HIV, knew where to get tested for HIV, had a sexually transmitted disease (STD) and were treated by a health professional for an STD during in the key context. Information on health insurance coverage (never, sometimes, and always) and type (private, public, etc.) in the key context was also obtained.

Social norms regarding sexual behaviours in key context—The survey assessed migrants' perception of social norms regarding sexual behaviours in the key context by asking males and females respectively whether they agreed with several statements, in the form of "men/women my age normally..." Specific statements examined are listed in Table 3.

Statistical analysis

Simple descriptive statistics on socio-demographic characteristics and migration profile were estimated for males and females from the border and northbound flows respectively. Chi-

square for categorical variables and t-test for continuous variables were used to test for significant differences between the two flows. Prevalence and 95% CI of last 12-month behavioural risk factors for HIV infection, HIV/STI testing and access to healthcare, and social norms toward sexual behaviours in key context were calculated and reported. Logistic regression models were estimated to test for statistically significant differences between border and northbound migrants, consistently adjusted for age, marital status, education, ethnicity, and time spent in key context during last 12 months. The Northbound flow was used as the referent category. Incidence rates of selected last 12-month HIV risk behaviours (%/month) in the border and other places were estimated by dividing prevalence of behaviours in the border /outside the border region by time spent in the corresponding region. Rate ratios (relative differences of incidence rates) and corresponding 95% CI based on the Fisher's exact test were estimated to compare the rates of these risk behaviours in and out of the border region. All analyses were stratified by gender. Survey weights were used to account for the complex sampling design and to produce population estimates. The equations used for computation of survey weights have been described elsewhere (Secretaria de Gobernación, 2009; Amuedo-Dorantes, Puttitanun, & Martinez-Donate, 2013). All analyses were conducted using STATA/MP 13.0 (StataCorp LP, College Station, TX).

Results

Overall, 1,038 individuals arriving from other Mexican border regions and 2,625 from sending communities were intercepted and identified as eligible for the study. Of them, 553 and 1,077 respectively agreed to participate in the survey interview, resulting in an overall response rate of 44.5%. The final sample included 452 males and 101 females from the border flow and 901 males and 176 females from the northbound flow.

Socio-demographic and migration characteristics of border and northbound migrants

Migrants traveling along the Mexican border region were relatively young (Mean=32.7 years [SD=10.2] for males; Mean=34.3 [SD=10.2] for females, Table 1). About a third (31.5% of males and 35.9% of females) had completed college or higher education while fewer than half had not completed high school (50.6% of males and 36.9% of females). Almost a third (32.0%) of border males were from northwest Mexico, followed by the south central (15.6%) and west (14.1%). For border females, the first three regions of residence were the northwest (55.9%), west (17.8%) and south central Mexico (10.2%).

Approximately, 31.0% of border males and 13.7% of border females had a migration history to the U.S., 22.5% and 3.5% respectively had been deported from the U.S., and 59.2% and 59.7% respectively reported a plan to enter the U.S. in the future. The majority of males (68.6%) visited the border region mainly to work or seek employment, followed by visiting family and friends (15.3%), and for business (9.3%). The first three main reasons for females were seeking employment (39.6%), other reasons (27.2%) and visiting family and friends (23.7%) respectively. During the last 12 months, males and females spent an average of 4.2 [SD=4.7] and 5.8 [SD=5.0] months respectively in the border region, reflecting that this population was relatively transient in the border region. During their stay in the border region in the previous year, 8.5% of males had been in prison for more than 24 hours (the

prevalence was 0.1% for females, $p<0.001$). Almost half (48.7%) of males and 31.1% of females had been employed full-time while in the border. Among all the occupations reported, we found a high prevalence of professional employment for both males (27.8%) and females (48.7%). Other main occupation sectors for males included construction (14.7%), industrial/factory (10.7%), and self-employment (8.2%). For females, other main sectors were industrial/factory (9.4%), self-employment (7.2%), and market/store/warehouse (5.6%).

The socio-demographic and migration characteristics of northbound migrants are also presented in Table 1. Compared to border migrants, male migrants traveling from Mexican sending communities had higher prevalence of a history of migration to the U.S. (46.1%, $p<0.01$), spent a longer time in key context during the last 12 months (Mean=6.4 months, [SD=5.0], $p<0.001$), and higher prevalence of being employed full-time in key context (60.9%, $p<0.05$). For both genders, fewer northbound migrants had an intention to enter the U.S. in the future (32.8% of males and 35.4% of females, $p<0.05$).

