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SAN DIEGO STATE UNIVERSITY

The role of migration and mobility on sexual and mental health at Mexico's North and South
Borders

A dissertation submitted in partial satisfaction of the requirements for the degree

Doctor of Philosophy

in

Public Health (Global Health)

by

Teresita Rocha Jimenez

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2019

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Chair

University of California San Diego

San Diego State University

2019

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ABSTRACT OF THE DISSERTATION

The Role of Migration and Mobility on Sexual and Mental Health at Mexico's Northern and Southern Borders

by

Teresita Rocha Jiménez

Doctor of Philosophy in Public Health (Global Health)

University of California, San Diego, 2019

San Diego State University, 2019

Professor Kimberly C. Brouwer, Chair

Background: Worldwide, migration and mobility have been associated with many health consequences, such as infectious disease transmission (e.g., HIV/STI infection) and mental health problems. However, little research has been done considering more dynamic processes and comprehensive migration and mobility patterns and how they impact vulnerable populations' health.

Objectives: Specific aims include: 1) to analyze if specific migration experiences, such as short-term travel to engage in sex work in another country and recent migration, are associated with recent HIV testing among female sex workers (FSW) at the Mexico-Guatemala border; 2) to analyze if forced migration, short-term migration, rural-urban migration, and deportation are associated with depressive symptoms among migrants at the Mexico-Guatemala border, and 3) to determine the extent and correlates of intra-urban mobility of female sex workers with

HIV/STI acquisition and other structural risks such as interaction with law enforcement, and work environment risks among a cohort of female sex workers in Tijuana, Mexico.

Methods: Aim 1 and 2 used cross-sectional data collected among female sex workers and recent migrants at the Mexico-Guatemala border (project *Cruzando Fronteras*). Aim 3 used a longitudinal cohort study data of FSW in Tijuana, Mexico (*Mapa de Salud*).

Results: We found that short-term travel to engage in sex work in another country was independently associated with HIV testing in the past year. Recent rural-urban migrants and short-term migrants had higher odds of having possible major depressive symptoms but recent international migration was protective. Low intra-urban mobility was associated with increased risk of acquiring syphilis, injection drug use, and vulnerable living conditions.

Conclusions: Study findings highlight the need to address comprehensive and complex migration and mobility experiences (e.g., low intra-urban mobility) to improve FSW and recent migrant sexual and mental health at Mexico's borders. Recommendations for interventions and future research are discussed.

Chapter 1. Introduction

Mobility and migration have been associated with positive factors, such as development, increased agency, improved socioeconomic status, and enhanced access to health services (Jose R. Bucheli, 2019; Cresswell, 2006b; Kanaiaupuni & Donato, 1999; Lassetter & Callister, 2009; Skeldon, 2014). However, migration and mobility have also been associated with negative health outcomes, such as substance use, barriers to accessing healthcare, transmission of diseases (e.g., HIV/STI), and psychiatric disorders (Achotegui, 2005; Breslau et al., 2011; Brouwer et al., 2009; Escobar, Nervi, & Gara, 2000; Olawore et al., 2018). The association between mobility and adverse outcomes has led to a historical pattern of surveillance and displacement of specific types of mobile groups of people, such as nomads, occupational migrants, homeless, and sex workers (Cresswell, 2006a, 2006b; Foucault, 2012; Guerrero, 2018; Hubbard, 1998; Malkki, 1992; Scott, 1998; Shannon, Rusch, et al., 2008).

Mexico is a country of origin, transit, and destination of migrants and in the past decade has also been a country of interception or “in-between”, where people with different migration experiences and mobility patterns (e.g., deportees, asylum seekers) have stayed in Mexican territory and settled or are waiting for their migration or refugee status to be resolved (Alarcón Acosta & Ortiz Esquivel, 2017; Cresswell, 2006c; Pinedo et al., 2018). This trend is not unique to Mexico, but is a worldwide phenomenon (e.g., Venezuelan, Syrian, and Central American refugees and asylum seekers) (Casey & González, 2019; Correal & Specia, 2018; Zong & Batalova, 2017).

A number of studies have focused on exploring how experiences across the three main migration phases (i.e., origin, transit, and destination) may impact migrants’ and mobile populations’ health status (Bhugra, 2004; Gushulak & MacPherson, 2011; Pinedo et al., 2018;

Servan-Mori, Leyva-Flores, Infante-Xibille, Torres-Pereda, & Garcia-Cerde, 2013).

Nevertheless, due to the complexities of current migration and mobility patterns, the present study considered a more comprehensive approach that includes five stages of migration or mobility: origin, transit, destination, interception phase, and return (Collyer, 2010; Menjivar, 2006; Zimmerman, Kiss, & Hossain, 2011). Additionally, we considered mobility experiences, such as short-term travel and low intra-urban mobility and how they may impact vulnerable populations' health (Shira M Goldenberg et al., 2014; van Blerk, 2016). The interception phase is particularly relevant to undocumented, forced migrants (e.g., displaced populations), and is characterized by situations of detention, provisional residence, constant mobility, or deportation. It may happen at any point in the migration process (Collyer, 2010; Dowd, 2008; Menjivar, 2006; Zimmerman et al., 2011). The interception phase can also happen within the same country or the same city (e.g., commute from residence to work location).

Therefore, the primary goal of this dissertation is to analyze the influence of migration and mobility experiences on mental health and sexual health outcomes among vulnerable populations, such as female sex workers and recent migrants at Mexico's northern and southern borders. Specific aims of each manuscript chapter are:

1. To analyze if short-term travel to engage in sex work in another country and recent migration are associated with HIV testing in the past year among female sex workers (FSW) in four communities on the Mexico-Guatemala border.
2. To assess if specific migration experiences such as forced migration, short-term migration, rural-urban migration, and deportation are associated with possible major depressive symptoms among migrants at the Mexico-Guatemala border.

3. To determine the extent and correlates of intra-urban mobility of female sex workers with HIV/STI acquisition and other relevant structural risks, such as negative interaction with law enforcement, and work environment risks among a cohort of female sex workers in Tijuana, Mexico.

Conceptual Framework

The overall conceptual framework of this dissertation was the Socio-Ecological Model (SEM) (Centers for Disease Control and Prevention, 2015).

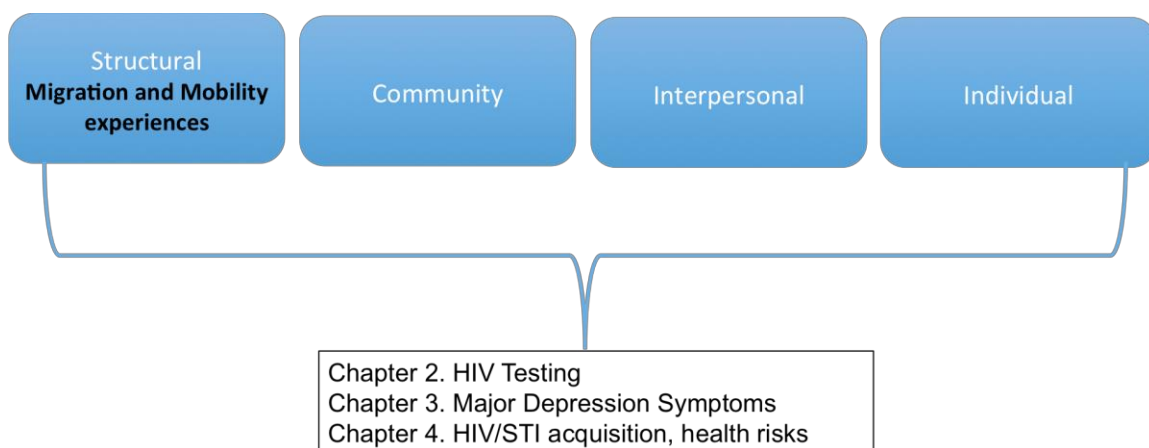


Figure 1.1 Socio-Ecological Model (SEM)

For the second chapter, an adapted version of the SEM and a framework considering the role of migration on HIV testing (Brockhoff & Biddlecom, 1999) was used. For the third chapter, an adapted conceptual framework of migration and psychiatric disorders (Bhugra, 2004; Zimmerman et al., 2011) was utilized in addition to relevant variables of the SEM that are known to impact mental health status such as social support and substance use. Finally, for chapter 4, we adapted the Rhodes’ ‘risk environment’ framework incorporating the individual, sex work environment, and spatial levels to guide our analysis (Galea, Ahern, & Vlahov, 2003; Rhodes, 2002; Shannon, Kerr, et al., 2008)

Background

The Mexico-Guatemala border

The Mexico-Guatemala border represents a key geographical position for regional and international migrants aiming to improve their economic situation or to flee from violence in their home countries and is a gateway into Mexico and the U.S. (Fernández Casanueva, 2012; Leyva et al., 2004; Masferrer, García-Guerrero, & Silvia E., 2018; Ruiz, 2001; Villa et al., 2004; Wendy A. Vogt, 2012; Wendy A Vogt, 2013). Additionally, this is a region where other types of migration and mobility flows, such as everyday commuters, seasonal agricultural workers, truck drivers, and sex workers converge (Bronfman, Leyva, & Negroni, 2004; Castillo Garcia, 2000). Migrants in this border are highly mobile and often remain in the region for an unknown or unlimited amount of time as a result of the porosity of the Mexico-Guatemala border, as well as the increased barriers to migrating northward (Collyer, 2007; Fernández Casanueva, 2012; Levitt, 2014; Lippman et al., 2007; Menjívar, 2006; Teresita Rocha Jiménez, Morales Miranda, Fernández Casanueva, Brouwer, & Goldenberg, 2018).

HIV and Sex Work

HIV prevalence among sex workers is estimated at 4.5% in Guatemala and the prevalence of HIV, syphilis, chlamydia, and gonorrhea has been measured at 1.1%, 9%, 14%, and 12%, respectively, at the Mexico-Guatemala border (Morales-Miranda et al., 2013; UNAIDS, 2011). In both countries, sex work is tolerated in some zones. Public health practices surrounding sex work require that sex workers who work in certain venues (e.g., formal sex work settings) undergo regular HIV/STI testing (i.e., every 3 months) at local clinics to maintain a health card (i.e., registered sex workers) (Institute of Development Studies, 2017; Ministerio de

Salud Pública y Asistencia Social Guatemala, 2012). In Mexico, this involves out-of-pocket fees and in Tapachula, Mexico, it requires transportation to a clinic located in the tolerance zone, an isolated area within the locality of Tapachula (Las Huacas) (Teresita Rocha Jiménez et al., 2018).

Local police officers and immigration authorities along the Mexico-Guatemala border frequently enforce public health regulations surrounding sex work (e.g., verify updated health cards) and immigration authorities often participate in raids on formal sex work settings (Teresita Rocha-Jiménez, Kimberly C. Brouwer, Jay G. Silverman, Sonia Morales-Miranda, & Shira M. Goldenberg, 2016a). In 2012, local Guatemalan female sex worker organizations lobbied Congress to abolish such practices and ensure that HIV/STI testing is a voluntary and private practice (Ministerio de Salud Pública y Asistencia Social Guatemala, 2012; Schlecther, 2018). However, practices on the ground remained relatively unchanged (Teresita Rocha-Jiménez et al., 2016a; Teresita Rocha-Jiménez, Kimberly C Brouwer, Jay G Silverman, Sonia Morales-Miranda, & Shira M Goldenberg, 2016b; Schlecther, 2018).

This mixing of public health promotion with involvement of legal authorities may have unintended consequences, such as engendering a preference to work in less visible settings (e.g., street, hotels), and subsequently, not maintaining a health card or avoiding health care services (e.g. HIV testing) regardless of the type of sex work setting (Lamas, 2015; Madrid Romero, 2014; Teresita Rocha Jiménez et al., 2018). Previous research in this setting has found that women with enhanced information on health practices surrounding sex work and longer experience as a migrant within the sex industry were found to employ protective strategies (e.g., not disclosing to authorities the type sex work venue where they engage in sex work) in

destination communities (Shira M Goldenberg et al., 2015; Teresita Rocha-Jiménez et al., 2016b).

Given the migration context of the Mexico-Guatemala border and previous research conducted at this border, in Chapter 2 analyzed if specific migration and mobility experiences, short-term travel to engage in sex work to another country, and recent migration were associated with HIV testing in the past year among female sex workers in four communities on the Mexico-Guatemala border. The analysis was guided by the Conceptual Model of the Influence on Migration on Sexual Behavior used by Brockerhoff and Biddlecom in a study addressing the role of migration on HIV risk in Kenya (Brockerhoff & Biddlecom, 1999). An adapted version of this framework was used to analyze HIV testing. This framework considers the connection between structural level characteristics, such as migration, policy and community level characteristics (e.g., work environment), interpersonal level characteristics (e.g., consistent condom use), and individual-level characteristics (e.g., years in sex work), to analyze HIV testing.

