Migrants in Transit: The Importance of Monitoring HIV Risk Among Migrant Flows at the Mexico–US Border

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We conducted a probability-based survey of migrant flows traveling across the Mexico–US border, and we estimated HIV infection rates, risk behaviors, and contextual factors for migrants representing 5 distinct migration phases. Our results suggest that the influence of migration is not uniform across genders or risk factors. By considering the predeparture, transit, and interception phases of the migration process, our findings complement previous studies on HIV among Mexican migrants conducted at the destination and return phases. Monitoring HIV risk among this vulnerable transnational population is critical for better understanding patterns of risk at different points of the migration process and for informing the development of protection policies and programs. (*Am J Public Health.* 2015;105:497–509. doi:10.2105/AJPH.2014.302336)

Previous research indicates that Mexican labor migrants in the United States are at increased risk for HIV infection[1–3] and may be a bridge population for increasing rates of HIV/AIDS in rural Mexico.[4–6] The behavioral ecological model posits that health behaviors are influenced by a hierarchy of factors, including individual characteristics, features of the proximal context, and broader structural factors.[7] The proximal context involves the physical and social conditions in which individuals live, work, learn, and play. The broader environment comprises political, social, and economic structures and cultural factors. Bidirectional influences exist across factors at the individual, contextual, and structural level, with interventions at the structural level having the most far-reaching public health impact.[7] Mexican migrants tend to be male and young, have low levels of educational attainment, and report limited HIV prevention knowledge and condom use.[8,9] Increased risk for HIV in migrants may result from the interplay between these individual characteristics and the broader contextual and structural factors in migration between Mexico and the United States.[10]

Migration is a complex and multistage process involving 5 phases: predeparture, transit, destination, interception, and return.[11] Different constellations of contextual and structural factors may influence risk behaviors for HIV infection among migrants at each of these stages. Research on HIV risk among migrants must cover the different phases involved in the migration process and identify risks as well as prevention and treatment opportunities associated with each of them.[12] Much of our knowledge regarding HIV prevalence and behavioral risk factors among Mexican migrants has emanated from surveys conducted among receiving communities in the United States [1,2,13–15] and sending communities in Mexico.[16,17] These studies have covered the destination and return phases of migration.

Mexican migrants in the United States (i.e., the destination) are exposed to contexts that may heighten their HIV risk. HIV prevalence rates are higher in the United States than in Mexico,[18] increasing the probability of coming into contact with the virus. Furthermore, many migrants live in environments characterized by unbalanced gender composition (i.e., male overrepresentation) and limited family- and community-based social behavioral controls.[19] They experience loneliness, geographic isolation, social exclusion,[20] fear,[21] poor living and working conditions, and limited access to health care, including access to HIV testing and other prevention services.[2,16,19,21–24] All these factors coalesce to increase the probability of risk behaviors for HIV, such as alcohol and drug use, sex with sex workers, and unprotected sex practices.[9,10] Surveys in Mexican sending communities have documented higher rates of behavioral risk factors, such as a higher number of sexual partners and illicit drug use, but also increased rates of condom use, knowledge of HIV transmission, and HIV testing among return migrants, compared to nonmigrants in the same communities.[16,25]

Little research has examined HIV risk among Mexican migrants during the predeparture, transit, and interception phases of the migration process. The same factors that may push migrants away from their sending communities, such as poverty,[26] violence,[27] and gender power unbalances,[28,29] are also structural factors that may increase their HIV risk even before they leave these communities.[30] The transit phase is defined as the period when migrants are between their place of origin and their destination.[11] For most Mexican migrants, the northern border of Mexico is an intermediate point in their trajectory between the 2 countries. Northbound unauthorized and deported migrants may spend time in this transit location making arrangements to enter or reenter the United States. This region has been described as at heightened risk for infectious diseases such as HIV to occur and is characterized by "an economically disadvantaged population" and "a nexus for drug use, prostitution, and mobility."[31(p428)]

Research with injecting drug users and sex workers in Mexican border cities has provided critical evidence of migration as a structural risk factor for HIV infection and substance use as well as the prevention needs of these high-risk groups.[14,32] These studies have offered some insights into the potential risks among migrants in this intermediate migration context. Finally, migrants apprehended while trying to enter or after reaching the destination communities (i.e., interception phase) are at a particularly critical stage. Detention in immigration

centers or prisons can have detrimental effects on migrants' health.[11] Interception may also be a marker of higher social vulnerability, as migrants who have less economic and social resources are more likely to experience this migration phase. A recent survey found higher rates of HIV infection and behavioral risk factors among deported Mexican migrants in Tijuana, Mexico, than among the US and Mexico populations.[33] In general, knowledge concerning HIV risk among migrants at the 5 migration phases is fragmented, and the heterogeneity of sampling and data collection methodologies that previous studies have used creates challenges for comparing data on the different phases.

There are an estimated 12 million Mexican migrants in the United States.[34] Although not all migrants go through all 5 migration phases (some may never be intercepted, some may settle permanently in the region of destination and never return), many Mexican migrants go through 2 or more of these phases in their lifetime. Data on Mexican migration patterns indicate that circular migration (i.e., traveling back and forth between Mexico and the United States) is relatively common among Mexican migrants.[34,35] About 29% of Mexican migrants are estimated to engage in circular migration,[36] and 50% of undocumented migrants leave the United States within the first year of immigration.[37] Proximity, social and political conditions, transportation costs, and cultural identity make Mexicans more likely to return to their home country than are migrants from other countries. Although the strengthening and stricter enforcement of border policies has lowered this trend in recent years, the incentives to emigrate out of Mexico have also increased.[38] These circular migration patterns between Mexico and the United States result in sizable migrant flows traveling across the Mexican border.

It is estimated that each year more than 600 000 Mexican migrants arrive in the United States, approximately 400 000 Mexican migrants return from the United States, and approximately 400 000 Mexican migrants are deported to Mexico.[39,40] The same individual may arrive, return, or be deported more than once. In 2012, the net rate of Mexicans departing Mexico (mostly to the United States) and entering Mexico (most of whom are return migrants) was 41.9 and 14.3 per 1000, respectively.[41] An estimated 300 000 Mexican migrants were admitted to a detention facility and repatriated by US immigration authorities,[42] and an additional 266 000 unauthorized Mexican migrants were apprehended at the Mexican border.[40] The volume and mix of migrants traveling across the Mexico–US border makes this region an important setting for binational monitoring of the mobile populations' health. Such monitoring can further our understanding of HIV infection levels and of behavioral and environmental factors that contribute to HIV infection among Mexican migrants representing different phases and contexts of the migration process. Ongoing surveillance of this region can also reveal changes in HIV infection and behavioral risk factors among migrants on the move and inform the need for interventions to reduce HIV risk among Mexican migrants in sending, receiving, and intermediate communities.

We estimated and compared the levels of HIV infection, risk behaviors, and contextual factors associated with different migration phases, using data from a survey of migrant flows who traveled across the Mexico–US border region and represented the different phases and geographic contexts of migration between Mexico and the United States.