Risk behaviours for HIV infection in key context

Approximately, 16.6% of male border migrants and 5.2% of female border migrants had more than one vaginal or anal sex partner during their stay in the border area (Table 2). Approximately, 13.6% of males and 2.6% of females had sex with casual partners, and among those who reported this behaviour, 39.0% and 84.6% of males and females respectively did not use condoms consistently or at all. In addition, 5.5% of males had sex with female sex workers (FSWs) in the border region, and 38.2% of them reported inconsistent or no condom use. No females reported sex with any sex worker. Last 12-month sex with partners who had other concurrent sex partners (14.3% of males and 15.3% of females) and sex under the influence of alcohol (23.2% of males and 25.2% of females) were prevalent in the border region. Use of substance (9.3% of males and 1.5% of females) and sex under the influence of drugs (4.9% of males and 1.4% of females) were also observed, especially for the male migrants. The most frequently used drugs in the border region were marijuana, cocaine, and crystal meth, with overall estimated prevalence of 5.8%, 4.0% and 2.8% respectively.

Comparing to male northbound migrants in sending communities, border migrants were more likely to report sex with FSWs and sex in exchange for money or other goods ($p<0.01$) but less likely to have sex under the influence of alcohol ($p<0.01$) in the border region, after adjusting for basic socio-demographic factors and time spent in these key contexts. In contrast, border female migrants were less likely to have unprotected vaginal or anal sex in the border region compared to their northbound peers in sending communities ($p<0.01$).

HIV/STI testing and access to healthcare in key context

Table 2 also reveals that close to a third of the border individuals (32.8% of males and 31.0% of females) rated their HIV risk in the border region as high. More than half of males (56.7%) and most females (76.3%) knew where to get HIV tested in the border region, and 8.0% of males and 12.1% of females got tested for HIV during the last 12 months. About 3.7% of males and 7.0% of females reported having an STI in the border region during the

last 12 months, and about half of the infected males (51.4%) and 77.9% of infected females were treated by a health professional. During the previous year, almost half of males (45.2%) and a third of females (31.4%) were not covered by any health insurance in the border region, and among those who were covered some or all of the time, most (75.3% of males and 63.6% of females) obtained insurance through private programs. Compared to border migrants, northbound individuals were substantially less likely to perceive their HIV risk as high in sending communities ($p<0.001$), and less likely to have health insurance coverage in key context all the time during last 12 months ($p<0.05$), regardless of gender.

Social norms regarding sexual behaviours in key context

Most of the male migrants agreed that in the border region, it is normative for men to have more than one sex partner (82.4%), be unfaithful to their spouse or stable partners (71.4%), have sex with casual partners (70.6%), and have sex with prostitutes or sex escorts (65.1%). It was also common for males to think it normative for men to get condoms easily (83.4%), carry condoms with them (73.4%), and use condoms with casual partners (70.4%) in the border region. The norm of using condoms with stable partners was less prevalent (37.7%). Compared to northbound migrants, border male migrants were more likely to consider it normative for men to carry condoms, have more than one sex partner, and have sex with FSWs in the border region than in sending communities ($p<0.05$; Table 3).

For females, over half of the border migrants agreed that women in the border region normally have sex with casual partners (58.4%) and have more than one sex partner (51.2%), and 38.8% of them considered it normative for women to be unfaithful to their spouse or stable partner. The majority of females thought it easy to get condoms in the border region (92.3%) and 61.7% agreed that females normally use condoms with casual partners. Less than half considered it normative for women to use condoms with stable partner (42.5%) and carry condoms with them (45.8%). We did not find significant differences in perceived social norms in the border region among border female migrants and norms perceived by northbound female migrants in their communities of origin.

Comparison of HIV risk behaviours in and out of the border region

Comparisons of incidence rates of selected last 12-month HIV risk behaviours in the border region versus other places among migrants from the border flow indicated that the rates of vaginal or anal sex/unprotected sex with casual partners, and vaginal or anal sex/unprotected sex with sex workers were generally higher in the border region than elsewhere among males (Table 4). The rate ratio for vaginal or anal sex with FSWs (RR=3.0, 95% CI: 1.5–6.3), and unprotected sex with FSWs (RR=6.6, 95% CI: 1.3–65.4) reached significance at the 95% level. For females, the incidence rates of having sex and unprotected sex with casual partners were similar in and outside the border region (1.3%/month versus 1.2%/month; 0.9%/month versus 0.9%/month, respectively).