Migration and Mental Health

Studies conducted among Latino immigrants in the United States (U.S) have found that exposure to political conflict and violence in the country of origin (Servan-Mori et al., 2013), was associated with mental health problems, among other health outcomes (Eisenman, Gelberg, Liu, & Shapiro, 2003; Lusk, McCallister, & Villalobos, 2013; Torres & Wallace, 2013). Other studies conducted among Mexican and Central American migrants aiming to move to the U.S found that arbitrary detention, physical, and sexual violence during their journey resulted in need of medical and psychological assistance (Infante-Xibille, Idrovo, Sánchez-Domínguez, Vinhas, & González-Vázquez, 2006; Temores-Alcántara, Infante, Caballero, Flores-Palacios, &

Santillanes-Allande, 2015). Lastly, a number of studies have explored how arriving in a new community may increase the risk of substance abuse, anxiety, and limited access to health services as a result of social isolation, language barriers, migration status, and stigma (Berk & Schur, 2001; Borges et al., 2009; Breslau et al., 2011; Fazel, Reed, Panter-Brick, & Stein, 2012; Lin et al., 2011; Pinedo et al., 2014; Sullivan & Rehm, 2005; Torres & Wallace, 2013; Zhong et al., 2015).

Given the complexity and the heterogeneous nature of migration patterns at the Mexico-Guatemala border and the scarcity of mental health research considering comprehensive migration processes, in Chapter 3 we assessed specific migration experiences (e.g., forced or coerced to move by someone against their will or due to violence in your community, short-term migration (i.e., between 3 months to a year in the interview site) (International Organization for Migration, 2004), rural-urban migration, and deportation. These have had higher odds of being associated with possible major depressive symptoms (Alderete, Vega, Kolody, & Aguilar - Gaxiola, 1999; Cislo, Spence, & Gayman, 2010; Fazel et al., 2012; Li, Stanton, Fang, & Lin, 2006; Skeldon, 1997; Sullivan & Rehm, 2005; Temores-Alcántara et al., 2015). Analysis of Chapter 3 was guided by an adapted version of the migration phases and psychiatric disorders framework. This adapted framework is based on Zimmerman and colleagues' migration and health framework that takes into consideration the interception phase to design adequate public health policies to protect migrants; and Bhugra's migration and psychiatric disorders health framework that considers both vulnerabilities and resilience in analyzing the relationship between migration and psychiatric disorders (Figure 1). Additionally, we explored sociodemographics (e.g., gender, education, income) as well as other characteristics that have been found to be associated with having symptoms of depression among mobile as well as non-

mobile populations (e.g., financial situation) or that have been found to be mediators (e.g., religion) (Bhugra, 2004; Delara, 2016; McQueen, Greg Getz, & Bray, 2003; Salgado et al., 2014).

The United States-Mexico border

Due to its proximity to the United States and economic opportunities, Tijuana is a key transit point for Mexican migration to the United States, as well as a destination for internal migration from other states of Mexico (Pérez Campusano & Santos Cerquera, 2013; Piñeiro, 1990). The Tijuana-San Diego border is one of the busiest international border crossings in the world and draws extensive commercial activity (both legal and illegal), including the exchange of goods, arms, and drugs (Astorga & Shirk, 2010). The Tijuana-San Diego crossing used to also be the busiest crossing points of entry of undocumented migrants aiming to reach the United States (Herrera-Lasso, González-Iza, & Rocha-Jiménez, 2009). After the implementation of deterrence immigration policies such as Operation Gatekeeper, the main undocumented migration flow moved eastward (e.g., Arizona) (Cornelius et al., 2008). In the past decade, the Tijuana-San Diego region started receiving more deportees than migrants in transit to the United States. Many of these deportees spent decades in the United States and once in Mexico frequently face stigma, discrimination, and isolation, and as a consequence engage in high-risk behaviors such as injection drug use (R. Alarcón & Becerra, 2012; Albicker & Velasco, 2016). All these components create an environment of health risks in Tijuana where the sex trade, migration, intra-urban mobility, drug use, and violence converge (Brouwer, Lozada, et al., 2012; Jesus Bucardo et al., 2005; Shira M Goldenberg et al., 2011). Given the aforementioned context, historically, Tijuana's government has followed displacement and enforcement policies for

specific groups (e.g., people who inject drugs, homeless, deportees, sex workers) (Connors, Gaines, Strathdee, Magis - Rodriguez, & Brouwer, 2018; Morales et al., 2019).

Sex work and HIV in Tijuana

Sex work in Tijuana, Mexico is mainly concentrated and socially tolerated in the red light district (*Zona Norte*), a clustering of commercial sex establishments covering approximately 2.9 km² around the city's main tourist area, and located near the border with the United States (Curtis & Arreola, 1991; T. L. Gaines et al., 2013) (See Map I). The Zona Norte is also adjacent to the Tijuana River Canal, an open-air water artery where PWID and other vulnerable populations (e.g., homeless) live, congregate, and use drugs (Brouwer, Rusch, et al., 2012; Gaines et al., 2015; Guerrero, 2018; Morales et al., 2019). Previous studies conducted in Tijuana have found that the prevalence of HIV (6%), chlamydia (6.6%), gonorrhea (9.6 %), and active syphilis (14.9%) of female sex workers is considerably higher in comparison to the general population prevalence (HIV general prevalence, 0.7%) (T. L. Gaines et al., 2013; Patterson et al., 2008; UNAIDS, 2011).

Female sex workers who work in more formal work venues (e.g., bars, night clubs) are required to maintain a health card that entails periodical HIV/STI testing monitored by local authorities (L. T. Gaines et al., 2013; Sirotin, Strathdee, Lozada, Abramovitz, et al., 2010). Maintaining an updated health card costs approximately US\$300-350 annually. This involves paying an annual fee (US\$100) and a monthly payment of approximately US\$20 to the Sanitary Control Clinic of the Municipal Health Direction (DMS) (J Bucardo, Semple, Fraga-Vallejo, Davila, & Patterson, 2004; Gaeta Rivera, 2016; Sirotin, Strathdee, Lozada, Abramovitz, et al., 2010). Women with positive STI tests are treated with antibiotics according to federal STI

guidelines and women who test positive for HIV are referred to the Center for the Prevention and Treatment of HIV and Sexually Transmitted Infections (CAPASITS) and have their health cards revoked (L. T. Gaines et al., 2013).

Intra-urban mobility and health risks

Previous studies analyzing the effect of geography on sexual risks and HIV/STI in Tijuana have found that the geographic center of the Zona Norte, where sex work is more visible, is associated with higher access to certain services (e.g., condoms, STI prevention services) (T. L. Gaines et al., 2013), but also with higher concentration of HIV/STI infections (Brouwer, Rusch, et al., 2012; Rusch et al., 2010) as well as police activity, (Werb et al., 2016) drug dealing (Willoughby, 2003), and drug use (Strathdee et al., 2005).

However, less is known about how intra-urban mobility, especially commuting distances between one's residence and sex work venue, impacts sex workers likelihood for acquiring HIV/STI and experiencing other relevant structural risks (e.g., barriers to accessing health care services, law enforcement encounters, mental health challenges) in this setting (van Blerk, 2016). Building on prior sex work research indicating the importance of understanding experiences related to "live-in" (i.e., living and working in the same place) (Chang A. & Ling, 2000; Ozegin & Hondagneu-Sotelo, 2008), Chapter 4 investigated the impact of mobility between residence and main sex work venue of female sex workers in Tijuana (van Blerk, 2016). Studies conducted among domestic workers, who live and work in the same location, have found that long shifts, employer restriction on when and how you can leave the premises, and stigma and discrimination have detrimental outcomes for worker's mental health status as well as limit access to health care services among other risks (Ahonen et al., 2010; Artázcoz et al., 2001; Sales

& Santana, 2003; Smith, 2011). Meanwhile, a study in Tijuana of PWID found that while more mobile PWID lived in more stable environments, they had less knowledge of health risks of injection and were more likely share needles and get arrested for carrying syringes (Brouwer, Lozada, et al., 2012; Brown, 2007).

Chapter 4 longitudinally analyzed the prevalence and correlates of low intra-urban mobility (i.e., short or no commute between residence and work) with HIV/STI acquisition and other relevant structural risks, such as negative interaction with law enforcement, work environment related risks (e.g., high volume of clients), and access to health care services.

We drew on Rhodes' 'risk environment' framework developed to conceptualize the physical and social space in which factors external to the individual interact to produce risks to the individual's health (e.g., drug use) (Rhodes, 2002). We also considered Galea and colleagues contextual determinants of drug risk, which considers the physical environment as a key factor that may affect risk behaviors (Galea et al., 2003). Lastly, we incorporated structural HIV determinants framework conceptualized by Shannon and colleagues (Shannon, Goldenberg, Deering, & Strathdee, 2014)

Overview of Research Studies

Chapters two and three utilized cross-sectional data from the *Cruzando Fronteras* study collected among female sex workers (chapter 2) and recent migrants (chapter 3) (PI: Brouwer; R01DA029899). This study aimed to explore substance use, migration, and HIV risk at the Mexico-Guatemala border. It was conducted from 2010-2015 and included the recruitment of three different waves of populations: female sex workers, recent migrants, and men who have sex with men (MSM). Participants were recruited in the cities of Tapachula and Ciudad Hidalgo,

Mexico, and Tecun Umán and Quetzaltenango in Guatemala by local trained staff and underwent face-to-face interviewer-administered questionnaires and on-site HIV testing. Chapter 2 used data from the female sex worker wave (N=266) and Chapter 3 used data from the recent migrant wave (N=392).

Chapter 4 used longitudinal cohort survey data from a study aimed at assessing how changes in social, spatial, and physical factors affect HIV and STI acquisition, risk behaviors, and access to healthcare at the United State-Mexico border (*Mapa de Salud* study PI: Brouwer, R01DA028692). From March 2010 to March 2014, participants were recruited by trained local staff from all identified sex work venues using modified time-location sampling. In order to obtain a diverse sample, we limited recruitment to no more than 15 women per venue. This study was conducted in Tijuana (N=301) and in Ciudad Juárez, Mexico (N=302). Upon written consent, participants responded to a face-to-face interviewer-administered questionnaire and on-site testing of HIV, syphilis, gonorrhea, and chlamydia. This study included 6, 12, and 18-month follow-up visits. For Chapter 4 of this dissertation, we analyzed the data collected in Tijuana, Mexico.

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Chapter 2. Migration and mobility: correlates of recent HIV testing among female sex workers at the Mexico-Guatemala border

Abstract

Globally, female sex workers (FSW) are disproportionately affected by HIV and sexually transmitted infections (STI). Many populations (e.g., men who have sex with men) in diverse settings face barriers to HIV testing due to stigma, criminalization, and limited of access to health services. Migration and mobility have positive and negative impacts on population's health. Thus, the goal of this study is to analyze if specific migration and mobility experiences are associated with HIV testing in the past year among female sex workers in the Mexico-Guatemala border. Crude and adjusted logistic regression models were used to evaluate the relationships. Overall HIV testing was low (41%); after adjusting for relevant covariates (i.e., health card, give a part of earnings to a bar owner or manager, client volume, and sociodemographics) short-term travel to engage in sex work in another country was independently associated with enhanced HIV testing in the past year. HIV prevention efforts to increase voluntary, free, and non-stigmatizing HIV testing especially need to be focused on reaching out to less mobile women as well as those who work in less visible venues.

Introduction

Globally, female sex workers (FSW) are disproportionately affected by HIV and sexually transmitted infections (STI) (Baral et al., 2012; Grayman et al., 2005; Kilmarx, 2009; Patterson et al., 2008; Shannon et al., 2014; Weine et al., 2013). HIV prevalence among FSW is twelve times higher than the general population and, in some countries of Sub-Saharan Africa (e.g., Botswana, Kenya), as high as 37% (Baral et al., 2012; Camlin, Cassels, & Seeley, 2018; UNAIDS, 2014, 2017). HIV transmission among FSW may be driven by a complex number of risks, such as behavioral (e.g., high number of sexual partners, inconsistent condom use), biological (e.g., prevalence of bacterial STI), and structural (e.g., limited access to condoms, inadequate HIV testing) factors (Baral et al., 2012; Kilmarx, 2009; Watts et al., 2010).