METHODS

From June 2009 to August 2010, we conducted a cross-sectional probability survey of migrants in Tijuana, Mexico. Migration experts estimate that most Mexican migrants traveling between Mexico and the United States do so by ground and approximately 90% of them access the Mexico–US border region from 8 Mexican border towns.[43,44] Migrants arrive at or depart from these Mexican border towns from specific sites associated with the transportation infrastructure linking these cities to the rest of Mexico and to the United States (e.g., bus stations, train stations, airports, deportation facilities). The city of Tijuana concentrates about 40% of the migration flow between Mexico and the United States.[45]

We modeled the survey after the large periodic survey of Mexican migrants known as the *Encuesta sobre Migración en la Frontera Norte de México* (Survey of Migration on the North Border of Mexico)—a migration survey commissioned by the *Mexican Secretaría del Trabajo y Previsión Social* (Mexico's Secretariat of Labor and Social Services) and the *Consejo Nacional de Población* (Mexico's National Population Council) and conducted by *El Colegio de la Frontera Norte* (North Border College) along the Mexico–US border.[43] We used a multistage probability sampling design. *Encuesta sobre Migración en la Frontera Norte de México* demographers generated the sampling framework quarterly by continuously counting the persons circulating through each of the sample sites during a 7-day period. On the basis of this framework, we selected a random sample of venue–time pairs quarterly to determine where and when the survey was to be conducted. Sampling venues included the Tijuana International Airport, the largest bus station in Tijuana (i.e., *Central Camionera de Autobuses*), and the main deportation station in Tijuana (i.e., *Delegacion Federal de Migracion, San Ysidro*). Within these venues, sampling points were the passport and security control and the luggage claiming gates at the airport; the ticket desk and the luggage claim areas at the bus station; and the gates of the immigration building at the San Ysidro deportation station. The temporal dimension consisted of the day of the week and the survey shift. We selected venues and temporal units with probability of selection proportional to the volume of the migrant flows traveling through each venue and period.

Mexican Migrant Flows

By contrast with migrants already living in a country or region (known as a region's migrant stock or foreign-born population), a migrant flow is the group of migrants that enter a country or region during a specific time frame. Similar to the *Encuesta sobre Migración en la Frontera Norte de México*, our survey recruited probability samples of the 4 migration flows that travel to the Mexico–US border region: (1) a northbound flow composed of migrants traveling north from other Mexican regions, (2) a border flow composed of migrants traveling to other areas of Mexico after a stay in the Mexican border region, (3) a southbound flow composed of migrants returning voluntarily to Mexico from the United States, and (4) a flow composed of

migrants removed from the United States by immigration authorities and released in the Mexican border region. These migrant flows include migrants with different spatial trajectories and represent different migration phases and contexts (Figure A, available as a supplement to the online version of this article at http://www.ajph.org).

The northbound flow travels from its communities of origin in Mexico and arrives at the border region as its final destination or as an intermediate site in its journey to the United States. This flow includes both individuals with a migration history and inexperienced migrants who are embarking on internal or international migration for the first time. When they arrive at the border, migrants in this flow have had limited exposure to the risks associated with this intermediate geographic context. We determined their behavior and infection status from their migration history and recent exposure to the contextual factors in their communities of origin. Data on HIV risk among migrants in this flow encompasses risks encountered in the communities of origin during the predeparture phase (northbound migrants without a history of migration to the United States) or the return phase (migrants with a US migration history).

Migrants in the border flow are leaving Tijuana to travel to other regions in Mexico after a stay in the Mexican border. They may or may not have been in the United States during their most recent migration spell, but the context in which they spent most time was the Mexican border. This flow is also a mix of individuals with and without migration experience. Most importantly, this flow carries the exposure to the Mexican border region, which is a high-risk transit area.[31] Because of its trajectory though an intermediate region between Mexico and the United States, this flow offers a snapshot of HIV risk during the travel or transit phase.

The southbound flow comprises migrants and immigrants who are returning voluntarily to sending communities in Mexico after having been in the United States for some time. This flow includes immigrants permanently established in the United States as well as temporary or seasonal migrants who are returning to their communities of origin in Mexico. Individuals in this flow carry with them the exposures accumulated during their recent stay in the United States. Thus, data from this flow can be regarded as representing HIV risk among migrants during the destination phase.

The deported flow includes individuals who were intercepted while trying to cross to the United States and individuals who successfully crossed and were deported after having been in the United States for a time. For them, the Mexican border region is a departure site on the way to their communities of origin in Mexico or, most often, from which to attempt to return to the United States. Because of its recent deportation and likely socioeconomic conditions (e.g., undocumented status, limited access to health care, fear of deportation) before deportation, this may be the most vulnerable migrant flow. Data on HIV risk among this flow provides information related to migrants at the interception phase.

By sampling these different migrant flows, the circular pattern and transnational nature of Mexican migration[11] can be captured, and the epidemiological picture painted so far by studies on migrants residing in sending communities in Mexico or in receiving communities in the United States can be completed with data from migrants who are transitioning from 1 migration phase to another. In essence, surveying migrant flows in the Mexico–US border region answers questions that are different from those answered by previous studies in Mexico or the United States. The former have provided estimates of the prevalence of HIV among return migrants or migrants in the United States. Those estimates are important for gauging the magnitude of the problem and informing the allocation of prevention and treatment resources in sending and receiving communities. A survey of migrant flows offers complementary estimates of HIV infection and the behavioral and contextual risk factors associated with different stages of the migration experience. This methodology can provide critical information about the patterns of risk practices and contributing factors associated with these key phases. The focus on migrant flows instead of migrant stocks can help us understand if and how risks change as migrants transition through different stages and contexts.

Procedures

We consecutively approached and screened individuals crossing through the sampling points for eligibility. We recruited northbound migrants upon arrival to the sites as they made their way to the luggage claim area of the airport or bus station. We recruited southbound and border migrants in the airport immediately after they went through the passport and security control area in the airport and on their way to the boarding gates. In the bus station, we recruited them on their way from the ticket desk to the waiting area. For deported migrants, recruitment took place as migrants made their way from the deportation station once they had been released by Mexican migration officials and were free to go.

A project staff member explained the study, emphasizing that participation was voluntary, and obtained informed verbal consent. Eligible individuals were aged 18 years or older, were born in Mexico or another Latin American country, were fluent in Spanish, were not Tijuana residents (except for deported migrants), were traveling for labor reasons or change of residence, and did not have a history of previous participation in the survey. Study participants received a $10 phone card incentive.

Participants completed an anonymous, interviewer-administered questionnaire using Questionnaire Development System computer-assisted personal interview (NOVA Research Company, Bethesda, MD). Questions covered sociodemographics, migration history, contextual factors related to the most recent migration stage, and last 12-month risk behaviors. We gave participants a Food and Drug Administration–approved rapid finger-stick blood HIV test. We used either Clearview HIV 1/2 STAT-PAK (Inverness Medical Professional Diagnostics, Princeton, NJ) or Hexagon HIV 1+2 (Human GMBH, Wiesbaden, Germany), depending on availability and price. Sensitivity for these tests is reported as 99.7% and 100.0%, respectively. Specificity is reported as 99.9% and 99.3%, respectively.[46,47] Using OraSure HIV-1 Oral Specimen Collection Device (OraSure Technologies, Inc., Bethlehem, PA), we collected oral mucosal transudate samples from participants with positive or invalid results to the rapid test, which were subject to confirmatory testing by means of the Western blot procedure (98.0% specificity[48]). We set up a binational, toll-free telephone line to communicate the results of confirmatory testing to the anonymous study

participants using a unique numeric code assigned to each participant. When indicated, we referred callers for follow-up testing and treatment as determined by their location.