Discussion

We took a snapshot of a subset of Mexican migrants when they departed from the border city of Tijuana after a recent stay in the Mexico-U.S. border region in Mexico between 2009

and 2010 and examined their behaviour and perceptions in this migration context. The current study is complementary to previous research on behavioural risk for HIV infection among Mexican migrants in transit by focusing on migrants' behaviours on the Mexico-US border specifically.

The socio-demographic and migration profile of border migrants indicates this flow of Mexican migrants represents a highly heterogeneous population instead of a typical transnational migrant one. On one hand, a third of them were highly educated with at least a college degree, and half of males and a third of females were full-time employed in the border region during the past year; on the other hand, however, more than half of males and a third of females did not complete high school education. Additionally, about 30% of border migrants have a migration history to the U.S. and 60% plan to enter the U.S. in the future. These findings suggest that this migration flow consisted of both international Mexican migrants who had been to or were about to enter the U.S., and domestic migrants whose final destination had been the northern border region. As they connect different communities and regions associated with international and domestic migration, migrants in this flow may play an important role in the HIV epidemic in Mexico and the U.S.

We hypothesized that migrants may be at increased risk for HIV infection while they stay in the Mexican border region. Our results partially support this hypothesis as they indicate that male migrants with a recent stay in the Mexican border region are more likely to perceive their risk for HIV infection as high and are more likely to engage in risk behaviours in the border region compared to migrants arriving from sending communities. For example, last 12-month sex with FSWs among males on the border (5.5%) was more prevalent than this behaviour among northbound males in sending communities (3.3%) and the difference remained significant after adjusting for socio-demographic factors and time spent in key context. The prevalence of having sex in exchange for money or other goods was also substantially higher among border males compared to their northbound counterparts (4.5% versus 0.5%). This deserves attention from public health professionals and policy makers as it suggests that migrants may be subject to greater vulnerability for HIV infection in the border region compared to sending communities in Mexico.

For the two behaviours for which we were able to directly compare incidence rates inside and outside the border region within the same migrant flow, sex/unprotected sex with casual partners and sex workers, the incidence rates of these behaviours were generally higher in the border region relative to outside of the border. In particular, among males, the rates of sex and unprotected sex with FSWs were substantially higher on the border compared to other places. The higher risk of sex and unprotected sex with FSWs in the border was also found for the comparison between border and northbound males, who reported on their behaviour on the border and sending communities, respectively. Higher rates of unprotected sex with FSW are concerning given the observed high prevalence of HIV (6%) and sexually transmitted infections (STIs, 6–14% depending on types of STIs) among FSWs in the border region found by previous research (Patterson et al., 2008).

The contrast in risk behaviours between border and northbound migrants was not consistent across all risk behaviours. For instance, the likelihood of having sex under the influence of

alcohol was actually lower among border males in the border region compared to northbound males in sending communities. Nor was the contrast consistent between genders. For females, those with a recent stay on the border were less likely to engage in unprotected vaginal or anal sex compared to those from sending communities, after adjusting for other socio-demographic factors. Such findings agree with a previous study indicating that the influence of migration is not uniform across genders or risk factors and different migration contexts are characterized by unique patterns of HIV risk factors (Martinez-Donate et al., 2015). Specific factors that drive the differences remained understudied and future research should examine them to help better understand HIV risk among Mexican migrants.

In general, results from this study reveal that migrants in the border region considered this area a more liberal environment for sexual behaviours than other Mexican sending communities. More male migrants departing from the border region regarded it normative for men to engage in high-risk behaviours for HIV infection in the border region, including having more than one sexual partner and sex with sex workers, than did migrants arriving from other areas in Mexico when reporting about norms in the communities of origin. Exposure to such liberal norms of sexual behaviours may increase Mexican migrants' risk behaviours, and in turn, expedite HIV transmission along their migration trajectories, whether crossing the border to the U.S. or returning to their sending communities in Mexico. Additional analysis (results not shown) found that males who thought it normative for their peers to have sex with sex workers in the border region were significantly more likely to engage in sex with sex workers, after adjusting for socio-demographic characteristics (AOR=6.74, 95% CI: 1.11–40.9). Although we did not find similar evidence of an association between perceived norms regarding other risk behaviours (e.g. having multiple sexual partners, sex with casual partners, etc.) and likelihood of reporting these behaviours, our results are partially consistent with the BEM and other health behaviour models, such as and the Theory of Reasoned Action (Ajzen, 1985), which regard subjective social norms as important predictors of health behaviours and intervention targets.