Universal HIV testing and diagnosis is an essential first step in the HIV treatment cascade (Hargreaves et al., 2016; Pottie et al., 2014; Sidibé, Loures, & Samb, 2016; Suthar et al., 2013; United Nations Programme on HIV/AIDS, 2014). World Health Organization (WHO) guidelines recommend that populations disproportionately affected by HIV, such as men who have sex with men (MSM) and FSW, get tested every 3-6 months (DiNunno et al., 2017; World Health Organization, 2012). Many populations (e.g., MSM, migrants) in diverse settings face barriers to HIV testing due to stigma, criminalization, and limited access to health services (Baral et al., 2012; Barrington et al., 2018; Pando et al., 2013; Shannon et al., 2015; United Nations Programme on HIV/AIDS, 2014; Wolfe, Carrieri, & Shepard, 2010). However, less is known about the HIV/STI testing access of populations disproportionately affected by HIV such as female sex workers in the Mexico-Guatemala border (Leyva-Flores et al., 2013; Morales-Miranda et al., 2013).

Worldwide, migration and mobility have often been associated with infectious disease transmission, such as HIV and sexually transmitted infections (STI) (Anglewicz, VanLandingham, Manda-Taylor, & Kohler, 2016; Leyva-Flores, Infante, Servan-Mori, Quintino-Pérez, & Silverman-Retana, 2016; Sanchez et al., 2012), as well as with limited access to health services due to migration status, stigma, language barriers, among other factors (Berk & Schur, 2001; Biswas, Kristiansen, Krasnik, & Norredam, 2011; Brouwer et al., 2009; Ghent, 2008; Margolis et al., 2017; Weine et al., 2013). Despite the negative factors associated with migration and mobility there may also be positive impacts of migration, such as improved socioeconomic status, a safer environment, and social mobility (José R Bucheli, 2019; Cresswell, 2006c, 2010; Lassetter & Callister, 2009; Skeldon, 1997, 2014), which can translate into increased access to health services and improved health outcomes (e.g., lower mortality risk, increased agency) (Gustafsson, 2018; Lassetter & Callister, 2009; Marthell, Pineda, & Tapia, 2007). Thus, there is a need to analyze and better understand population mobility in its various forms, and how it may affect HIV prevention measures such as HIV testing (Camlin et al., 2018).

The Mexico-Guatemala border has a key geographic position for migration flows as a gateway into Mexico and up to Northern countries such as the United States (Campos-Delgado & Odgers-Ortiz, 2012; Carreón-Diez, Herrera-Lasso, & Córdova-Alcaraz, 2006; Wendy A Vogt, 2013). It is also characterized by a highly mobile population living in specific zones of the border, such as the Tecún Umán-Tapachula border crossing where everyday commuters, truck drivers, agricultural seasonal workers, and sex workers converge (Bronfman et al., 2004; Castillo Garcia, 2000; Flores, Caballero, Dreser, Guerrero, & Bronfman, 2004; Shira M. Goldenberg, Strathdee, Perez-Rosales, & Sued, 2012; Herrera-Lasso et al., 2009; Leyva et al., 2004). HIV prevalence among sex workers is estimated at 4.5% in Guatemala and the prevalence of HIV,

syphilis, chlamydia, and gonorrhea has been measured at 1.1%, 9%, 14%, and 12%, respectively, at the Mexico-Guatemala border (Morales-Miranda et al., 2013; UNAIDS, 2011).

In both countries, sex work is quasi-regulated and tolerated in some zones. Public health practices surrounding sex work require that sex workers who work in certain sex environments (e.g., formal sex work settings) undergo regular HIV/STI testing (i.e., every 3 months) at local clinics to maintain a health card (i.e., registered sex workers) (Institute of Development Studies, 2017; Ministerio de Salud Pública y Asistencia Social Guatemala, 2012). In Guatemala, health permits are provided free-of-charge through community health clinics (Ministerio de Salud Pública y Asistencia Social Guatemala, 2012). In Mexico, this involves out-of-pocket fees and in Tapachula, Mexico, it requires transportation to a clinic located in the tolerance zone, an isolated area within the locality of Tapachula (Las Huacas) (Teresita Rocha Jiménez et al., 2018).

An epidemiological survey conducted in Central America in 2013 found that between 74-80% of female sex workers who participated in the survey in Guatemala reported receiving an HIV test in the past year (Morales-Miranda et al., 2013). However, previous research conducted in Central American border settings found lower HIV testing prevalence among female sex workers (60%) (Leyva-Flores et al., 2013). Another study, in the United States-Mexico border city of Tijuana, found that only 36% of FSW working in informal venues had ever been tested for HIV (N. E. Chen, Strathdee, Uribe-Salas, et al., 2012).

Local police officers and immigration authorities along the Mexico-Guatemala border frequently enforce public health regulations surrounding sex work (e.g., verify updated health cards) and immigration authorities often participate in raids in formal sex work settings (Teresita Rocha-Jiménez et al., 2016a). Such practices give police and immigration authorities broad leverage to extort and unlawfully detain sex workers under the premises of not maintaining their

permits (Platt et al., 2012; Teresita Rocha-Jiménez et al., 2016a; Schlecther, 2018). In 2012, local Guatemalan female sex worker organizations lobbied their government to end the involvement of authorities and the forced nature of the health checks, in order to ensure that HIV/STI testing is a voluntary and private practice (Ministerio de Salud Pública y Asistencia Social Guatemala, 2012; Schlecther, 2018).

However, practices on the ground remained relatively unchanged (Teresita Rocha-Jiménez et al., 2016a; Teresita Rocha-Jiménez et al., 2016b; Schlecther, 2018). This mixing of public health promotion and involvement of legal authorities may have unintended consequences, such as engendering a preference to work in less visible settings (e.g., street, hotels), workplace instability, and subsequently, not maintaining a health card or avoiding health care services (e.g. HIV testing) regardless of the type of sex work setting (Lamas, 2015; Madrid Romero, 2014; T Rocha Jiménez et al., 2017; Teresita Rocha Jiménez et al., 2018; Teresita Rocha-Jiménez et al., 2016a). Previous research in this setting has found that women with enhanced information on health practices surrounding sex work and greater experience as a migrant within the sex industry were found to employ protective strategies (e.g., not disclosing to the authorities the type sex work venue where they engage in sex work) in destination communities (Shira M Goldenberg et al., 2015; Teresita Rocha-Jiménez et al., 2016b).

Given the migration context of the Mexico-Guatemala border and previous research conducted at this border, the aim of this paper is to analyze if specific migration and mobility experiences are associated with HIV testing in the past year among female sex workers in four communities on the Mexico-Guatemala border. Based on the literature and previous findings, we hypothesize that female sex workers who are recent migrants and sex workers who travel to another country to engage in sex work will have lower odds of reporting an HIV test in the past

year compared to those who have resided longer than 5 years in the interview city and those who do not travel to engage in sex work, respectively (Brockerhoff & Biddlecom, 1999; Shira M Goldenberg et al., 2014; Richter et al., 2014; Teresita Rocha Jiménez et al., 2018).

Our analysis is guided by the Conceptual Model of the Influence on Migration on Sexual Behavior used by Brockerhoff and Biddlecom in a study addressing the role of migration on HIV risk in Kenya (Brockerhoff & Biddlecom, 1999). We use an adapted version of this framework to analyze HIV testing. This framework considers the connection between structural level characteristics, such as migration, policy and community level characteristics (e.g., work environment), interpersonal level characteristics (e.g., consistent condom use), and individual-level characteristics (e.g., years in sex work), to analyze HIV testing (Figure 1). Additionally, we will explore sociodemographics (e.g., age, education) as well as other characteristics that have been found to be associated with HIV testing such as working in formal venues, (L. T. Gaines et al., 2013), owning a health card (Teresita Rocha-Jiménez, 2013), and knowledge of HIV/STI transmission (Grayman et al., 2005; Wingood & DiClemente, 2000) .

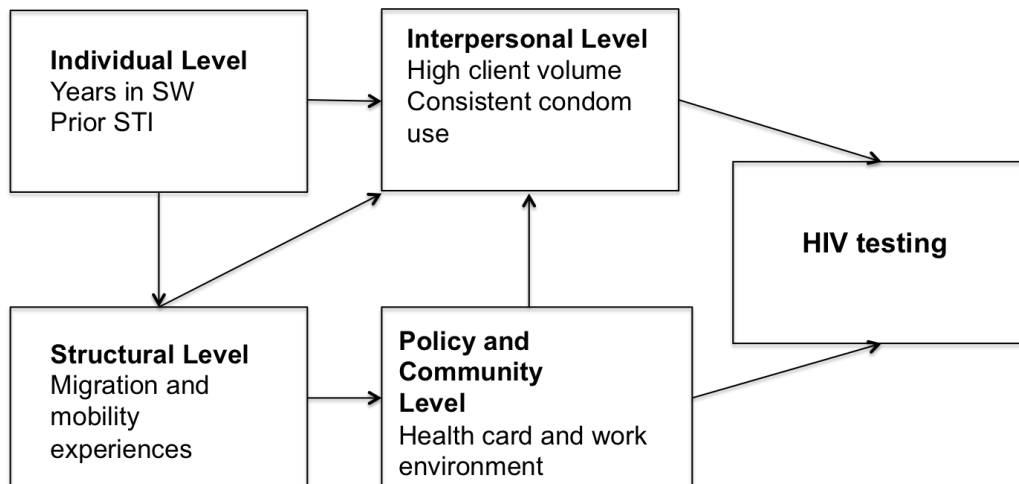


Figure 2.1 Adapted Conceptual Model of the Influence of Migration on HIV testing (Brockerhoff & Biddlecom, 1999)

Methods

Study Setting and Procedures

From 2013-2015, we recruited female sex workers (N=266) as part of a cross-sectional study (*Cruzando Fronteras*, PI: Brouwer; R01DA029899) of substance use and HIV risk among key populations. HIV prevalence in this cohort (3.4%) was analyzed and described elsewhere (Teresita Rocha-Jiménez, Morales-Miranda, Fernández-Casanueva, & Brouwer, 2019).

Using a combination of modified time-location sampling of sex work venues (e.g., bars, street) and peer referral, participants were recruited in the border cities of Ciudad Hidalgo and Tapachula in Mexico and Tecún Umán and Quetzaltenango in Guatemala. Due to their geographic location and relative economic prosperity, these cities represent key sites for both internal and international migration flows and the sex trade (Campos-Delgado & Odgers-Ortiz, 2012; Morales-Miranda et al., 2013).

Eligibility criteria for the study included: a) being biologically female, b) having reported exchanging sex for money, drugs or goods in the last month, c) using illicit substances (beyond marijuana) in the past 2 months, d) 18 years old or older, e) Spanish speaker, f) willing and able to provide informed consent, g) willing to undergo on-site HIV testing. For the present study, we excluded 11 participants who did not report if they had ever received an HIV test or the date of their last test. Upon written consent, trained interviewers conducted face-to-face interviewer-administered questionnaires to obtain information on sociodemographics, migration and mobility experiences, work environment factors, interpersonal characteristics, social support, individual characteristics, and substance use. Interviews were conducted in private rooms and lasted approximately 50-80 minutes. Participants were compensated \$10 USD in in-kind goods for completing the interview and testing, and \$5 USD for returning to receive their HIV test results.

If positive, local field staff accompanied participants to the local HIV/STI treatment institutions (i.e., Center for the Prevention and Treatment of HIV and Sexually Transmitted Infections, CAPASITS in Mexico and the Health Ministry in Guatemala).

This project was approved by the Human Research Protections Program (IRB) of the University of California, San Diego; the Bioethics Committee of the University of Valle of Guatemala (UVG); and the Bioethics Committee of the Institute of Health of the State of Chiapas, Mexico.

Measures

Dependent Variable

HIV testing in the past year

Participants were asked if they had ever been tested for HIV before - not considering testing associated with blood donation - and the date of the last HIV test. The variable HIV testing in the past year was built by calculating the months that had passed between the last HIV test and interview date. Participants were categorized as not having recent HIV testing if they had never been tested or had not been tested within the past year.

Independent Variables

Sociodemographics included age, years in sex work, maintains a religious affiliation (including Catholic or Protestant/Evangelical Christian), and has children. Given the low level of education among the entire sample, education was categorized *post hoc* as elementary school or less, and marital status was categorized as being married or in common law vs. not married/single. Income was dichotomized, based on the 75th percentile, as earning more or less than 125 USD dollars per week.

Structural Level. Migration and mobility experiences

Short-term travel to engage in sex work to another country: We created a dichotomous variable for participants who reported engaging in sex work in another country besides where they were interviewed in the past year (yes/no).