Samples

We set a target total sample size of 3000 on the basis of power estimates necessary to detect small HIV prevalence rates. In all, 6594 individuals met eligibility criteria for study inclusion. Among these, 3390 participated in the survey; 95.3% (n = 3230) completed the questionnaire and 83.6% (n = 2811) agreed to be tested for HIV (Figure B, available as a supplement to the online version of this article at http://www.ajph.org). The overall response rate was 51.4%, with substantial variation across flows. The highest response rate was obtained with the deported flow (98.0%), probably because at the time they were recruited for the survey, migrants in this flow were not traveling yet and many did not have immediate plans or people waiting for them. The final sample included 2908 men and 482 women.

Statistical Analysis

We weighted the observations for estimation of flow-specific parameters. We computed survey weights for each observation to account for the complex survey design and response rates. The computation of weights followed the general principles used for estimating the weights of any survey on the basis of multistage sampling procedures and has been reported elsewhere.[21] Using the weighted data, we computed descriptive statistics, including means, SDs, percentages, and 95% confidence intervals (CIs). We computed point prevalence estimates and 95% CIs for HIV infection and related risk factors by migration phase and gender. We used logistic and multiple linear regression models with unweighted data to test for statistically significant differences in selected sociodemographic, migration, contextual, and behavioral risk factors between migrants in the 5 migration phases. Whenever possible, we used the predeparture phase (that of northbound migrants without migration experience) as the reference category vis-à-vis the other migration phases (transit, destination, interception, and return). For variables not applicable to the predeparture phase (e.g., history of illegal border crossing), we used the return phase as the reference vis-à-vis the transit, destination, and intersection phases. We adjusted models for differences in contextual and behavioral risk factors for age, education level, marital status, and ethnicity. We stratified all analyses by gender and conducted them using Stata/MP 13.0 (StataCorp LP, College Station, TX).

RESULTS

The study sample represented a weighted population of 1 033 201 migrants traveling through Tijuana during the 15-month study period, with approximately 889 661 migrant males and 143 540 migrant females.

Male Migrants

Sociodemographic characteristics. Male migrants were typically in their midthirties and had low levels of formal education. About half were married or cohabiting with their partners. Migrants in most other phases tended to be less educated and more likely to be of indigenous ethnicity than were migrants at the predeparture phase.

Migration history. By definition, none of the migrants at the predeparture phase and all the migrants at the return, destination, and interception phases had a history of migration to the United States. Among male migrants in the transit phase, 31% had a history of migration to the United States (Table 1). Migrants in the transit phase reported shorter periods of time lived in the United States and being less likely to have a history of illegal entry into the United States or deportation than did migrants in the return phase. Migrants in the destination phase were more likely to consider the United States their country of residence than were migrants in the return phase. Migrants in both the destination and the interception phases were more likely to have a history of illegal crossing and deportation than were migrants in the return phase. Finally, migrants in the interception phase were the most likely to have a history of illegal crossing and deportation.

Contextual factors. After adjusting for age, education, marital status, and ethnicity, male migrants in the transit, destination, and interception phases were less likely to live with their spouses, partners, or a family member; live in a house or apartment; have a formal work contract; have health insurance; or know where to get tested for HIV than were migrants in the predeparture phase (Table 1). By contrast, migrants in the predeparture phase were less likely to have a history of detention or imprisonment in the last 12 months and to perceive high levels of risk for HIV in their communities. We observed some differences in contextual factors between male migrants in the predeparture versus the return phase, including availability of a formal employment contract, health insurance, knowledge of HIV testing locations, and perception of HIV risk in the community. In general, these contextual factors were worse for migrants in the return phase than for those in the predeparture phase.

Behavioral risk factors. After adjusting for sociodemographic factors, we found that migrants in the return phase had higher rates of behavioral risk factors, such as multiple sexual partners, sex with casual partners or sex workers, and unprotected sex with casual partners or sex workers (Table 2) than did migrants in the predeparture phase. We also observed a higher risk profile, although this was less consistent across factors, for migrants at the border, destination, and interception phases. Notably, sex with intravenous drug users was significantly more likely among deported migrants than among migrants at predeparture. Conversely, rates of HIV testing over the lifetime and in the last 12 months were significantly higher for migrants at the return, destination and interception phases than for migrants at predeparture.

Female Migrants

Sociodemographic characteristics. Female migrants had a sociodemographic profile similar to that of the male migrants. In general, women at predeparture were younger than were those at the destination phase and older than were those at interception. Those at predeparture also had higher levels of education than did intercepted migrants (Table 3).

Migration history. Only 14% of female migrants at the transit phase had a history of migration to the United States (Table 3). Migrants in all other phases had spent less time in their communities of origin during the last 12 months than had migrants in the predeparture phase. Migrants in the predeparture phase were also less likely to be heading to the

TABLE 1—Sociodemographic, Migration, and Contextual Characteristics of Male Mexican Flows Representing Different Migration Phases and Contexts: Tijuana, Mexico, 2009–2010