We did not find differences between migrants in the border and in sending communities regarding perceptions about condoms, such as easiness to obtain them and extent to which they are used with stable and casual partners is normative. Migrants in the border were more likely to perceive it normative for men to carry condoms in this context compared to the views of migrants arriving from sending communities regarding this behaviour in those communities. These findings are in contrast with the greater likelihood of engaging in unprotected sex with casual partners and sex workers found for border migrants and suggests the need for additional research to better understand the factors that contribute to migrants' greater rates of unprotected sex with high risk partners in this region.

In spite of the high risk environment male migrants are exposed to on the border and recent recommendations for more frequent HIV testing among at-risk populations (Lucas & Armbruster, 2013), we detected low levels of last 12-month HIV testing (8.0% for males and 12.1% for females). HIV testing has also been under-utilized among other high-risk populations in Tijuana, with almost two-thirds of IDUs and half of FSWs never receiving a test in their lifetime (Moyer et al., 2008; Sirotin et al., 2010). This evidence calls for

increased efforts to promote HIV testing on the border, targeting the traditional high-risk populations as well as transient migrants.

There are several limitations for this study. First, our sample is not homogenous in terms of time spent in the border region during the past year. Hence, the prevalence of HIV risk behaviours and HIV testing levels may not be comparable to estimates from other studies. However, the purpose of this cross-sectional study was to characterize the HIV risk profile of this migration flow on the border, and the method was appropriate to answer the research question. Second, due to the study design, we were not able to extend comparison of last 12-month risk behaviours in and out of the border region to behaviours other than sex with unstable partners (i.e. casual partners and sex workers). Even comparison of sex with unstable partners had to follow the assumption that these types of sexual partners were location specific. It would be helpful for future studies on Mexican migrants to collect information on behaviours in different regions specifically to allow direct comparison of more risk behaviours for HIV infection between places. Third, the sample does not cover migrants who arrived in Tijuana using other transportation means, like private vehicles, train, by foot, etc. However, these migrants only comprise a small proportion (approximately 1–2% in 2009) of the migration flows converging in the Mexico-US border (Eduardo Gonzalez-Fagoaga, EMIF Statistics and Research Coordinator, personal communication, Aug 20, 2013). Fourth, the response rate of the survey was moderate, but above the minimum recommended level to inform key policy or resource allocation decisions (40% or above) (Advisory Panel On Telephone Public Opinion Survey Quality, n.d.). Finally, all the data were self-reported. As HIV-related risk behaviours are relatively sensitive, prevalence presented may be subject to information bias and underestimated.

Implications for public health interventions

Mexican migrants' elevated risk for HIV infection in the Mexico-US border calls for public health interventions that target this underserved population as they travel through and along the border. Efforts to combat the HIV epidemic should be addressed by both Mexico and the U.S., considering the high volume of migration between the two countries.

Currently, two Mexican nongovernment organizations, Prevencasa and Programa Compañeros, in collaboration with U.S. research teams and other organizations, have designed and implemented several HIV prevention programs in two border cities, Tijuana and Ciudad Juarez. The programs focus on the most at-risk populations, including IDUs, both male and female, FSWs, men who have sex with men, high-risk youth and prison inmates (United States Agency for International Development, 2010). For mobile migrants, a recent program by the Secretary of Health offers HIV testing, risk reduction counselling, and referrals to deported migrants at the deportation station of San Ysidro/El Chaparral. Furthermore, this program offers migrants free enrolment in Seguro Popular, a public health insurance program, employment orientation, transportation to shelters and information on food and lodging resources. While it is necessary to keep these programs going, efforts need to be extended to other migrant populations, given their volume in the Mexican border region and their potential role as bridge populations. The BEM (Hovell et al., 2009) and other socio-ecological models (McLeroy, Bibeau, Steckler, & Glanz, 1988) of population

health emphasize the role of policies and cultural factors as determinants of health and call for multilevel interventions to more effectively change health behaviours. At the individual level, migrants can benefit from programs to increase their HIV-related knowledge and awareness of HIV risk implemented in the border region, which in turn may help reduce their risk behaviours in this migration context. On the community level, it is important to provide affordable health insurance to other migrants who visit the border region temporarily, and make HIV testing and other health care services more available and easier to access on the border. On the societal level, policies are needed to improve the overall risk environment of the border area, like programs aiming to promote condom use with commercial sex workers, and efforts to reduce sharing of injection equipment among substance users in this region. More broadly, programs and policies are needed to increase access to food, safe housing. Such interventions could potentially benefit a proportion of migrants who engage in these behaviours.