Recent migrants: According to demography studies and the United Nations Development Program, people who have spent 5 years or less in the current city are considered recent migrants (H. Chen, 2017; International Organization for Migration, 2004). Both international migrants and internal migrants may fall into this definition.

Policy Level. Public health regulations surrounding sex work

Health Card: Participants were asked if they had an updated/current health card (yes/no) (Teresita Rocha-Jiménez et al., 2016a).

Community Level. Work environment

Formal and Informal venues: Formal venues encompass working in more ‘visible’ places such as bars, nightclubs, and discotheques. In formal venues sex workers need to have a health card, are subject to authorities’ inspections, and usually have a manager, or an owner in charge. Informal venues include working in the street, *cantinas*, *closed houses*¹, or hotels. Informal venues are clandestine and sometimes far from the tolerance zones and women find their own clients and the place (e.g., hotel, streets) where they exchange sex. Some participants responded to working in more than one type of venue (Teresita Rocha-Jiménez et al., 2016b). Thus, they are not mutually exclusive.

¹ For the purpose of this paper, closed houses are defined as a clandestine space, usually a big house, where women exchange sex with men. Its clandestine nature can be explained by the illegality of the activities that usually happen in this space (i.e. substance use, adolescents and girls exchanging sex) and the will to maintain its activities as discrete as possible (i.e. residential area vs. commercial areas).

Participated in HIV/AIDS informational or educational activities, past year: Participants were asked if they participated in an HIV/AIDS informational or educational activity in the last year, including events organized by NGOs, local clinics, or others. We created a dichotomous variable (yes/no) for attending at least one event in the last year.

Give part of your earnings to a bar owner or manager: We created a dichotomous variable for having to currently pay a pimp, manager, or bar owner a part of their earnings (yes/no). We did not ask participants about the nature of these third party interactions (i.e., a range of experiences from supportive and protective to coercive and exploitative) (McBride et al., 2019).

Interpersonal Level

Volume: We created a variable that captured participants who reported having more than 20 different clients in the past 30 days (based on 75th percentile).

Individual Level

Knowledge of HIV/STI transmission: Using the HIV Knowledge Questionnaire (15 items) as a continuous variable (range 0-15, Median=10.0, Standard Deviation=3.5) whereby higher scores indicate greater knowledge of HIV (Carey & Schroder, 2002; Haile, Chambers, & Garrison, 2007).

Self-identified fichera: *Ficheras* are women who usually drink, alcoholic or not alcoholic beverages with clients, for each drink they receive a token (*fichas* in Spanish) and the end of the day the bar owners give cash in exchange for the tokens obtained (Hernández Hernández, 2016). This activity can be independent or part of women's engagement in sex work.

Substance Use

Alcohol Use: The Alcohol Use Disorders Identification Test Consumption (AUDIT-C) was used to assess problem drinking (K. A. Bradley et al., 2007). Additionally, categorical variables were created to reflect hazardous drinking for women: a) drinking more than 4 days per week, and b) drinking 4 or more drinks on a regular day. *Drug use:* Participants were asked if they had ever used drugs and how often during the last 6 months they used a certain drug. Dichotomous categories for substance use to reflect type and frequency of use were created. For analysis purposes, hard drug use included the use of cocaine, crack, crystal methamphetamine, or heroin in any mode of administration (Cross, Johnson, Davis, & Liberty, 2001; Golub & Johnson, 2001). Marijuana, inhalants, amphetamines, and tranquilizers were excluded from this definition.

Data Analysis

Descriptive statistics were calculated to provide an overview of participants' demographics. Pearson Chi-Square or Fisher's Exact Test, for discrete variables, and Wilcoxon Rank Sum for non-parametric continuous variables ($p < 0.05$). Univariate logistic regressions were performed to identify factors associated with recent HIV testing. Variables significant at a $p \leq 0.2$ cutoff were considered for inclusion in a final hierarchical multivariable logistic regression model (Table 2.3) (Hosmer Jr, Lemeshow, & Sturdivant, 2013). To reduce multicollinearity, variables that were highly correlated with each other (an $r > 0.4$) were not included in the same model; in the event of two highly correlated covariates, the one with the strongest association with the outcome was retained. To ensure the integrity of the model, interactions between the predictors were also assessed and included when significant. Using a

forward stepwise multivariate regression procedure, variables were based on ‘blocks’ of each category of the framework. Only variables significant at $p \leq 0.05$ were retained in the final multivariate model. All regression models are presented with crude and adjusted Odds Ratios, 95% confidence intervals, with any $p \leq 0.05$ considered significant. All analyses used SPSS Statistics 21 Software (IBM, 2012).

Results

Participant Characteristics

Sociodemographic characteristics by migration and mobility experiences are summarized in Table 2.1. The median age of the sample was 27 years old (Interquartile Range [IQR]: 24-37). Sixty-six percent reported maintaining a religious affiliation, and 70% reported not being married. Almost 60% had elementary schooling or less and 84% reported having children. Seventy percent of the sample reported earning 125 USD or less per week. Most of the participants were from Central America, 60% of the participants were born in Guatemala, Mexico (19%), 11% in Honduras, 6% in El Salvador; the rest of the participants were from Nicaragua (4%), and the Dominican Republic (0.5%). Thirty percent of the total sample were international migrants, 40% internal migrants (i.e., were born in different state or city in Mexico or Guatemala), the rest (30%) are women who were born in the interview site.

Substance Use

Almost 30% reported drinking 4 or more days per week and 84% of the total sample reported drinking more than 4 drinks in a regular day. A substantial percentage of our sample (84%) reported using hard drugs in the past 6 months. Only 9 participants reported a history of injection drug use (Table 2.2).

Variables associated with HIV testing

Only 41% of the participants (n=105) reported receiving an HIV test in the past year. In the univariate analyses, we found that migration and mobility were associated with increased HIV testing; 3.67 higher odds for those engaging in short-term travel to do sex work to another country (95% CI=1.93-6.94), nearly twice the odds for recent migrants (95% CI=1.18-3.32), as well as for frequent border crossers (95% CI=0.99-2.98). Having a current health card (OR=12.63, 95% CI=4.27-37.4), working in formal venues (OR=4.59, 95% CI=1.83-5.49), participating in HIV informational or educational activities (OR=7.01, 95% CI=3.63-13.6), having knowledge of HIV/STI transmission (OR=2.27, 95% CI=1.28-4.01) were also significantly associated with HIV testing in the past year. Giving a part of your earnings to a bar owner or manager was associated with nearly a five-fold increase in the odds of HIV testing in the past year (OR=4.59, 95% CI=2.57-8.2). Prior STI diagnoses ever (OR=4.15, 95% CI=1.89-9.11) and in the past 6 months (OR=13.97, 95% CI=1.74-112.02) and high client volume (>20 different clients, past month) (OR=3.36, 95% CI=1.94-5.86) were significantly associated with higher odds of HIV testing in the past year (Table 2.2). Finally, earning less than 125 USD per week was associated with lower odds of receiving an HIV test in the past year (OR=0.31, 95% CI=0.17-0.54).

Variables independently associated with HIV testing in the past year

Using multivariable modeling, we analyzed HIV testing in the past year as the main outcome and our two main migration and mobility experiences as main predictors (Table 2.3 and 2.4). After adjusting for policy (i.e., health card), community (i.e., give a part of earnings to a bar

owner or manager), interpersonal (i.e., client volume), and individual level variables (i.e., age, years in sex work, prior STI) (see Table 2.4) short-term travel to engage in sex work in another country was independently associated with HIV testing in the past year (AOR=2.25, 95% CI=1.08-4.69). When we analyzed recent migration as the main predictor, we found that after adjusting for the aforementioned levels this variable was not independently associated with HIV testing in the past year.

Discussion

Prevalence of HIV testing in the past year among this population of female sex workers was 41%. This is a considerably low percentage considering WHO recommendations for sex workers to have access to voluntary HIV testing every 3-6 months (World Health Organization, 2012).

Previous studies in different settings, such as Vietnam, Canada, and South Africa, have found that mobility and migration may be a risk for HIV/STI diagnosis among female sex workers and a barrier for accessing health services, including HIV testing (Shira M Goldenberg et al., 2014; Grayman et al., 2005; Richter et al., 2014). However, we found that female sex workers who engaged in short-term travel to another country for sex work had independently higher odds of being tested for HIV in the past year compared to those who did not travel to another country to do sex work. Prior work in this region has found that international migrants reported higher levels of consistent condom use and health card ownership, compared to non-international migrant sex workers, which entails high levels of HIV/STI testing (Rocha-Jiménez, Morales-Miranda, Fernandez-Casanueva, & Brouwer, 2019).

These findings suggest that perhaps mobile women among this sample are being better reached by public health services than women who do not travel. An educational intervention conducted to increase knowledge, information, and access to HIV/STI prevention services in border settings, including the Mexico-Guatemala border, reported recruiting, not purposely, a higher percentage of migrant sex workers in the intervention group (Leyva-Flores et al., 2013).

A previous qualitative study conducted among sex workers at the Mexico-Guatemala border found that international migrants engaged in circular migration (i.e., to their home community or country) to access certain sexual and reproductive health services that were not accessible in the interview site (Teresita Rocha Jiménez et al., 2018). This may be happening among the participants who reported traveling to another country to engage in sex work. Additionally, in the univariate analysis, crossing the Mexico-Guatemala border at least three times in the past year was associated with higher odds of HIV testing, and this variable was correlated with short-term travel. This may also suggest that women might be crossing the border to access to health services or, given that they are more visible than their counterparts, are having more access to HIV prevention services.

As expected, having a current health card was significantly associated with HIV testing in the past year. Unfortunately, income plays an important role in this variable, as the health card is not free in one of our study sites (Mexico). We found in the univariate analysis that women who earn less than 125 USD per week had significantly lower odds of getting tested for HIV in the past year. Income may also be playing an important role among women interviewed in Guatemala as health cards are still required in higher-end venues (e.g., formal venues like night clubs) where women are likely to earn more money (Teresita Rocha-Jiménez et al., 2016a). Several studies conducted among sex workers have documented the need for voluntary and free

HIV testing, especially in low and middle-income countries (Baral et al., 2012; Nhurod et al., 2010; Teresita Rocha Jiménez et al., 2018; Suthar et al., 2013).

Higher HIV testing prevalence among those with a prior sexually transmitted infection diagnosis may suggest that women who may be most exposed to sexual risks are being reached by health services or may be more concerned about knowing their HIV status. This highlights the importance of HIV testing and education alongside STI testing or/and treatment wherever they are accessing these services.

Unfortunately, we do not know where participants were diagnosed and if they received an HIV test after or before STI diagnosis. In addition to HIV testing, female sex workers testing positive for an STI could be ideal candidates for voluntary pre-exposure prophylaxis (or PrEP) counseling. However, public health regulations surrounding sex work in both Mexico and Guatemala do not yet include PrEP availability (Colectivo Amigos Contra el SIDA, 2018; López González, 2019; United Nations Population Fund, Instituto Nacional de Salud Pública, Clínica Condesa, Unitaids, & ImPrEP, 2018). As part of broader multi-prolonged HIV prevention interventions, sex worker communities and organizations should be consulted when designing HIV/STI prevention campaigns and programs (Shira M Goldenberg et al., 2015; Schlecter, 2018).

Interestingly, we also found that high client volume (more than 20 different clients, past month) was significantly associated with HIV testing in the past year. Some studies have found that risk perception may play an important role in sexual behavior (Brockerhoff & Biddlecom, 1999; Rosenstock, Strecher, & Becker, 1994). It is possible that exposure to risky sexual behaviors, such as having many different clients, may motivate women to get tested.

Furthermore, high client volume may be correlated with the type of sex work venue (e.g., formal

vs. informal). A previous analysis from this study found that women who worked in formal venues had higher odds of having high client volume but also consistent condom use (Teresita Rocha-Jiménez et al., 2019).

We also hypothesized that recent migrant sex workers might have lower odds of getting an HIV test in the past year. In the univariate analysis we found that recent migrants had significantly higher odds of HIV testing in the past year. In the multivariable model, this variable lost significance when adjusting for other relevant variables, such as having a current health card, participating in HIV education activities, prior STI diagnosis, client volume, and individual level characteristics (Table 2.4, Final Model).