Characteristic	Sending Communities		Border	Receiving Communities		P [a]
	Predeparture (Weighted n = 112 668), % (95% CI) or Mean ±SD	Return (Weighted n = 96 337), % (95% CI) or Mean ±SD	Transit (Weighted n = 252 663), % (95% CI) or Mean ±SD	Destination (Weighted n = 391 083), % (95% CI) or Mean ±SD	Interception (Weighted n = 36 860), % (95% CI) or Mean ±SD	
Sociodemographics						
Age, y	32.6 ±10.2[b]	35.9 ±10.8**	32.7 ±10.2	34.7 ±11.9**	31.8 ±9.2	< .001
Completed high school or higher	60.9 (54.5, 66.9)[b]	22.9** (18.0, 28.7)	50.3 (41.4, 59.1)	20.8** (16.1, 25.4)	13.7** (10.3, 17.0)	< .001
Married or cohabiting	51.6 (45.2, 57.9)[b]	61.6 (54.9, 67.8)	50.3 (41.4, 59.1)	51.5 (45.1, 57.8)	49.2 (44.2, 54.2)	.008
Indigenous ethnicity	2.3 (1.1, 4.8)[b]	7.7* (4.7, 12.3)	1.7 (0.2, 3.1)	4.9* (2.9, 6.9)	4.8 (2.8, 6.8)	.02
Migration						
History of migration to the United States	0.0	100.0	31.0 (21.7, 40.4)	100.0	100.0	NA
Lifetime in the United States, y	0.0	9.5 ±9.7[c]	1.6 ±3.9	11.9 ±9.5	9.2 ±8.8	< .001
Time in the United States during last 12 mo, d	0.0	159.3 ±148.0	21.2 ±67.0	278.5 ±122.6	243.4 ±152.0	< .001
Time in the Mexico–US border region during last 12 mo, d	69.5 ±120.3[b]	25.7 ±69.7**	126.1 ±141.5**	24.1 ±78.0**	38.5 ±95.3**	< .001
Time in sending Mexican communities, d	235.3 ±144.6[b]	141.2 ±143.1**	145.7 ±148.9**	37.3 ±82.9**	66.7 ±126.3**	< .001
Current country of residence is the United States	0.0	29.3 (23.7, 35.6)[b]	0.0	47.2** (41.0, 53.4)	32.0** (27.2, 36.7)	< .001
Crossed the border illegally the last time	0.0	49.6 (40.9, 58.3)[b]	23.7** (14.6, 32.8)	63.2 (57.1, 69.3)	96.4** (94.6, 98.2)	< .001
History of deportation from the United States	0.0	49.9 (43.1, 56.6)[b]	22.5** (13.2, 31.9)	52.6 (46.2, 59.0)	100.0	< .001
Final destination is the United States	16.1 (11.8, 21.5)[b]	51.4** (44.7, 58.1)	59.2** (50.3, 68.2)	NA	NA	< .001
Plans to return to the United States	NA	NA	NA	73.6 (67.0, 80.1)[b]	70.6** (66.0, 75.2)	< .001
Contextual factors						
Living with spouse or partner	43.7 (37.5, 50.1)[b]	38.5** (32.1, 45.4)	16.3** (11.5, 22.4)	20.5** (16.4, 25.3)	22.2** (18.0, 26.9)	< .001
Living with other family members	81.4 (75.4, 86.2)[b]	82.8 (77.0, 87.4)	45.0** (36.0, 54.4)	62.8** (55.8, 69.3)	65.3** (59.1, 71.0)	< .001
Living with friends or co-workers	6.2 (3.8, 10.1)[b]	3.3 (1.7, 6.3)	24.9** (17.5, 34.2)	25.0** (19.4, 31.4)	20.4** (15.9, 25.6)	< .001
Living in a house or apartment	99.1 (97.8, 99.7)[b]	93.5** (88.9, 96.3)	67.4** (58.5, 75.2)	88.9** (84.1, 91.9)	86.4** (82.8, 89.3)	< .001
Had a formal employment contract[c]	51.7 (44.6, 58.6)[b]	16.4** (11.1, 23.5)	50.6* (40.1, 61.1)	17.0** (12.4, 22.8)	16.7** (12.8, 21.5)	< .001
Had health insurance	64.7 (58.4, 70.6)[b]	32.1** (26.1, 38.9)	54.8 (45.6, 63.7)	39.0** (32.7, 45.7)	27.0** (22.6, 32.0)	< .001
Knows where to get tested for HIV	66.7 (59.9, 73.0)[b]	51.8 (44.4, 59.2)	55.7** (46.1, 64.9)	59.2 (52.1, 65.8)	49.0 (43.0, 55.1)	< .001
Was detained or imprisoned in last 12 mo	5.7 (3.1, 10.3)[b]	26.8** (21.2, 33.3)	13.1* (7.2, 22.6)	37.0** (30.9, 43.5)	34.3** (29.8, 39.1)	< .001
Perceived high risk for HIV in the community	8.0 (4.5, 13.9)[b]	16.3* (11.6, 22.4)	32.8** (25.0, 41.7)	17.9** (13.5, 23.4)	29.3** (24.7, 34.4)	< .001

Note. CI = confidence interval; IQR = interquartile range; NA = not applicable.

[a]*P* value for overall effect of migration phase is derived from logistic (for binary outcomes) and multiple linear (for continuous outcomes) regression models. Models for sociodemographic and migration variables were unadjusted. Models for contextual factors were adjusted for age, marital status, education, and ethnicity.

[b]Reference category.

[c]Among those employed.

*P < .05; **P < .01 (all for comparison with the reference category).

TABLE 2—HIV Infection and Last 12-Month Behavioral Risk Practices for HIV Infection Among Male Mexican Migrant Flows Representing Different Migration Phases and Contexts: Tijuana, Mexico, 2009–2010

	Sending Communities		Border	Receiving Communities		
Variable	Predeparture (Weighted n = 112 668), % (95% CI)	Return (Weighted n = 96 337), % (95% CI)	Transit (Weighted n = 252 663), % (95% CI)	Destination (Weighted n = 391 083), % (95% CI)	Interception (Weighted n = 36 860), % (95% CI)	P[a]
≥ 2 sexual partners	40.5 (34.40, 46.90)[b]	41.2 (34.60, 48.00)	44.0* (34.90, 53.10)	40.2 (33.80, 46.80)	37.1 (32.30, 41.90)	.185
Anal sex with same-sex partners	5.1 (2.80, 9.10)[b]	2.7 (1.10, 6.10)	2.6 (0.00, 5.40)	1.7 (0.00, 3.60)	1.1 (0.20, 1.90)	.791
Unprotected anal sex with same-sex partners	2.2 (1.00, 4.90)[b]	1.3 (0.30, 4.90)	2.2 (0.00, 5.00)	1.3 (0.00, 3.20)	0.2 (0.00, 0.50)	.525
Vaginal or anal sex with casual partners or sex workers	32.3 (26.70, 38.50)[b]	39.6** (33.10, 46.30)	39.5* (30.50, 48.50)	37.2 (30.90, 43.50)	32.6 (28.00, 37.20)	.022
Unprotected vaginal or anal sex with casual partners or sex workers	16.3 (12.20, 21.30)[b]	23.2* (18.10, 29.20)	21.5 (13.00, 30.00)	19.1 (13.60, 24.60)	17.4 (13.50, 21.20)	.021
Sex with intravenous drug user	1.5 (0.50, 4.70)[b]	3.2 (1.40, 7.20)	0.9 (0.20, 1.50)	3.2 (0.90, 5.40)	6.4** (3.90, 8.90)	.044
Sex under the influence of alcohol	41.7 (35.50, 48.20)[b]	42.7 (36.20, 49.60)	40.0 (30.90, 49.00)	37.7 (31.60, 43.90)	35.9 (31.10, 40.80)	.054
Sex under the influence of other drugs	2.6 (1.10, 6.00)[b]	10.0** (6.40, 15.30)	7.2 (0.50, 13.90)	6.0 (2.60, 9.40)	10.7 (7.60, 13.70)	< .001
Lifetime history of STI	13.2 (9.40, 18.30)[b]	23.1 (17.80, 29.50)	22.7 (14.90, 30.60)	21.0* (15.50, 26.60)	21.8** (17.60, 26.00)	.123
Had STI during last 12 mo	7.1 (4.40, 11.40)[b]	10.4 (6.70, 15.70)	6.5 (2.90, 10.00)	7.3 (4.20, 10.40)	9.8 (6.60, 13.00)	.850
Ever tested for HIV infection	48.5 (42.10, 55.00)[b]	49.7** (42.90, 56.50)	41.7 (32.60, 50.70)	45.7** (39.30, 52.20)	51.1** (46.10, 56.20)	< .001
Tested for HIV in last 12 mo	16.9 (12.50, 22.40)[b]	18.6* (13.80, 24.60)	12.5 (6.30, 18.70)	17.3** (12.30, 22.20)	25.6** (21.30, 29.80)	< .001
HIV infection point estimate	1.01 (0.24, 4.180)[b]	0.08 (0.01, 0.50)	3.89 (1.01, 13.80)	0.18 (0.03, 1.21)	0.80 (0.37, 1.69)	.559
HIV infection lower bound estimate[c]	0.91 (0.21, 3.79)[b]	0.07 (0.01, 0.43)	3.31 (0.86, 11.90)	0.14 (0.02, 0.99)	0.73 (0.34, 1.54)	.496

Note. CI = confidence interval; NA = not applicable; STI = sexually transmitted disease.
[a]*P* value for overall effect of migration phase was derived from logistic regression models. Models were adjusted for age, marital status, education, and ethnicity.
[b]Reference category.
[c]Assuming all male survey respondents not tested at the study site were HIV negative.
$*P < .05$; $**P < .01$ (all for comparison with the reference category).