In conclusion, an important subset of Mexican migrants are exposed to and participate in high-risk behaviours while travelling along or temporarily staying in the border region. Migrants in this context, especially male migrants, appear to be more likely to engage in risky sexual behaviour with female sex workers and rate their HIV risk as high compared to migrants in sending communities. Migrants' normative views of risky sexual behaviours are also more prevalent in the border compared to sending communities. Overall, our findings suggest that the Mexico-US border region in Mexico represents a high-risk environment that may facilitate HIV transmission among migrants traveling through or staying in this region. These results call for joint and intensified interventions targeting Mexican migrants on the border to address migration related HIV transmission in Mexico and the U.S.

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Table 1

Sociodemographic and migration characteristics of Border and Northbound migrants.

	Males			Females		
	Border migrants (N=252,663)	Northbound migrants (N=215,022)	P-value	Border migrants (N=52,588)	Northbound migrants (N=38,823)	P-value
Sociodemographic						
Age, Mean (SD)	32.7 (10.2)	34.3 (10.7)	0.072	34.3 (13.3)	35.0 (13.3)	0.830
Education attainment, %			0.105			0.965
Less than high school	50.6	56.5		36.9	41.4	
Completed high school	18.9	19.0		26.0	22.3	
Completed college	30.5	24.4		37.1	36.3	
Married/cohabiting, %	50.3	56.6	0.208	40.2	38.9	0.907
Indigenous ethnicity, %	1.7	4.6	0.027	0.1	2.9	<0.001
Country of origin (Mexico), %	99.8	99.3	0.204	99.7	99.4	0.558
Region of origin in Mexico, %			0.032			0.389
Northeast	7.3	6.5		4.4	5.2	
Northwest	32.0	23.3		55.9	39.5	
West	14.1	24.7		17.8	16.2	
East	12.6	8.0		1.8	4.2	
North central	4.3	6.1		4.1	10.3	
South central	15.6	20.4		10.2	17.3	
Southeast	2.6	0.6		1.5	0.2	
Southwest	11.6	10.4		4.2	7.1	
Migration History						
Migration history to the US, %	31.0	46.1	0.008	13.7	22.8	0.244
History of deportation from the US, %	22.5	22.5	0.996	3.5	2.3	0.639
Plan to enter the US in the future, %	59.2	32.8	<0.001	59.7	35.4	0.030
Main reason for visiting the border region, %			<0.001			0.054
Visit family and friends	15.3	10.5		23.7	32.0	
For business	9.3	7.6		9.5	2.8	
To work or look for employment	68.6	48.8		39.6	20.2	

	Males			Females		
	Border migrants (N=252,663)	Northbound migrants (N=215,022)	P-value	Border migrants (N=52,588)	Northbound migrants (N=38,823)	P-value
Other reasons	6.9	33.1		27.2	45.0	
Last 12 months in key context^{1/}						
Time spent in key context during last 12 months (months), Mean (SD)	4.2 (4.7)	6.4 (5.0)	< 0.001	5.8 (5.0)	6.0 (5.2)	0.901
Have been in prison for more than 24 hours in key context during last 12 months, %	8.5	6.1	0.389	0.1	1.2	0.048
Detention in key context due to immigration matters ^{2/} , %	40.5	NA	NA	100	NA	NA
Employed full-time most of the time in key context during last 12 months, %	48.7	60.9	0.016	31.1	38.2	0.470
Most common occupation in key context last 12 months, %			0.001			0.569
Professional	27.8	21.5		48.7	36.0	
Construction	14.7	10.5		0	0.1	
Industrial/factory	10.7	8.0		9.4	5.9	
Self-employed	8.2	7.6		7.2	21.4	
Market/store/warehouse	5.2	10.4		5.6	8.7	
Agriculture/landscaping	2.2	19.2		1.6	0.1	
Other	31.2	33.3		27.5	27.8	

^{1/} Key context refers to the migration environment represented by each flow- sending communities, and Mexican border region.