It is important to consider the characteristics of the participants who did not receive an HIV test in the past year. In the univariate analysis, participants who reported work in informal venues had significantly lower odds of receiving an HIV test (Table 2.2). Studies conducted in border settings have found that informal and unstable workplaces are associated with less access to health services (N. E. Chen, Strathdee, Rangel, et al., 2012; Sirotin, Strathdee, Lozada, Abramovitz, et al., 2010). A lower percentage of this group (19% vs. 35%) had knowledge of HIV/STI transmission, which may also be related to services not reaching this population but also with broader structural factors, such as receiving very limited sexual and reproductive health information (Teresita Rocha Jiménez et al., 2018). An interesting variable to consider are women who self-identify as a housewife, but occasionally engage in sex work; 35% of the women who did not receive an HIV test in the past year fell into this category. In the crude analysis, this was significantly associated with lower odds of receiving a HIV test. As we mentioned before, the perception of being an occasional sex worker and broader structural conditions (e.g., sex work

venue, stigma) have as consequence not having access to adequate prevention services (Saggurti, Schensul, & Verma, 2009; Taylor, Hembling, & Bertrand, 2015).

This study has several limitations. The data used for this analysis are cross-sectional; therefore causality may not be inferred. All the data were self-reported; therefore, social desirability or recall bias may have influenced results. In order to address this potential bias, trained local staff conducted all the interviews in safe and private spaces (e.g., study's office) after conducting extensive outreach to establish trust and explaining with detail what we meant by ever HIV testing. Participants also were assured that their individual responses would be kept confidential and would not affect their current access to care or services. As the data were collected via modified time-location sampling and peer-referral, we are not able to generalize to all sex workers in this or other settings. Nevertheless, this analysis contributes to understanding the limitations of HIV testing among populations disproportionately affected by HIV.

Conclusions

Female sex workers who reported traveling to engage in sex work had higher odds of receiving an HIV test. This might warrant further study to understand the structural conditions of why mobile female sex workers have increased access to HIV testing. However, overall access to HIV testing among female sex workers in border settings needs to increase. Efforts especially need to consider voluntary and non-stigmatizing prevention HIV services and focus on reaching out to less mobile women, who work in less visible venues.

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Table 2.1 Sociodemographic characteristics by migration status among substance using female sex workers at the Mexico-Guatemala border (N=255)

Characteristic	Total (n=255) n (%)	Recent Migration [^] (n=87) n (%)	No Recent Migration (n=168) n (%)	Short-term travel to engage in sex work to another country ^{^^} (n=53) n (%)	No short-term travel to engage in sex work to another country (n=202) n (%)
HIV testing in the past year	105 (41)	47 (54)	58 (35)	35 (66)	70 (35)
Country of Interview					
Guatemala	190 (75)	71 (82)	119 (71)	41 (77)	149 (74)
Mexico	65 (25)	16 (18)	49 (29)	12 (23)	53 (26)
Age (median, IQR*)	27 (22-34)	26 (21-32)	27 (22-35)	29 (24-33)	26 (21-35)
Years in sex work (median, IQR*)	4 (2-11)	4 (1-9)	5 (2-12)	7 (3-13)	4 (1-9)
At least one year in sex work	224 (88)	71 (82)	153 (91)	49 (93)	175 (87)
Income (<125 USD, weekly)	182 (71)	48 (55)	134 (80)	37 (70)	145 (72)
Marital status					
Not married vs. Married/Common law	196 (77)	65 (75)	131 (78)	41 (77)	155 (77)
Religion					
Maintains a religious affiliation vs. none	168 (66)	52 (60)	116 (69)	34 (64)	134 (66)
Education					
Elementary school or less	145 (57)	55 (63)	90 (54)	39 (74)	106 (53)
Has children	215 (84)	71 (82)	144 (86)	52 (98)	163 (81)
Of above, kids <18 years old	202 (94)	65 (92)	137 (95)	49 (94)	153 (94)
Country of origin					
Mexico	49 (19)	6 (7)	43 (26)	8 (15)	41 (20)
Guatemala	151 (59)	47 (54)	104 (62)	26 (49)	125 (62)
El Salvador	16 (6)	8 (9)	8 (5)	5 (9)	11 (5)
Nicaragua	10 (4)	3 (3)	3 (2)	0 (0)	10 (5)
Honduras	28 (11)	22 (25)	6 (4)	13 (25)	15 (7)
Dominican Republic	1 (0.5)	1 (1)	0 (0)	1 (2)	0 (0)

*Recent migrants include participants who have been in the interview city less than five years. This may include international and internal migrants.

^^ Participants reported briefly traveling to a different country to engage in sex work in the past year. *Interquartile range

Table 2.2 Univariate association of variables with HIV testing in the past year among substance using female sex workers at the Mexico-Guatemala border (N=255)

Characteristic	HIV testing in the past year (n=105) n (%)	No HIV testing in the past year (n=150) n (%)	OR (95% CI)	P Value
<i>Structural Level. Migration and mobility</i>				
Short-term travel to engage in sex work in another country, past year	35 (33)	18 (12)	3.67 (1.93-6.94)	<0.001
Recent migration (time in the interview city <5 years)	49 (47)	46 (31)	1.98 (1.18-3.32)	0.010
Crossed the Mexico-Guatemala border at least 3 times, past year [^]	37 (35)	36 (24)	1.72 (0.99-2.98)	0.052
<i>Policy Level. Public health surrounding sex work</i>				
Current health card	27 (26)	4 (3)	12.63 (4.27-37.4)	<0.001
<i>Community Level. Work environment (n=251)</i>				
Type of Venue(s)+				
Formal Venue++	48 (47)	32 (22)	3.16 (1.83-5.49)	<0.001
Informal Venue+++	76 (74)	128 (87)	0.44 (0.23-0.84)	0.012
Participated in HIV/AIDS informational or educational activities, past year	46 (45)	15 (10)	7.01 (3.63-13.6)	<0.001
Gives a part of earnings to a bar owner or manager	48 (47)	24 (16)	4.59 (2.57-8.21)	<0.001
<i>Interpersonal Level</i>				
Consistent condom use	62 (59)	47 (31)	3.16 (1.87-5.31)	<0.001
Client volume (>20 different, past month)	48 (46)	30 (20)	3.36 (1.94-5.86)	<0.001
Knows someone who died from AIDS	33 (31)	45 (30)	1.07 (0.62-1.84)	0.808
Family knows you engage in sex work	61 (58)	44 (42)	2.54 (1.52-4.24)	<0.001
<i>Individual Level</i>				
Country of Interview Guatemala vs. Mexico	83 (79)	107 (71)	1.52 (0.84-2.73)	0.166
Income (<125 USD, weekly)	60 (57)	122 (81)	0.31 (0.17-0.54)	<0.001

Table 2.2 Univariate association of variables with HIV testing in the past year among substance using female sex workers at the Mexico-Guatemala border (N=255)

Characteristic	HIV testing in the past year (n=105) n (%)	No HIV testing in the past year (n=150) n (%)	OR (95% CI)	P Value
At least one year in sex work	94 (90)	130 (87)	0.49 (0.60-2.87)	0.493
Knowledge of HIV/STI transmission (median, IQR*)	10 (9-12)	8.50 (6-11)	1.17 (1.10-1.27)	<0.001
Prior STI diagnosis (ever)	24 (23)	10 (7)	4.15 (1.89-9.11)	<0.001
Prior STI diagnosis (past 6mo)	9 (9)	1 (0.7)	13.97 (1.74-112.02)	0.002
Self-identified as a street worker	26 (25)	34 (23)	1.12 (0.63-2.02)	0.698
Self-identified as a bar sex worker	37 (35)	21 (14)	3.34 (1.82-6.16)	<0.001
Self-identified as a housewife with occasional clients	15 (14)	51 (34)	0.32 (0.17-0.62)	0.001
Self-identified as a fichera**	17 (16)	8 (5)	3.43 (1.42-8.35)	0.006
Substance Use				
Drinks 4 or more days per week	35 (33)	40 (27)	1.38 (0.79-2.37)	0.251
Drinks more than 4 drinks on a regular day	93 (89)	122 (81)	1.78 (0.86-3.68)	0.121
Ever injection drug use (n=9)	6 (6)	3 (2)	2.97 (0.73-12.15)	0.167
Any hard substance use, past 6mo***	88 (84)	106 (71)	2.15 (1.15-4.02)	0.017

*Interquartile range ^ Based on the median, range 0-365.

+Some participants reported working in more than one place as their main workplace and some of them reported a formal and an informal venue as their main workplace. ++ Formal venues include reporting working in a bar, nightclub, *discoteque* or brothel. These venues usually require a health card.

+++Informal venues include reporting working in the street, *cantina*, *closed house* (clandestine space where women exchange sex with men), hotel, massage parlor, client's car, private house, park or any other public space, place where they use or buy drugs.

***Ficheras* are women who usually drink alcoholic or non-alcoholic beverages with clients. For each drink they receive a token (*fichas* in Spanish) and at the end of the day the bar owners give cash in exchange for the tokens obtained. ***Includes reporting the use of cocaine, crack, crystal meth, or heroin by any mode of administration. Boldface indicates characteristics that were statistically significantly associated at $p < 0.05$ with HIV testing in the past year.

Table 2.3 Factors independently associated with HIV testing in the past year among substance using recent migrants at the Mexico-Guatemala border (N=255)

Characteristic	AOR (95% CI) Model 1	AOR (95% CI) Model 2	AOR (95% CI) Model 3	AOR (95% CI) Model 4	AOR (95% CI) Model 5 (Final)
<i>Structural Level. Migration and mobility (main predictor)</i>					
Short-term travel to engage in sex work in another country, past year	2.34 (1.32-4.85)**	3.41 (1.73-6.68)***	2.34 (1.32-4.85)**	2.34 (1.11-4.78)**	2.16 (1.02-4.57)**
<i>Other variables adjusted for</i>					
<i>Policy level. Public health surrounding sex work</i>					
Current health card		11.84 (3.93-35.62)***	7.24 (2.25-23.25)***	6.83 (2.07-22.63)***	6.70 (1.98-22.62)***
<i>Community level. Work environment.</i>					
Give a part of earnings to the bar owner or manager			2.55 (1.31-4.97)***	2.23 (1.12-4.43)**	2.41 (1.17-4.98)**
Participated in HIV/AIDS activities, past year			4.90 (2.40-10.04)***	5.23 (2.50-10.94)***	5.15 (2.42-10.96)***
<i>Interpersonal level</i>					
Client volume (>20 different clients, past month)				2.87 (1.49-5.48)***	2.62 (1.34-5.12)***
<i>Individual level</i>					
Age					0.99 (0.95-1.04)
At least one year in SW					1.47 (0.57-3.78)
Prior STI diagnosis (ever)					3.72 (1.46-9.48)***

*p value <0.10,
**p value >0.05,
***p value <0.01

Table 2.4 Factors independently associated with HIV testing in the past year among substance using recent migrants at the Mexico-Guatemala border (N=255)

Characteristic	AOR 95% CI Model 1	AOR 95% CI Model 2	AOR 95% CI Model 3	AOR 95% CI Model 4	AOR 95% CI Model 5 (Final)
<i>Structural Level. Migration and mobility (main predictor)</i>					
Recent migration	2.23 (1.31-3.78)**	1.51 (0.85-2.69)	1.34 (0.70-2.55)	1.43 (0.74-2.75)	1.58 (0.80-3.12)
<i>Other variables adjusted for</i>					
<i>Policy level. Public Health surrounding sex work</i>					
Current health card		10.64 (3.51-32.26)***	7.16 (2.18-23.53)***	6.89 (2.04-23.27)***	6.29 (1.81-21.82)***
<i>Community level. Work environment.</i>					
Give a part of earnings to the bar owner or manager ^a			2.51 (1.28-4.90)***	2.16 (1.08-4.33)**	2.38 (1.15-4.95)**
Participated in HIV/AIDS activities ^b			5.88 (2.91-11.88)***	6.30 (3.04-13.04)***	6.11 (2.88-12.95)***
<i>Interpersonal level</i>					
Client volume (>different 20 clients) ^a				2.94 (1.54-5.63)***	2.71 (1.39-5.29)***
<i>Individual level</i>					
Age					0.99 (0.96-1.04)
At least one year in SW					1.79 (0.69-4.60)
Prior STI diagnosis (ever)					3.88 (1.55-9.72)***

*p value <0.10, ** p value>0.05, ***p value<0.01, ^a Past month. ^b Past year.

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Chapter 3. Intercepted journeys: associations between migration and mobility experiences and possible major depressive symptoms among substance using migrants at the Mexico-Guatemala border

Abstract

Substance use and depressive psychiatric symptoms have been associated with migration and mobility. The aim of this paper is to analyze the association of migration and mobility patterns with possible major depressive symptoms among migrants at the Mexico-Guatemala border. Using modified time-location sampling we recruited 392 migrants. Crude and adjusted logistic regression models were conducted and found that 12% of the sample had possible major depressive symptoms. After adjusting for relevant covariates, recent rural-urban and short-term migrants had higher odds of possible major depressive symptoms, whereas international migration was protective.