United States at the time of the survey than were their counterparts at the return and transit phases. Deported women were less likely to consider the United States their country of residence and more likely to have a history of illegal entry into the United States than were migrants at the return phase.

Contextual factors. We identified fewer and less consistent differences in contextual factors across the 5 migration phases for female migrants (Table 3). Female migrants at the return phase were less likely to live with their spouses or partners and less likely to have health insurance than were women at the predeparture phase. During the transit and interception phases, female migrants were less likely to live in a house or apartment and more likely to perceive high levels of HIV risk in their communities.

Behavioral risk factors. Multivariate models suggest that female migrants at the return and destination phases had generally lower rates of risk behaviors than did women at predeparture (Table 4). Conversely, HIV testing rates were significantly higher for women in every other migration phase than were rates for women at predeparture.

HIV Prevalence Estimates for Migrants

Estimates of HIV prevalence among male migrants were 1.01% at predeparture, 0.08% at return, 3.89% at transit, 0.18% at destination, and 0.80% at interception (Table 2). HIV prevalence was 0.17% for female migrants in the destination phase. No female migrants in the other phases tested positive for HIV (Table 4).

In all, we found 18 study participants (17 men and 1 woman) to be positive for HIV (3 in the predeparture, 2 the return, 3 the transit, 3 the destination, and 7 the interception phases). Their sociodemographic and risk characteristics are provided in the online version of this article as supplemental Table A at http://www.ajph.org. Of the 18 migrants who tested positive for HIV, 6 reported prior testing for HIV infection; only 2 reported that the result of their last HIV test was positive. Among survey respondents we did not test for HIV (n = 572), 56.8% reported having ever been tested for HIV infection. Only 1 (at the destination phase) reported a positive HIV status. Because infection could not be verified by our testing

TABLE 3—Sociodemographic, Migration, and Contextual Characteristics of Female Mexican Migrant Flows Representing Different Migration Phases and Contexts: Tijuana, Mexico, 2009–2010

Characteristic	Sending Communities		Border	Receiving Communities		P [a]
	Predeparture (Weighted n = 28 567), % (95% CI) or Mean ±SD	Return (Weighted n = 8443), % (95% CI) or Mean ±SD	Transit (Weighted n = 52 588), % (95% CI) or Mean ±SD	Destination (Weighted n = 50 449), % (95% CI) or Mean ±SD	Interception (Weighted n = 3493), % (95% CI) or Mean ±SD	
Sociodemographics						
Age, y	35.3 ±13.8[b]	34.4 ±12.1	34.3 ±13.3	39.1 ±12.9**	30.6 ±9.5	< .001
Completed high school or higher	60.2 (48.2, 71.1)[b]	53.1 (31.9, 73.2)	60.8* (40.5, 81.1)	37.2 (25.2, 49.2)	19.6** (6.2, 33.0)	< .001
Married or cohabiting	38.9 (28.0, 51.0)[b]	44.5 (24.8, 66.1)	40.2 (20.8, 59.7)	42.7 (29.6, 55.9)	50.1 (33.1, 67.0)	.656
Indigenous ethnicity	1.9 (0.3, 12.5)[b]	5.8 (1.3, 22.2)	0.1 (0.0, 0.3)	2.3 (0.0, 5.3)	3.5 (0.0, 10.3)	.302
Migration						
History of migration to the United States	0.0	100.0	13.7 (2.6, 24.9)	100.0	100.0	NA
Lifetime in the United States, y	0.0	10.8 ±9.8[b]	1.3 ±2.6	13.6 ±11.0	7.1 ±9.6	< .001
Time in the United States during last 12 mo, d	0.0	262.9 ±120.7	32.8 ±75.4	265.2 ±123.4	168.0 ±168.1	< .001
Time in the Mexico–US border region during last 12 mo, d	93.7 ±135.0[b]	11.0 ±44.1**	175.0 ±151.6**	13.3 ±53.2**	16.7 ±55.7***	< .001
Time in sending Mexican communities, d	215.8 ±150.2[b]	71.4 ±109.9**	126.4 ±145.6*	48.8 ±95.0**	143.4 ±159.3*	< .001
Current country of residence is the United States	0.0	69.6 (50.0, 84.0)[b]	0.0	61.3 (48.2, 74.4)	33.1 (16.3, 49.9)	.002
Crossed the border illegally last time	0.0	6.0 (1.0, 27.9)[b]	10.1 (2.0, 18.1)	22.3 (10.1, 34.4)	89.5** (78.2, 100.0)	< .001
History of deportation from the United States	0.0	10.6 (3.6, 27.4)[b]	3.5* (0.0, 8.5)	11.8 (3.1, 20.5)	100.0	.089
Final destination is the United States	22.5 (14.1, 33.8)[b]	80.3** (63.1, 90.6)	59.7** (40.2, 79.3)	NA	NA	< .001
Plans to return to the United States	NA	NA	NA	87.8 (78.4, 97.2)	66.7* (49.5, 83.9)	.024
Contextual factors						
Living with spouse or partner	30.6 (20.6, 42.8)[b]	5.4** (1.5, 17.7)	35.2 (18.4, 56.7)	29.6 (18.6, 43.7)	25.9 (13.5, 43.8)	.014
Living with other family members	73.9 (60.5, 84.0)[b]	83.9 (59.4, 94.9)	64.4* (43.3, 81.1)	89.0 (81.1, 93.8)	84.9 (56.9, 96.0)	.083
Living with friends or co-workers	5.6 (2.3, 13.4)[b]	6.8 (0.9, 37.7)	21.2 (9.1, 42.0)	6.9 (3.3, 13.7)	6.2 (0.9, 33.2)	.245
Living in a house or apartment	97.6 (91.9, 99.3)[b]	100.0	85.4** (65.7, 94.7)	96.9 (93.2, 98.6)	81.7* (7.0, 93.0)	.001
Had a formal employment contract[c]	39.8 (24.3, 57.7)[b]	20.0 (2.1, 74.7)	62.5 (40.8, 80.1)	16.5 (8.3, 30.2)	16.4 (4.8, 43.0)	.482
Had health insurance	57.1 (44.7, 68.7)[b]	32.8** (13.9, 59.6)	68.6 (49.2, 83.1)	46.6** (33.1, 60.6)	34.3** (18.9, 53.9)	< .001
Knows where to get tested for HIV	61.3 (47.9, 73.1)[b]	70.7 (45.0, 87.7)	74.9 (57.0, 87.0)	66.1 (50.8, 78.6)	67.2 (45.0, 83.7)	.435
Was detained or imprisoned in last 12 mo	1.5 (0.2, 10.0)[b]	3.5 (0.4, 23.4)	1.8 (0.3, 11.0)	6.5 (2.1, 18.0)	10.1** (4.5, 21.3)	.037
Perceived high risk for HIV in the community	9.6 (5.1, 17.6)[b]	7.7 (1.9, 27.1)	31.0** (17.1, 49.4)	13.1 (7.0, 23.1)	32.9** (19.0, 50.6)	< .001

Note. CI = confidence interval; IQR = interquartile range; NA = not applicable.