^{2/} Among those who had been in prison for more than 24 hours in the border region during last 12 months.

Comparison of last 12-month HIV related risk behaviors, testing and access to healthcare in key context¹ among Border and Northbound migrants.

Table 2

	Males			Females		
	Border migrants % (95% CI)	Northbound migrants % (95% CI)	P-value ²	Border migrants % (95% CI)	Northbound migrants % (95% CI)	P-value ²
Risk behaviors						
More than one vaginal or anal sex partners	16.6 (11.4–23.6)	27.8 (23.8–32.1)	0.378	5.2 (1.7–15.3)	18.8 (11.8–28.7)	0.061
Unprotected vaginal or anal sex	23.2 (17.1–30.5)	52.6 (48.0–57.2)	0.148	18.8 (9.4–34.2)	41.9 (32.1–52.4)	0.027
Anal sex with same-sex partners (men only)	1.8 (0.4–7.6)	3.5 (2.1–6.0)	0.492	NA	NA	NA
Unprotected anal sex with same- sex partners (men only)	1.5 (0.3–8.2)	1.9 (0.9–3.6)	0.324	NA	NA	NA
Vaginal or anal sex with casual partners	13.6 (8.6–20.7)	22.2 (18.6–26.2)	0.136	2.6 (0.9–7.6)	18.9 (11.2–30.1)	0.103
Unprotected vaginal or anal sex with casual partners	5.3 (2.6–10.5)	11.9 (9.3–15.1)	0.267	2.2 (0.6–7.4)	6.0 (2.6–13.5)	0.696
Vaginal or anal sex with sex workers	5.5 (2.6–11.2)	3.3 (2.0–5.4)	0.005	0	0	NA
Unprotected vaginal or anal sex with sex workers	2.1 (0.7–6.5)	1.7 (0.9–3.3)	0.391	0	0	NA
Sex with partners who had other sexual partners	14.3 (8.3–23.6)	10.4 (7.9–13.4)	0.226	15.3 (2.8–52.9)	12.9 (7.1–22.1)	0.139
Sex with intravenous drug user	0.3 (0.1–1.0)	1.7 (0.7–3.7)	0.973	1.0 (0.1–7.2)	0.8 (0.2–3.4)	0.969
Sex in exchange for money or other goods	4.5 (1.5–12.3)	0.5 (0.1–1.9)	0.003	0	4.5 (1.4–13.3)	NA
Sex against their will	0.2 (0.0–1.5)	0.8 (0.3–2.5)	0.753	0.8 (0.1–6.0)	4.3 (1.2–14.0)	0.573
Substance use	9.3 (5.3–16.0)	10.4 (7.9–13.7)	0.516	1.5 (0.4–6.1)	3.9 (1.2–11.9)	0.971
Sex under the influence of alcohol	23.2 (16.2–32.0)	33.3 (29.1–37.9)	0.019	25.2 (9.6–51.8)	24.2 (16.2–34.6)	0.855
Sex under the influence of illicit Drugs	4.9 (1.9–12.0)	6.3 (4.3–9.1)	0.246	1.4 (0.3–6.2)	1.1 (0.3–4.4)	0.615
Testing and healthcare access						
Self-rated HIV risk as high	32.8 (24.9–41.8)	12.2 (9.4–15.7)	<0.001	31.0 (16.9–49.7)	9.2 (5.2–16.0)	<0.001
Tested for HIV during the last 12 mos.	8.0 (3.7–16.3)	13.6 (10.7–17.2)	0.607	12.1 (4.5–28.6)	5.9 (2.9–11.7)	0.055
Knew where to get tested for HIV	56.7 (47.8–65.5)	61.9 (57.3–66.2)	0.057	76.3 (62.9–89.7)	62.5 (51.8–72.1)	0.989
Had a STI during the last 12 mos.	3.7 (1.9–7.0)	6.6 (4.6–9.3)	0.306	7.0 (2.8–16.1)	9.5 (4.7–18.1)	0.196
STI was treated by health professional ³	51.4 (21.6–80.2)	37.9 (22.0–56.9)	0.947	77.9 (30.5–96.6)	62.9 (22.6–90.8)	0.932
Health insurance in key context						
• None of the time	45.2 (36.0–54.4)	50.3 (45.7–54.9)	Ref	31.4 (14.1–48.7)	48.1 (37.6–58.8)	Ref
• Some of the time	6.5 (3.6–11.3)	8.0 (57.1–11.1)	0.190	5.0 (1.6–14.8)	4.9 (2.0–11.7)	0.802
• All of the time	48.3 (39.2–57.5)	41.7 (37.2–46.3)	<0.001	63.6 (45.7–81.5)	47.0 (36.6–57.6)	0.010