Introduction

Migration experiences and its stressors impact individual health (Bhugra, 2004; Bhugra & Jones, 2001). The health-related impacts of migration and mobility may be positive or negative. For instance, (Cresswell, 2006c; Kanaiaupuni & Donato, 1999; Moyer et al., 2008; Skeldon, 2014). However, migration and mobility have also been associated with negative health outcomes, such as substance misuse, barriers to accessing healthcare as well as psychiatric disorders (Achotegui, 2005; Breslau et al., 2011; Escobar et al., 2000).

A number of studies have focused on exploring how experiences of the three main migration phases (i.e., origin, transit, and destination) may impact migrants' mental health status (Bhugra, 2004; Gushulak & MacPherson, 2011). Studies conducted among Latino immigrants in the United States (U.S) have explored how circumstances of departure, such as exposure to political conflict and violence in the country of origin (Servan-Mori et al., 2013), were associated with mental health problems among other health outcomes (Eisenman et al., 2003; Lusk et al., 2013; Torres & Wallace, 2013). Other studies have focused on the transit phase. A study conducted among Mexican and Central American migrants aiming to move to the U.S found that arbitrary detention, physical, and sexual violence during their journey resulted in need of medical assistance and psychological help (Infante-Xibille et al., 2006; Temores-Alcántara et al., 2015). Lastly, a number of studies have explored how arriving at a new community may increase the risk of substance abuse, anxiety, and limited access to health services as a result of social isolation, language barriers, migration status, and stigma (Berk & Schur, 2001; Borges et al., 2009; Breslau et al., 2011; Fazel et al., 2012; Lin et al., 2011; Pinedo et al., 2014; Sullivan & Rehm, 2005; Torres & Wallace, 2013; Zhong et al., 2015). These approaches consider migration in a linear, stepwise manner, which may not reflect other

migration patterns of migrants. There is limited research that considers a non-linear, more comprehensive perspective on the migration process that takes into account a variety of migration experiences (Collyer, 2007, 2010; Menjívar, 2006), or which considers an interception phase (Martinez-Donate et al., 2015; Zimmerman et al., 2011). The interception phase is particularly relevant to undocumented, forced migrants (e.g., displaced populations), and stranded migrants² and is characterized by situations of detention, provisional residence, constant mobility, or deportation. It may happen at any point in the migration process (Collyer, 2010; Dowd, 2008; Menjívar, 2006; Zimmerman et al., 2011) (Figure 1).

Analyzing non-linear migration experiences is particularly relevant to the study of migrant mental health at the Mexico-Guatemala border. Central America's political instability, social insecurity, poverty, and precariousness due to civil wars, gang-and drug related violence, natural disasters, and climate change of the last 50 years have driven almost 4 millions of migrants northward (Armijo, 2010; Armijo, Benítez, & Hristoulas, 2009; Canales Cerón & Rojas Wiesner, 2018a; Lesser & Batalova, 2017; Semple, 2019; Wendy A. Vogt, 2012; Wendy A Vogt, 2013). Thus, this border region represents a key geographical position for regional and international migrants aiming to improve their economic situation or to flee from violence in their home counties and as a gateway into Mexico and the U.S. (Fernández Casanueva, 2012; Leyva et al., 2004; Masferrer et al., 2018; Ruiz, 2001; Villa et al., 2004; Wendy A. Vogt, 2012; Wendy A Vogt, 2013). Additionally, this is a region where other types of migration and mobility flows such as everyday commuters, truck drivers, businesspersons, and seasonal agricultural workers, converge (Bronfman et al., 2004; Castillo Garcia, 2000). Migrants in this border often

² There are several definitions of “stranded migrants” but for the purpose of this paper we will use it to refer to migrants that for a variety of reasons, find themselves trapped in transit and become vulnerable to human rights abuses in the course of their journey (Dowd, 2008)

remain in the region - in-between, stranded, or uncertain stage for an unknown or unlimited amount of time as a result of the nature of the porosity of the Mexico-Guatemala border, as well as the increased barriers to migrating northward (Collyer, 2007; Fernández Casanueva, 2012; Levitt, 2014; Lippman et al., 2007; Menjívar, 2006; Teresita Rocha Jiménez et al., 2018).

Given the complexity and the heterogeneous nature of migration patterns at the Mexico-Guatemala border and the scarcity of mental health research considering comprehensive migration processes, the aim of this paper is to assess specific migration experiences and their association with possible major depressive symptoms among recent migrants at the Mexico-Guatemala border. Based on the literature on migrant mental health, we hypothesize that migrants who were forced or coerced to move by someone against their will or due to violence in their community, short-term migrants (i.e., between 3 months to a year in the interview site) (International Organization for Migration, 2004), rural-urban migrants, and deported migrants will all have higher odds of having possible major depressive symptoms in comparison to those who were not forced to migrate, longer-term migrants, non rural-urban migrants, and migrants with no history of deportation respectively (Alderete et al., 1999; Cislo et al., 2010; Fazel et al., 2012; Li et al., 2006; Skeldon, 1997; Sullivan & Rehm, 2005; Temores-Alcántara et al., 2015).

Methods

Our analysis is guided by an adapted version of the migration phases and psychiatric disorders framework. This adapted framework is based on Zimmerman and colleagues' migration and health framework that takes into consideration the interception phase to design adequate public health policies to protect migrants; and Bhugra's migration and psychiatric disorders health framework that considers both vulnerabilities and resilience in analyzing the relationship between migration and psychiatric disorders (Figure 1). Some studies have found

that stress-coping strategies (e.g., positive reframing) and social support may be protective factors counteracting stress and anxiety among migrants, specifically among Hispanic immigrants living in the U.S. (R. D. Alarcón et al., 2016; M. Alegria et al., 2007; Cardoso & Thompson, 2010). Additionally, we will explore sociodemographics (e.g., gender, education, income) as well as other characteristics that have been found to be associated with having symptoms of depression among mobile as well as non-mobile populations (e.g., financial situation) or that have been found to be mediators (e.g., religion) (Bhugra, 2004; Delara, 2016; McQueen et al., 2003; Salgado et al., 2014).

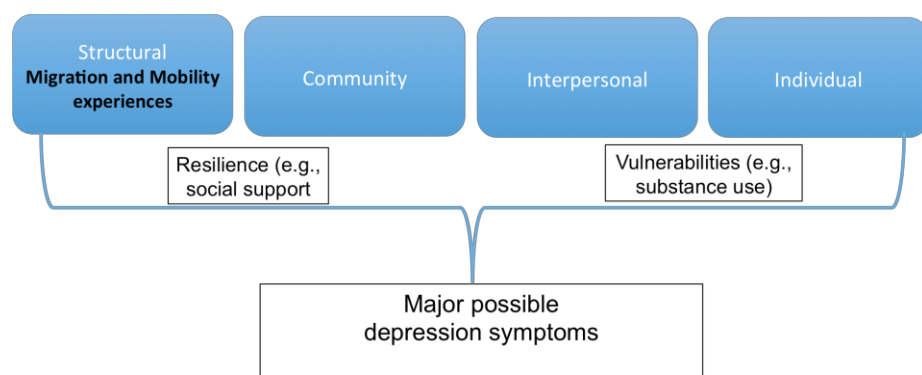


Figure 3.1 Adapted Conceptual Framework of Socio Ecological Model and Psychiatric Disorders (Bhugra, 2004; Zimmerman et al., 2011)

Study Setting and Procedures

From September 2013 to July 2015 we recruited 392 migrant participants as part of a larger cross-sectional NIH-funded study (*Cruzando Fronteras*) of substance use and HIV risk. Participants were primarily recruited in the border cities of Ciudad Hidalgo and Tapachula in Mexico and Tecún Umán and Quetzaltenango in Guatemala, key sites for major migration routes (Campos-Delgado & Odgers-Ortiz, 2012; Morales-Miranda et al., 2013). Participants were recruited using a combination of modified time-location sampling of migrant “venues” (e.g.,

migrant shelters, border crossings) and peer referrals. Trained local staff invited participants to participate and administered a brief screening questionnaire to assess eligibility.

Eligibility criteria for the study included: a) 18 years old or older; b) Spanish speaker; c) willing and able to provide informed consent; d) willing to undergo on-site HIV, HCV, and syphilis testing; e) have had problem drinking or used illicit substances (beyond marijuana by itself) by any mode of administration in the past 2 months; e) meet the definition of recent migrant (see paragraph below). The Alcohol Use Disorders Identification Test-Consumption (AUDIT-C), a standardized alcohol misuse screening tool, was used to assess problem drinking. We used the recommended alcohol misuse thresholds of at least 4 for men or 3 for women (K. A. Bradley et al., 2007).

Recent migrants/mobile individuals included those with at least one of the following characteristics: a) Moved states or countries (to live) within the past 5 years; b) Traveled to another country or state for work for at least 3 months of the year; or c) were deported (from any country) within the past 5 years. Upon written consent, trained local staff conducted face-to-face interviews in Spanish using computer-assisted personal interviewing technology. Depressive symptoms were assessed with the self-reported Center for Epidemiologic Studies Depressive Scale - Revised 10-item (CESD-R-10), a widely-used and consistent index of depressive symptomatology (Björgvinsson, Kertz, Bigda-Peyton, McCoy, & Aderka, 2013; Radloff, 1977).

The survey took approximately 90 minutes to complete and included questions about: sociodemographics, substance use practices, history of community and personal violence, migration experiences, and mental health. Participants were compensated \$10 USD in in-kind goods for completing the interview and testing. This project was approved by the Human Research Protections Program (IRB) of the University of California, San Diego; the Bioethics

Committee of the University del Valle, Guatemala (UVG); and the Bioethics Committee of the Institute of Health of the State of Chiapas, Mexico.

Dependent variable

The CESD-R-10 defines a score of 10 points or higher (out of 30) as having symptoms of depression (Björgvinsson et al., 2013; Radloff, 1977). Using this criterion, almost half of our study's sample (47%) was categorized as having symptoms of depression. Given the uncertain clinical implications of this broad definition and limited variability that this would have provided to our analysis, we decided to use a more robust definition that captured "possible major depressive symptoms" (Radloff, 1977). Possible major depressive symptoms are defined by the presence of anhedonia (i.e., loss of interest) or dysphoria (i.e., sadness) 5-7 days of the past week, and at least two additional symptoms (i.e., appetite, sleep, concentration, fatigue, suicidality, or agitation) occurring 5-7 days of the past week (Björgvinsson et al., 2013; Haroz, Ybarra, & Eaton, 2014; Radloff, 1977) (See Figure 3.2).

Independent Variables

Sociodemographics, financial situation, and substance use

Sociodemographics included age, gender, maintains a religious affiliation (including Catholic, Protestant or Christian), member of an indigenous group (including Maya, Garifuna, or Xinka), and has children. Participants were asked if they identified themselves as heterosexual, gay, or bisexual. We created a category that included bisexual and gay participants vs. heterosexual. Education was categorized post hoc as elementary school or less, and marital status was categorized as being married or in common law vs. not married/single. Income was

dichotomized as earning more or less than 40 USD dollars per week. Participants were asked the amount of money they earn weekly in Mexican pesos or Guatemalan quetzales and then we converted it to USD dollars using the conversion of the day the interviews were conducted. The cutoff of 40 USD dollars is based on an approximate of the minimum averaged wage in Mexico and Guatemala. Participants were asked about their perception of their current financial situation and we dichotomized this as bad or extremely bad vs. neither good nor bad, good, or extremely good. Participants were also asked if they thought of themselves as homeless (e.g., not having a stable place to live or living in the street) in the past 6 months (yes/no).

The AUDIT-C Scale was used to identify harmful alcohol use. A score of 8 or more points indicates current harmful alcohol use as well as alcohol dependence (Katharine A Bradley et al., 2007; World Health Organization, 2001). Drug use questions included the use of cocaine, crack, heroin, inhalants, amphetamines, methamphetamines, tranquilizers, and the combination of these substances by any mode of administration. Participants were asked if they have ever used any of these, in the past 6 months, and how often (i.e., at least once a month, 2-3 days per month, once a week, 2-3 days per week, 4-6 days per week or more often). Hard drug use was created considering the use of heroin, methamphetamine, crack, or cocaine in the past 6 months by any mode of administration.