[a]*P* values for overall effect of migration phase were derived from logistic (for binary outcomes) and multiple linear (for continuous outcomes) regression models. Models for sociodemographic and migration variables were unadjusted. Models for contextual factors were adjusted for age, marital status, education, and ethnicity.

[b]Reference category.

[c]Among those employed.

*P < .05; **P < .01 (all for comparison with the reference category).

TABLE 4—HIV Infection Rates and Last 12-Month Behavioral Risk Practices for HIV Infection Among Female Mexican Migrant Flows Representing Different Migration Phases and Contexts: Tijuana, Mexico, 2009–2010

Variable	Sending Communities		Border	Receiving Communities		
	Predeparture (Weighted n = 28 567), % (95% CI)	Return (Weighted n = 8443), % (95% CI)	Transit (Weighted n = 52 588), % (95% CI)	Destination (Weighted n = 50 449), % (95% CI)	Interception (Weighted n = 3493), % (95% CI)	P^a
≥ 2 sexual partners	27.6 (17.8, 40.1)[b]	16.1 (4.2, 45.6)	18.1 (3.4, 32.9)	7.4* (0.0, 15.0)	17.0 (4.0, 30.1)	.036
Vaginal or anal sex with casual partners or sex workers	24.0 (14.6, 36.9)[b]	12.2 (2.2, 45.6)	14.7 (0.5, 28.9)	4.3 (1.1, 7.6)	12.7 (1.9, 23.6)	.215
Unprotected vaginal or anal sex with casual partners or sex workers	10.9 (4.9, 22.5)[b]	10.1 (1.3, 48.3)	14.1 (0.0, 28.3)	1.8 (0.0, 3.6)	10.4 (0.0, 20.9)	.385
Sex with intravenous drug user	2.3 (0.6, 8.0)[b]	3.5 (0.4, 23.1)	2.7 (0.0, 6.6)	0.5 (0.0, 1.3)	2.7 (0.0, 8.0)	.993
Use of illegal drugs	7.6 (2.8, 19.2)[b]	18.1 (5.2, 47.2)	5.9 (0.0, 14.5)	2.4 (0.0, 6.1)	2.0 (0.0, 4.5)	.676
Sex under the influence of alcohol	32.3 (22.0, 44.5)[b]	10.8 (2.4, 36.7)	42.4 (21.7, 63.0)	15.7 (7.6, 23.8)	15.7 (5.4, 26.1)	.339
Sex under the influence of other drugs	0.0	0.0	1.3 (0.0, 3.3)	0.0	0.0	NA
Lifetime history of STI	21.9 (13.7, 33.2)[b]	31.4 (12.7, 59.0)	26.2 (11.6, 40.7)	27.3 (14.8, 39.8)	27.7 (12.3, 43.2)	.784
Had STI during last 12 mo	12.8 (6.6, 23.4)[b]	10.5 (1.5, 48.0)	11.2 (3.0, 19.3)	9.9 (9.6, 18.9)	13.3 (1.2, 25.5)	.368
Ever tested for HIV infection	39.3 (28.0, 52.0)[b]	68.3 (46.6, 84.1)	38.3 (21.0, 55.7)	57.2* (43.5, 70.8)	54.3* (37.3, 71.4)	< .001
Tested for HIV last 12 mo	12.3 (6.0, 23.4)[b]	22.6 (8.0, 49.4)	26.6 (9.7, 43.5)	13.1 (5.6, 20.7)	17.6 (5.3, 29.9)	.158
HIV infection point estimate	0.0	0.0	0.0	0.17 (0.02, 1.21)	0.0	NA
HIV infection lower bound estimate[c]	NA	NA	NA	0.12 (0.02, 0.90)	NA	NA

Note. CI = confidence interval; NA = not applicable; STI = sexually transmitted disease.
[a]*P* values for overall effect of migration phase were derived from logistic regression models. Models were adjusted for age, marital status, education, and ethnicity.
[b]Reference category.
[c]Assuming all female survey respondents not tested at the study site were HIV negative.
**P* < .05; ***P* < .01 (all for comparison with the reference category).

procedures, we did not include this participant in our HIV prevalence estimates.

Overall, 26 participants called the toll-free telephone line. Only 1 of the individuals (a deported migrant) received his final results and was referred to the Outpatient Center for HIV/AIDS Prevention and Treatment in Tijuana. Two additional individuals who tested positive with the confirmatory testing called only once before results were available. The remaining 15 confirmed positive cases never called to find out their results (data not shown).

A comparison of respondents tested for HIV in our study and those who refused testing suggested a riskier profile of the tested subsample than of the nontested participants (data available as a supplement to the online version of this article as Table B at http://www.ajph.org). If all nontested male participants had been HIV negative, the HIV prevalence would have ranged 0.07% to 3.31% for men; and it would have been 0.12% among women.

DISCUSSION

We used a novel approach to examine HIV risk among Mexican migrants. Instead of surveying migrant stocks in communities of origin or destination, we focused on migrant flows in the Mexico–US border region to estimate levels of infection and contextual and behavioral risk factors among migrants representing different spatial trajectories and phases associated with the migration process. Our results indicate that prevalence rates of HIV among migrants in these different phases range from 0.08% to 3.89% for men and from 0.00% to 0.17% for women. For male migrants at the predeparture (1.01%), transit (3.89%), and interception (0.80%) phases, these rates are higher than are rates estimated for males aged 15 to 49 years in the United States (0.70%)[49] and overall HIV rates in Mexico (0.20%).[50]

Our HIV prevalence estimates differed from zero-prevalence estimates obtained in a survey of 1429 migrants conducted in Tijuana in 2002.[51] That survey found high reported rates of sexually transmitted diseases and behavioral risk factors and indicated the possibility of a rapid increase in HIV infection in this population. The results from our survey support that prediction, suggesting a marked increase in observed rates of HIV among migrant

flows traveling across this border region since 2002. Lifetime sexually transmitted disease rates in our survey (13.2%–23.1% for men; 21.9%–31.4% for women) are almost 3 times greater than are those found in the 2002 survey.[51] An upward trend in sexually transmitted disease rates would be consistent with the increase seen in HIV infection rates across these 2 survey periods. Still, comparisons across these 2 surveys have to be made cautiously. Although the surveys sampled from the same 4 migrant flows, there are some methodological differences that could explain the different HIV and sexually transmitted disease estimates. The 2002 survey did not differentiate between northbound migrants with and without a history of migration, and it included 3 additional sites: 2 small bus stations (which contributed a small fraction of the sample size) and a second deportation station (which was no longer in operation at the time of our survey). Furthermore, the 2002 survey used oral, nonrapid HIV testing.[52]

Prevalence rates of last 12-month behavioral risk factors for HIV among male migrants, including sex with multiple partners, sex with casual partners or sex workers, unprotected sex with risky partners, and sex under the influence of alcohol and other drugs were elevated across all migration phases. For instance, our estimated rates of last 12-month multiple sexual partners for male migrant flows (37.1%–44.0%) contrast starkly with the 8.5% prevalence rate estimated for nonmigrant adults in Mexico[53] and the 18.0% prevalence rate estimated for US adults.[54] Our findings regarding prevalence of unprotected sex are consistent with previous reports of limited condom use among male migrants in the United States and return migrants in Mexico.[17,55,56]

Our estimates of HIV infection and behavioral risk factors varied noticeably by migration phase. In general, the results suggest that, for male migrants, risk behaviors tend to increase after they leave their communities of origin and the increase in risk behaviors corresponds with deterioration in the conditions in which migrants find themselves. Compared with the premigration phase, we found that migrants in postmigration phases had reduced access to steady partners and family members (2 potential proxies for social support and family controls), less stable housing (indicated by fewer migrants living in houses or apartments), lower rates of health insurance (a key indicator of access to health care), less knowledge of HIV testing locations (signifying lower access to these preventive services), and increased exposure to high HIV risk populations (on the basis of greater rates of detention or imprisonment and perception of their communities as posing a high risk for HIV). Changes in these contextual factors may explain increased rates of risk behaviors for HIV infection, as predicted by the behavioral ecological model[7] and by our hypothesis that different migration phases involve dissimilar contexts that may influence HIV risk.