	Males			Females		
	Border migrants % (95% CI)	Northbound migrants % (95% CI)	P-value ²	Border migrants % (95% CI)	Northbound migrants % (95% CI)	P-value ²
Type of health insurance in key Context ⁴						
• Public program	22.0 (12.2–31.9)	21.5 (16.7–27.3)	Ref	23.3 (10.2–44.8)	21.9 (12.6–35.2)	Ref
• Private (paid for by • employer, self, or others)	75.3 (65.1–85.6)	77.7 (71.8–82.7)	0.545	69.4 (45.8–85.9)	76.3 (63.0–85.9)	0.363
• Other	2.6 (0.7–9.9)	0.8 (0.1–3.7)	0.726	7.3 (1.0–37.7)	1.8 (0.5–6.8)	0.409

¹Key context refers to the migration environment represented by each flow- the Mexican border region for Border migrants and the sending communities for Northbound migrants.

²P-values are based on logistic regression models, adjusted for age, marital status, education, ethnicity, and time spent in key context during last 12 months.

³Among those who had a STI while in the border during the last 12 months.

⁴Among those who had health insurance some or all of the time.

Table 3
Comparison of social norms regarding sexual behaviours in key context¹ among Border and Northbound migrants.

Men/women my age normally...	Males		Females		P-value ²
	Border migrants % (95% CI)	Northbound migrants % (95% CI)	Border migrants % (95% CI)	Northbound migrants % (95% CI)	
Use condoms with their stable partner	37.7 (28.9–46.6)	37.0 (32.5–41.6)	42.5 (23.6–63.9)	25.9 (17.8–36.1)	0.067
Use condoms with casual partners	70.4 (61.6–77.9)	67.9 (63.3–72.1)	61.7 (43.2–77.4)	55.3 (44.5–65.6)	0.459
Carry condoms with them	73.4 (65.5–80.1)	56.6 (51.8–61.1)	45.8 (26.6–66.4)	35.8 (26.0–46.9)	0.425
Easy to get condoms	83.4 (75.4–89.4)	82.3 (78.2–85.8)	92.3 (82.9–96.7)	83.1 (74.0–89.4)	0.117
Unfaithful to their spouse or stable partner	71.4 (61.5–79.5)	71.5 (67.1–75.7)	38.8 (23.2–57.2)	54.4 (43.7–64.7)	0.154
Have sex with casual partners	70.6 (59.7–79.5)	76.9 (72.7–80.7)	58.4 (36.7–77.3)	64.5 (53.9–73.8)	0.508
Have more than one sex partner	82.4 (75.3–87.8)	71.6 (67.1–75.8)	51.2 (31.6–70.4)	47.0 (36.6–57.6)	0.766
Have sex with prostitutes or sex escorts (men only)	65.1 (56.1–73.1)	51.0 (46.3–55.8)	NA	NA	NA

¹ Key context refers to the migration environment represented by each flow- sending communities, and Mexican border region.

² P-values are based on logistic regression models, adjusted for age, marital status, education, ethnicity, and time spent in key context during last 12 months.

Table 4

Comparison of incidence rates of last 12-month HIV risk behaviours in and out of the border region among the border migrants.

	In the border %/Month	Other places %/Month	Rate ratio (95% CI)
Male			
Vaginal or anal sex with casual partners	3.6	3.1	1.2 (0.8–1.6)
Unprotected vaginal or anal sex with casual partners	1.8	1.5	1.2 (0.7–1.9)
Vaginal or anal sex with sex workers	1.2	0.4	3.0 (1.5–6.3)**
Unprotected vaginal or anal sex with sex workers	0.4	0.06	6.6 (1.3–65.4)*
Female			
Vaginal or anal sex with casual partners	1.3	1.2	1.1 (0.3–3.6)
Unprotected vaginal or anal sex with casual partners	0.9	0.9	1.0 (0.2–4.1)
Vaginal or anal sex with sex workers	0	0	NA
Unprotected vaginal or anal sex with sex workers	0	0	NA

*
p<0.05

**
p<0.01