Migration and mobility experiences

Participants were asked if they were forced or coerced to move by someone against their will and in a separate question they were asked if they were forced to move or due to violence in

their community³. We specified that this did not include moving for economic reasons. The variable “recent international migration” encompassed participants who were born in a different country from where they were interviewed and had been in the current country less than 5 years. Recent rural-urban migration was defined as ever having lived in a rural area for more than 6 months and having recently moved (within the past 5 years) from a rural area/small town (e.g., Coatepeque, Malacatán, Tecún Umán, Huixtla, Arriaga, Cacahoatán, Ciudad Hidalgo) to a city (e.g., Tapachula, Quetzaltenango). Classification of sites as rural or urban was based on population density and economic activity (International Organization for Migration, 2004; Pérez Campusano & Santos Cerquera, 2013; United Nations Development Programme, 2014). Short-term migration was defined as spending between 3 months to a year in the interview city (International Organization for Migration, 2004). The variable “crossed the Mexico-Guatemala border at least 5 times in the past year” was created based on a cutoff at the 75th percentile. The inclusion to these different groups was not mutually exclusive, thus a participant can fall into more than one of these categories.

Social support

We asked 8 questions and an extra item from the 19-item Medical Outcome Study Social Support Survey (mMOS-SS) (Moser, Stuck, Silliman, Ganz, & Clough-Gorr, 2012). This survey includes emotional/informational items, tangible support items, affectionate support items, and positive social interaction items. A higher total mMOS-SS reflects stronger social support. We reported the mean and standard deviation (SD) as well as each item dichotomized by ever (which included sometimes, about half the time, often or always) vs. never.

³ Unfortunately, we do not know if this involved trafficking, as we did not ask this directly. Based on the responses of who forced our participants to move (e.g., gangs) we believe that most of the cases are displaced persons (see Discussion).

Statistical Analysis

Descriptive statistics were calculated to provide an overview of recent migrants' demographics by possible major depressive symptoms status. Pearson Chi-Square or Fisher's Exact Test were used for discrete variables, and Wilcoxon Rank Sum was used for non-parametric continuous variables ($p \leq 0.05$). Bivariate logistic regression was performed to identify factors associated with possible major depressive symptoms. Variables significant at a $p \leq 0.1$ cutoff were considered for inclusion in a final multivariable logistic regression model (Table 3.4) (Hosmer Jr, Lemeshow, & Sturdivant, 2013). To reduce multicollinearity, variables that were highly correlated (an $r > 0.4$) were not included in the same model; in the event of two highly correlated covariates, the one with the strongest association with the outcome was retained. To ensure the integrity of the model, interaction between predictors and key independent variables – such as gender – were calculated, but no significant interaction was found. Using a forward stepwise multivariate regression procedure, variables were added based on 'blocks' of each category of the framework. Only variables significant at $p \leq 0.05$ were retained in the final multivariate model (Table 3.4). All regression models are presented with crude and adjusted Odds Ratios, 95% confidence intervals, with $p \leq 0.05$ considered significant. All analyses were conducted using SPSS Statistics 21 Software (IBM, 2012).

We assessed internal consistency reliability using Cronbach's alpha (α) and the 10 items ranged from 0.74 to 0.83 for the current study sample. The overall Cronbach's alpha was 0.79. Individual level item analysis of the 10 items on the CESDR-10 in the sample indicated that the removal of any of the items would have reduced the overall alpha only slightly (Haroz et al., 2014; Ruiz-Grosso et al., 2015; Tavakol & Dennick, 2011).

Results

Participant Characteristics

Sociodemographic characteristics by possible major depressive symptoms are summarized in Table 3.1. Four participants identified as transgender and were excluded from this analysis because of the small sample size and likely unique correlates of depressive symptoms. One in five (21%) of the sample identified with an indigenous group, 79% maintained a religious affiliation, and 70% reported not being married. Almost half had only elementary schooling or less and 67% reported having children. Half of participants were born in Guatemala, 23% in Honduras, and 18% in El Salvador; the rest of the participants were from Mexico (6%), Nicaragua (3%), and Panama (0.3%).

Substance Use

The drugs most commonly used by participants in the past 6 months were marijuana (47%) and hard drugs including heroin, crack or cocaine in any mode of administration (34%), which included cocaine (not injected) (22%) and smoking crack (20%). Thirty-two participants reported ever injecting a drug (8%) (Table 3.1). However, recent injection was uncommon.

Variables associated with possible major depressive symptoms among substance using recent migrants

Forty-five participants (11.5%) were identified as having possible major depressive symptoms. In the univariate analyses, female migrants had significantly higher odds (OR=2.26, 95% CI=1.16-4.40, p=0.016) of having possible major depressive symptoms in comparison to their male counterparts. Earning less than 40 USD weekly was also associated with possible major depressive symptoms (OR=2.6, 95% CI=1.36-5.05, p=0.004) as well as perceived homelessness in the past 6 months (OR=1.98, 95% CI=1.06-3.70, p=0.032) (Table 3.2).

Fifty six percent of the total sample reported being currently employed, with 27% of these having an informal job such as sporadic construction work, 16% working in agriculture, 12% being a taxi, *tricilero*⁴, or bus driver, 5% doing domestic work, 5% selling sex, and 4% selling drugs. Some participants reported engaging in more than one economic activity at the same time. In terms of substance use, hazardous and harmful alcohol use was significantly associated with possible major depressive symptoms (OR=2.22, 95% CI=1.16-4.23, p=0.016). Although by design a substantial percentage of the entire sample reported using hard drugs in the past 6 months (34%), this was not significantly associated with possible major depressive symptoms (Table 3.2).

In terms of migration and mobility experiences, 43% reported being forced to move due to violence in their community, and 20% of the sample reported being forced or coerced to move against their will. Neither of these experiences were significantly associated with possible major depressive symptoms. Out of 167 participants who reported being forced to move from their community or against their will, only 24 participants specified by whom. Sixteen responded that they were forced to move by gangs or organized crime, six reported by a family member or acquaintance, and two owed money to someone.

Being a recent international migrant (45%) was associated with significantly lower odds of having possible major depressive symptoms (OR=0.50, 95% CI=0.26-0.97, p=0.040).

Experience of recent rural-urban migration, however, was significantly associated with higher odds of having possible major depressive symptoms (OR=2.34, 95% CI=1.25-4.37, p=0.008). We asked participants how long they had spent in the interview city, and we found that short-term, recent migrants (i.e., spent between 3 months to a year in the current city) had

⁴ *Tricicleros* are cycle rickshaw drivers who work at the border crossing people back and forth and within the border cities.

significantly higher odds of having possible major depressive symptoms (OR=2.44, 95% CI=1.28-4.64, p=0.007) but participants who had spent less than 3 months or were just passing through the interview city had lower odds of possible major depressive symptoms (OR=0.37, 95% CI=0.18-0.76, p=0.007). Thirty-four percent of the sample had ever been deported from a country other than the U.S. but this experience was not associated with possible major depressive symptoms. However, participants who had ever been deported from the U.S had significantly lower odds of having possible major depressive symptoms in comparison with participants who had never been deported from the U.S (OR=0.30, 95% CI=0.11-0.86, p=0.026) (Table 3.2).

Social support items as a scale were not significantly associated with our outcome, but when the items were analyzed individually we found that participants who reported “having someone to help you with daily chores or when you are sick” had significantly lower odds of having possible major depressive symptoms (OR=0.48, 95% CI=0.24-0.89, p=0.021).

Independent predictors of possible major depressive symptoms

Using multivariable modeling, we analyzed possible major depressive symptoms as the main outcome and migration and mobility experiences as the main predictors. Covariates in the final model included gender (female vs. male), income (<40 USD weekly), and perceived homelessness in the past 6 months. After adjusting for the aforementioned covariates, we found that the adjusted odds of recent rural-urban migrants having possible major depressive symptoms were 2.73 greater compared to those who did not recently migrate from a rural to an urban area (95% CI=1.33-5.60, p=0.006). Short-term migration was also independently associated with possible major depressive symptoms (AOR=3.17, 95% CI=1.48-6.55, p=0.003). Interestingly, recent international migrants had lower adjusted odds of possible major depressive symptoms in

contrast with non-recent international migrants (AOR=0.27, 95% CI= 0.12-0.61, p=0.002) (Table 3.3). When entered in the final model, spending less than three months or just passing through the interview city did not remain significant. Ever being deported from the U.S. was highly correlated with recent international migration and thus did not remain in the final model. Sociodemographic characteristics and other relevant information (e.g., substance and social support) of migration experiences that are significantly associated with possible major depressive symptoms are summarized in Table 3.4.

Discussion

The prevalence of symptoms of depression among substance using recent migrants at the Mexico-Guatemala border was 47% and the prevalence of possible major depressive symptoms among this population was 11.5%. This is substantially higher than the general population. A national survey in Mexico found 5.8% of the adult population met the criteria of having at least one depressive disorder in the past month (Ma Elena Medina-Mora et al., 2003) and the Mexican Institute of Statistics and Geography (INEGI) found that 11.7% of the population of 12 years old or older felt depressed at least once a week (Instituto Nacional de Estadística y Geografía, 2017). A systematic review conducted to collect the existing evidence regarding the performance of CESD found that the prevalence of major depressive symptoms among adults and adolescents in the general population was 8.8% (Vilagut, Forero, Barbaglia, & Alonso, 2016), lower than the possible major depressive symptoms of our sample (11.5%). Findings from different studies conducted among different migrant populations (e.g., Latino immigrants in the U.S., Guatemalan refugees in Mexico, and with persons who inject drugs (PWID) with a history of deportation from the U.S to Mexico) (M. Alegría et al., 2007; Pinedo et al., 2018; Sabin, Cardozo, Nackerud,

Kaiser, & Varese, 2003) suggest that compared to the general population our sample has a higher prevalence of symptoms of depression as well as possible major depressive symptoms; and a similar or higher prevalence of symptoms of depression and slightly lower of possible major depressive symptoms compared to other vulnerable populations. For example, Pinedo and colleagues found that 45% of the PWID with a history of deportation reported symptoms of depression compared to 47% of our sample.

We found interesting associations between migration and mobility experiences and possible major depressive symptoms among substance-using recent migrants at the Mexico-Guatemala border. As we hypothesized - and after adjusting for gender, homelessness, and financial status - short-term migration and rural to urban migration were associated with possible major depressive symptoms.

In terms of short-term migration, research conducted among Cuban migrants in the United States found that migrants who have been a shorter time in the United States had higher odds of symptoms of depression in comparison with migrants who had resided longer in the United States (Cislo et al., 2010). This is thought to be related with increasing experience and learning how to navigate the health system among migrants in a new community, which has been found to be inversely related to depressive symptoms along with income, education, and social support (R. D. Alarcón et al., 2016; Jurado et al., 2017). In the present study, a high percentage of the short-term migrants were unemployed (41%), 28% considered themselves homeless, 33% reported earning less than 40 USD weekly, and 26% of this group reported that in the past year they thought they needed to go to see a doctor but did not go, mainly due to cost (Table 3.4). These are all structural barriers that may contribute to explaining why short-term migrants have higher odds of having possible major depressive symptoms.

Studies exploring rural-urban migration in China, Mexico, Thailand, and in the United States have found mixed results in regards to mental health status. For instance, a study conducted in Thailand found that rural-urban migration improved migrants' mental health status because this was associated with less presence of previous disadvantages (e.g., poverty, limited access to health services) (Nauman, VanLandingham, Anglewicz, Patthavanit, & Punpuing, 2015). Nonetheless, other studies conducted in China, Mexico, and in the United States have found that rural-urban migration is associated with mental health problems due to social inequality, precariousness, stigma, and discrimination (Alderete et al., 1999; Canales Cerón & Rojas Wiesner, 2018b; Lin et al., 2011; María Elena Medina-Mora et al., 2014; Wiesner, 2017).

Something important to consider among our sample of rural to urban migrants is that 16% of this group identified themselves as members of an indigenous group; other studies have shown that Indigenous groups who migrate internationally may face particularly severe mental health inequities, perceived discrimination, and risky alcohol use behaviors (Table 3.4) (Haviland de León, Rocha Jiménez, Lewin-Fishcher, & Zúñiga, 2016; Salgado et al., 2014; Zúñiga et al., 2014). Almost forty percent of the recent rural-urban migrants in our study reported earning less than 40 USD weekly and considered themselves homeless in the past 6 months - both factors associated with possible major depressive symptoms. Failing to achieve expected economic goals has been found to increase depressive symptoms among migrant populations (Alderete, Vega, Kolody, & Aguilar-Gaxiola, 2000).