HIV prevalence rates were remarkably higher for male migrants in the transit phase. The relatively small number of HIV-positive cases precludes formal statistical tests on the significance of these differences. However, the higher HIV prevalence found for these migrants traveling in the Mexican border region is consistent with the higher HIV/AIDS incidence,[57] higher rates of quasi-legal commercial sex work,[58] greater availability of drugs,[59] and higher rates of drug-related violence[60] found in Mexican states along the Mexico–US border compared with the rest of Mexico or the United States. This group of migrants had been in the Mexican border area for a significantly longer period than was any other group of migrants in our study and, conceivably, prolonged exposure to this riskier social context may have contributed to elevating their HIV risk. These findings call for interventions to reduce the length of time migrants spend in this risky context and actions to improve their living and traveling conditions while in this region.

Our survey also evidenced lower levels of HIV infection but higher rates of behavioral risk factors for male migrants in the return phase than for migrants in the predeparture phase. In general, male migrants in the return phase were more likely to report multiple sexual partners, unprotected sex with casual partners and sex workers, and sex under the influence of alcohol or other drugs. The riskier behavioral profile is likely to reflect, at least in part, the worsening of contextual factors these migrants face once they are back in their communities of origin. For instance, return migrants were less likely to live with their spouses or partners during the return phase and had less access to health care, including less knowledge of HIV testing locations in those communities.

Additional cultural factors may contribute to these findings. Previous ethnographic research has suggested that it is common for male migrants who have returned to their communities to celebrate their success and prove their masculinity through sexual and drug use behaviors. Research has also documented reacculturation challenges and family conflicts arising from the loss of control over the behavior of the spouses migrants left behind.[20] Coupled with higher rates of risk behaviors observed for migrants returning from the United States, on their own or via deportation, these findings suggest that migration may bring about changes in contextual factors and behaviors that increase HIV risk among male migrants and that the risk persists even when these men have returned to their communities of origin.

A different picture emerged for migrant women. Although the only case of HIV infection we found among the women was among those returning voluntarily from the United States, female migrants at the predeparture and transit phases showed higher levels of behavioral risk than did female migrants returning from the United States or migrant women who have returned to their Mexican communities of origin. The improvement in risk behaviors for female migrants after migration to the United States may be explained by greater exposure to HIV prevention messages and greater autonomy to negotiate safer sexual practices in the United States.[61] Higher acculturation among Latinos has been associated with protective factors for HIV infection, such as empowerment and lower prevalence of machismo.[62,63] Previous research has also described women's economic, social, and cultural subordination to their partners as risk factors for HIV/AIDS among Mexican women in Mexico, particularly in rural areas.[64] More research is needed to understand and address the HIV prevention needs of migrant women, with an emphasis on women in migrant-sending communities.

Generally, results from this survey also show that HIV testing rates are unacceptably low across all migration phases. On average, less than half of migrants had ever been tested for HIV. Two thirds of migrants who we found to

be HIV positive had not been tested for HIV before and 89% were unaware of their HIV infection. By comparison, 18% of Americans and 20% of Latinos in the United States living with HIV infection are not aware of their HIV status.[65] In Mexico, this proportion is estimated to be 52%.[66] Our data suggest that most HIV-infected migrants traveling across the Mexico–US border region are unaware of their HIV status and presumably are not engaged in HIV care. These individuals may also be more likely to unknowingly transmit the infection to others.

Our results also indicate more access to HIV testing in the United States than in Mexican sending communities. We find that testing rates are higher among male and female migrants at the destination and return phases than at the predeparture and transit phases. The differences attenuated when restricted to the last 12 months. These results contrast with the higher rates of health insurance found among migrants in the predeparture and transit phases and point to other factors, such as HIV/AIDS stigma, perception of risk, and access to testing locations as possibly explaining these differences.

Implications for Research, Practice, and Policy

Our study reveals patterns of contextual and behavioral risk unique to each of the 5 migration phases represented by the migrant flows who travel through the Mexico–US border. Previous research has shown that high-risk behaviors among Mexican migrants increase significantly after migration to the United States.[56] Our findings support this notion but paint a more nuanced picture, suggesting that the influence of migration is not uniform across genders or behaviors (e.g., HIV testing vs sex with risky partners). Exposure to different migration-related contexts associated with different migration phases results in distinct patterns of HIV risk among male and female migrants at different points of the migration process. Future research should focus on identifying and addressing the specific contextual and structural factors that uniquely drive HIV risk within each migration phase and for each gender.

The opposite findings found for male and female migrants are intriguing. Future research with larger subsamples of Mexican women should confirm the protective effect of migration for female migrants that our survey suggests. Studies should also explore social and cultural factors contributing to HIV risk among Mexican women in migrant-sending communities and identify effective interventions directed at young women in sending communities and at female migrants in the Mexican border region—the 2 phases found to entail the greatest HIV risk for migrant women. Empowerment-based and peer-driven interventions are promising approaches and should be tested with these populations on the basis of their success with other vulnerable groups of women.[67,68]

Vigorous efforts to improve HIV diagnosis and engagement in HIV care among Mexican migrants at all migration phases are urgently needed. Provider-initiated, opt-out HIV testing policies should be implemented in health care settings in both the United States and Mexico to test migrants who may receive care for any other health reasons. Likewise, because of the substantial percentage of migrants who are detained and deported every year (more than 1 in 3 of the migrants returning from the United States, according to our survey), we recommend implementation of policies to routinely offer opt-out testing to migrants in correctional settings and immigration detention centers as a way to reduce undiagnosed HIV in this population. We also recommend additional research to better understand the factors that hinder HIV testing in migrant-sending communities and the Mexican border region, with emphasis on perceived and actual access to testing locations and the role of stigma and other cultural factors as potential determinants of lower rates of HIV testing among migrants in these communities.

The behavioral ecological model emphasizes the role of laws, regulations, and public policies as powerful determinants of health behaviors directly and indirectly through their impact on contextual and individual factors.[7] To a large extent, broader structural factors governing migration between Mexico and the United States may determine the aggravation of risk behaviors and contextual factors observed at postmigration phases. Current US immigration policies provide few avenues for legal entry of Mexican labor migrants and their families. In our survey, between 63% and 96% of Mexican migrants who return, on their own or via deportation, had crossed the border illegally the last time. Tightened border control practices limit migrants' ability to travel home periodically to reunite with their families. The consequences are extended separation from steady partners, lack of social support, reduced family controls, and unmet affection needs that, for male migrants, may result in a greater likelihood of having sex with casual partners or sex workers.

Health care policies that do not cover undocumented migrants, even after the passage of the Affordable Care Act,[69] limit interactions with the health care system and may reduce opportunities for HIV testing of migrants in the United States.[70] Undocumented status precludes access to well-paid jobs with sick leave and vacation time. Programs, such as Secure Communities, that involve local law enforcement agencies in the enforcement of federal immigration laws[71] and state- and local-level antiimmigration laws, such as the controversial Arizona SB 1070, have induced fear of deportation among undocumented immigrants.[21,72] Along with linguistic and cultural barriers, precarious employment conditions and the fear of deportation deter migrants from seeking health services.[73] From an immigration control perspective, the effectiveness of these policies is questionable. Those who are determined to enter the United States eventually do so.[74] Instead, these immigration and health care policies may end up increasing the risk for HIV and other health issues among migrants and, eventually, their negative impact could extend to the host populations in the United States in the form of higher population-level rates of HIV infection and other diseases.

Future research should examine such negative effects. These consequences should be pondered as the nation debates alternative immigration reform proposals and considered in future discussions regarding potential expansions of health care law to cover the needs of this medically underserved and socially vulnerable population.

From 2007 through 2012, the United States has deported more than 2 million migrants[75] as a strategy to curb illegal immigration. Excluding migrants sampled from the deported flow, more than half of migrants with a history of

migration to the United States in our survey had a history of deportation. Mass deportations, including lateral deportation practices (apprehended migrants are often transferred back to Mexico miles from the point of their original apprehension), have resulted in a large number of deported migrants being stranded at the north border of Mexico as they try to return to the United States to reunite with their families. Transit locations in Central America and Mexico are risky social contexts—with few public services, frequent human rights violations, violence, poverty, and corrupt authorities[76]—that increase the vulnerability of migrant populations.

Migrants in the border region are often subject to extortion from cartels that control the smuggling of drugs and people across the border, and they may be forced to engage in illegal activities, such as drug dealing and commercial and transactional sex in exchange for smugglers' expensive border-crossing fees. Deported migrants at the border experience loneliness and economic hardship, and they may resort to substance use and unprotected sex, which increase the risk for HIV.[77] Thus, the conjunction of US immigration policies and the political and social context at the northern border of Mexico increases migrants' risk for HIV during their stay at the Mexican border.

Interventions in the Mexico–US border region can play a critical role in reducing rates of HIV infection and behavioral risk factors among Mexican migrants. In addition to providing a unique observatory for the study of HIV infection and risk factors among Mexican migrant flows, this region offers an extraordinary opportunity to deliver HIV prevention and treatment to these mobile populations at a highly critical migration phase.

Using sites and recruitment procedures similar to those included in our survey, brief education and outreach interventions targeting migrant flows traveling across the Mexican border region should be developed, implemented, and evaluated. These interventions could contribute to increasing HIV prevention knowledge, promoting HIV testing, and reducing sexual risk behaviors among migrant flows. Interventions in these sites could provide referrals when necessary for HIV prevention and treatment resources in the Mexican border area and in the communities to which migrants are heading. Furthermore, these programs should link migrants to available support resources in the border communities.

An example of such an intervention model is a prevention clinic for deported migrants implemented in the *El Chaparral* (formerly San Ysidro) deportation station in Tijuana, Mexico. In 2011, the National Center for HIV/AIDS Prevention and Control Program in Mexico and the Mexican Secretariat of Health, through its Migrant Health and HIV/AIDS Prevention and Control programs, allocated funds for the development and implementation of a small prevention clinic that offers some basic preventive services, including HIV testing, prevention resources, and a link to care for migrants deported to Mexico via Tijuana (G. Rangel, PhD, MPH, personal written communication, August 6, 2014). In addition to HIV-specific services, migrants at this deportation station are offered public health care insurance, transportation to migrant shelters, information about employment opportunities in Tijuana, and psychological support on an as-needed basis. Although the impact of this intervention has not been formally evaluated, arguably it may help mitigate some of the negative effects of deportation, and it provides a model to be expanded to deportation stations in other border cities.

However, additional, more comprehensive interventions are needed to support migrants during their stay in the Mexican border region. Programs and policies to keep migrants safe from violence and extortion and to guarantee access to basic food, housing, health care, and substance abuse services are fundamental in this border region. These structural prevention programs could effectively reach a large number of migrants traveling through this intermediate region. Because of the circular migration pattern exhibited by many Mexican migrants, these interventions also may indirectly help to lower HIV risk among migrant and nonmigrant populations in sending and receiving communities.

Limitations

This study is subject to several limitations. Our survey excluded migrants at the destination phase who never return to Mexico and migrants who travel between sending and receiving communities directly by air or in private vehicles. Furthermore, the focus on migrant flows results in overrepresentation of circular, highly mobile migrants. As a result of the infectious nature of HIV, the focus on mobile populations is important because of their potential to serve as a bridge between sending and receiving communities.

We conducted our survey solely in Tijuana, and the results may not apply to migrants traveling across other Mexican border regions. The response rate was only moderate (51.4%) but was within the target range (40.0%–60.0%) recommended for surveys informing policy or resource allocation decisions.[78] Nonetheless, self-selection bias may have affected our estimates of HIV infection and behavioral risk factors. The differences between the profiles of the tested versus nontested participants indicates that the tested subsample had a riskier behavioral profile, suggesting that the true estimates of HIV infection may be between our point estimate and our lower bound estimate, assuming 0.0% rates among nontested participants.

The size of the female subsample was limited. Additional research with larger samples of female migrants is necessary to more accurately estimate rates of HIV infection and to explore the apparent discrepancy between rates of HIV infection and levels of behavioral risk factors among the various subgroups of migrants. Rates of behavioral risk factors are based solely on self-report and may be subject to recall and social desirability bias. Consequently, our results may underestimate the prevalence of these practices among the migrant flows studied.

Finally, our estimates reflect and compare risk behaviors over the last 12 months for migrants representing distinct migration phases. The uniform timeframe increases the comparability across groups. However, our estimates may capture behaviors that took place in other migration phases and contexts (not just the most recent one). For example, whereas northbound migrants with a history of migration were regarded as representing the return phase, on average this group had also spent almost 6 months in the United States during the previous year. Still, the amount of time the return phase migrants had spent in their communities of origin (141 days) was significantly higher than was that of the migrants returning from the United States on their

own (destination phase, 37 days) or via deportation (interception phase, 67 days). Despite these limitations, this study provides unique and critical data on HIV infection rates, behavioral risk patterns, and contextual correlates among migrant flows traveling through the Mexico–US border region as they transition from 1 migration phase to another. ■

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Contributors

A. P. Martinez-Donate conceptualized the study, supervised the analyses, and wrote drafts of the article. M. F. Hovell and M. G. Rangel supervised the study. X. Zhang conducted the analyses. J. E. Gonzalez-Fagoaga helped with the sampling methodology and computed survey weights. All authors contributed to the design of the study instruments, helped with the interpretation of findings, and reviewed drafts of the article.

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