Our study revealed that recent international migration had significantly adjusted lower odds of having possible major depressive symptoms, which is different from findings from other studies. The healthy migrant effect, which indicates that healthier individuals are more likely to migrate and that have the ability to move, may be playing an important role in this association

(Aguila, Escarce, Leng, & Morales, 2013; R. D. Alarcón et al., 2016; Lewin Fischer, 2012; Salgado de Snyder, 2014; Zúñiga et al., 2014). One important factor to consider of the recent international migrant group is that 25% of this group was trying to migrate to the United States before arriving at the current city; so it is likely that some were still trying to migrate northward at the time of the interview. Temores-Alcántara and colleagues have documented that migrants in transit through Mexico may have increased resilience to negative experiences given that they have a major goal that they're looking forward to (Temores-Alcántara et al., 2015).

Sixty-two percent of international migrants reported that they had plans of moving out of the interview city in comparison with 50% and 53% of short-term and rural-urban migrants respectively (Table 3.4). Another important element to consider is how vulnerabilities, perceived stress, and coping strategies might differ across groups (Bhugra, 2004). Farley and colleagues found that Mexican citizens used elements such as positive reframing and denial to cope with the stress of being an undocumented migrant and have unstable jobs in comparison to non-migrants, which were predictors of better mental health (R. D. Alarcón et al., 2016; Farley, Galves, Dickinson, & Perez, 2005). This might suggest that international migrants from our sample may be coping with difficult conditions similarly.

Deportation from any country other than the U.S. was reported among 25% of the short-term migrants. In other studies, deportation and fear of deportation have been found to be associated with depressive symptoms among Latinos deported from the U.S. (Pinedo et al., 2018; Rojas-Flores, Clements, Hwang Koo, & London, 2017). However, in this study, deportation from the U.S. was correlated with international migration (Table 3.2), and this variable disappeared upon adjustment in the multivariable model.

Contrary to what we hypothesized, and what other studies have found (Fortuna, Porche, & Alegria, 2008; Lusk et al., 2013), being forced or coerced to move against their will or due to violence in their community was not significantly associated with possible major depressive symptoms. It is possible that the instrument used (CESDR-10) to capture symptoms of depression, as well as the time considered in our predictors (i.e., recent migration), may not have been suitable to capture trauma.

However, it is important to highlight that 43% of our sample reported being forced to move due to violence and 20% were forced or coerced to move against their will. Almost 60% of the international migrants, 44% of the short-term migrants (44%), and 51% of the rural-urban migrants reported being forced to move due to violence in their community. Thirty percent of the international migrants reported being forced or coerced to move against their will, 25% of the short-term migrants, and 27% of the rural-urban migrants reported this experience. Although we do not have further details of what this entailed it is likely that these experiences respond to trafficking experiences that previously have been documented in this region (Casillas, 2011b; González, 2018; Teresita Rocha-Jiménez et al., 2016b).

These data are especially relevant as currently there are thousands of Central Americans seeking asylum in the United States (Correal & Specia, 2018; Sánchez, 2018). Most of the participants who indicated by whom they were forced to move reported that it was due to gang violence in their origin community. These data show that an important percentage of migrants in the Mexico-Guatemala border are fleeing from their communities very likely due to violence, and that future research studies, health, and policy interventions must consider such reality (Dominguez-Villegas, 2019).

Lastly, limited access to health care services has been found to be higher among migrants in specific settings, such as the United States and Canada, and this may be related to poor mental health (Derose, Escarce, & Lurie, 2007; Derose, Gresenz, & Ringel, 2011; Hilario, Oliffe, Wong, Browne, & Johnson, 2018; Temores-Alcántara et al., 2015; Zúñiga et al., 2014). In this study, we found that 25% of the total sample reported not going to the doctor in the past year although they needed to go, and the cost of going had a marginal association with possible major depressive symptoms (Table 3.2). Twenty-six percent of the short-term migrants reported not going to the doctor in comparison with 21% and 16% of international and rural-urban migrants. The latter especially may be related to the short amount of time in the interview site.

This study has several limitations. Symptoms of depression are based on a self-reported measure, and thus potentially subject to bias. Participants may have underreported symptoms fearing the stigma associated with mental health conditions. Nevertheless, our categories are based on a previously validated and widely used clinical scale for depressive symptoms (CESDR-10 scale). Also, our field team included a trained psychologist who has previously worked with vulnerable populations at the border (e.g., female sex workers and migrants). The field staff stressed that the only purpose for conducting the survey was research, with care or future benefits unrelated to the responses. While the CESDR-10 scale was not originally designed to capture depressive symptoms among Spanish speakers (Radloff, 1977), the performance of the CES-D scale in screening for depressive disorders has been reported with reliable results in Spanish speakers (e.g., Puerto Rican elderly, Colombian university students, Mexican middle schoolers, Mexican deportees from the United States, and Peruvian patients (Galvis, 2010; González-Forteza & Jiménez-Tapia, 2008; Pinedo et al., 2018; Ros et al., 2011; Vilagut et al., 2016). These studies' internal consistency (α) was found to range between 0.74-

0.94. Furthermore, this scale has been used in other studies to assess mental health status among Mexican and Latino migrants (Alderete et al., 1999; Cislo et al., 2010) as well as other migrant populations (Dai et al., 2015; Lam & Johnston, 2015).

As our data are cross-sectional, we cannot establish causality between migration experiences and risk of possible major depressive symptoms, nor causal pathway among the different migration stages (e.g., origin, transit, destination, interception stage, and return) with possible major depressive symptoms. Nevertheless, findings of this study may inform future studies that aim to analyze complex migration and mobility experiences and their association with psychiatric disorders. Furthermore, these findings may motivate conducting migration research that considers non-linear migration patterns and their role in health risk and resilience.

Finally, given that substance use was an eligibility criterion for this study, participants may be more likely to have depressive symptoms than the broader population of recent migrants or the local population in the interview cities. Despite this, we found similar levels of symptoms of depression than in other studies conducted with other migrant populations (Pinedo et al., 2018; Sabin et al., 2003). This study contributes to increasing our understanding of the current health status of recent migrants and provides information for future research studies with this population.

The present study contributes to improved understanding of the role of non-linear migration patterns and experiences at the interception and transit phase of the migration journey that are associated with symptoms of depression among migrants at the Mexico-Guatemala border. Findings from this study highlight that symptoms of depression are a common health problem among rural-urban and short-term migrants. They also show the diversity of experiences among migrants in Mexico's Southern border and how their impact to health goes beyond the

traditional migration paradigm (Correal & Specia, 2018; Cuero Montenegro, 2018; Sánchez, 2018). Future studies and public policies should consider migrants that are fleeing from their communities due to violence (Dominguez-Villegas, 2019).

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Table 3.1 Sociodemographic characteristics by possible major depressive symptoms among substance using recent migrants at the Mexico-Guatemala border (N=392)

Characteristic	Total Sample (n=392) n (%)	Possible Major Depressive [^] Symptoms (n=45) n (%)	No Major Depressive Symptoms (n=347) n (%)
Country of Interview			
Mexico	172 (44)	10 (22)	162 (47)
Guatemala	220 (56)	35 (78)	185 (53)
Age (median, IQR ^{**})	31 (24-37)	32 (25-37)	31 (24-37)
Gender			
Male	308 (79)	29 (64)	279 (80)
Female	84 (21)	16 (36)	68 (20)
Sexual Orientation			
Heterosexual	373 (95)	43 (95)	330 (95)
Gay or Bisexual	19 (5)	2 (4)	17 (5)
Member of an indigenous group	57 (21)	10 (29)	47 (20)
Marital Status			
Not married ⁺⁺	276 (70)	28 (62)	248 (72)
Married/Common law	116 (30)	17 (38)	99 (28)
Religion			
Maintains a religious affiliation	311 (79)	34 (76)	277 (79)
Educational attainment			
Elementary school or less	192 (49)	19 (42)	173 (50)
Has children	261 (67)	27 (60)	234 (67)
<i>Country of Origin</i>			
Mexico	23 (6)	0 (0)	23 (7)
Guatemala	196 (50)	28 (62)	168 (48)
Honduras	91 (23)	11 (24)	80 (23)
El Salvador	70 (18)	5 (11)	65 (19)
Nicaragua	11 (3)	1 (2)	10 (3)
Panama	1 (0.3)	0 (0)	1 (0.3)

^{**}Interquartile range.

⁺⁺Includes participants who reported being single, divorced, separated, and widowed vs. married or common law.

Variables in bold were significant by Pearson Chi-Square or non-parametric Wilcoxon Rank Sum ($p < 0.05$).

[^]Possible major depressive symptoms are defined by the presence of anhedonia (i.e., loss of interest) or dysphoria (i.e., sadness) 5-7 days of the past week, and at least two additional symptoms (i.e., appetite, sleep, concentration, fatigue, suicidality, or agitation) occurring 5-7 days of the past week.

Table 3.2 Univariate association of variables with possible major depressive symptoms among substance using recent migrants at the Mexico-Guatemala border (N=392)

Characteristic	Possible Major Depressive Symptoms [^] (n=45) n (%)	No Major Depressive Symptoms (n=347) n (%)	OR (95% CI)	P Value
<i>Sociodemographics</i>				
Gender				
Female vs. Male	16 (36)	68 (20)	2.26 (1.16-4.40)	0.016
Sexual Orientation				
Gay or bisexual vs. heterosexual	2 (4)	17 (5)	0.90 (0.20-4.04)	0.894
Member of an indigenous group	10 (29)	47 (20)	1.68 (0.75-3.76)	0.205
Marital Status				
Married/Common Law vs. Not married	28 (62)	248 (72)	1.52 (0.80-2.90)	0.203
Religion				
Maintains a religious affiliation vs. None	34 (76)	277 (79)	0.78 (0.38-1.62)	0.506
Education				
Elementary school or less vs. other	19 (42)	173 (50)	0.74 (0.39-1.38)	0.336
Has children	27 (60)	234 (67)	0.73 (0.381-1.37)	0.321
Currently employed	24 (53)	194 (56)	0.90 (0.48-1.68)	0.744
Informal job ^{^^}	8 (17)	98 (28)	0.59 (0.25-1.22)	0.142
Taxi or bus driver, <i>triciclero</i>	2 (4)	46 (13)	0.30 (0.07-1.30)	0.108
Agriculture	4 (9)	59 (17)	0.48 (0.16-138)	0.172
Domestic work	2 (4)	17 (5)	0.90 (0.20-4.04)	0.894
Sex work	7 (16)	50 (14)	1.09 (0.46-2.59)	0.837
Selling drugs	1 (2)	12 (3)	0.63 (0.08-4.99)	0.666
Low income (<40 USD, weekly) n=380	21 (51)	97 (29)	2.63 (1.36-5.05)	0.004
Current Financial Situation				
Bad or extremely bad	29 (64)	174 (50)	1.80 (0.94-3.44)	0.074
Perceived homelessness ^a	24 (53)	127 (37)	1.98 (1.06-3.70)	0.032
<i>Substance Use</i>				
Alcohol Use				
Hazardous and harmful alcohol use	29 (64)	156 (45)	2.22 (1.16-4.23)	0.016
Drug Use				
Marijuana ^a	23 (51)	163 (47)	1.18 (0.63-2.19)	0.601
Cocaine (not injected) ^a	5 (11)	83 (24)	0.39 (0.15-1.04)	0.060
Smoked crack ^a	9 (20)	70 (20)	0.98 (0.45-2.15)	0.978
Hard drug use (heroin, crack, meth, cocaine) ^a	14 (31)	121 (35)	0.85 (0.43-1.65)	0.618
Injection drug use, ever	4 (9)	28 (8)	1.11 (0.37-3.33)	0.850

Table 3.2 Univariate association of variables with possible major depressive symptoms among substance using recent migrants at the Mexico-Guatemala border (N=392)

Characteristic	Possible Major Depressive Symptoms [^] (n=45) n (%)	No Major Depressive Symptoms (n=347) n (%)	OR (95% CI)	P Value
<i>Migration and mobility experiences</i>				
Forced or coerced to move against your will	13 (29%)	65 (19%)	1.76 (0.87-3.54)	0.112
Forced or coerced to move by someone or due to violence in your community	17 (38%)	150 (43%)	0.79 (0.42-1.51)	0.487
Recent International Migration (<5 years)	14 (31)	165 (48)	0.50 (0.26-0.97)	0.040
Recent Rural-Urban Migration (<5 years)	25 (56)	121 (35)	2.34 (1.25-4.37)	0.008
Short-term migration (3 months-1 year)	19 (42)	80 (23)	2.44 (1.28-4.64)	0.007
Trying to move to the United States before arriving at the current city	4 (6)	41 (13)	0.48 (0.16-1.38)	0.172
Ever Deported from any country other than the U.S.	17 (38)	117 (34)	1.19 (0.63-2.26)	0.599
Ever deported from the U.S.	4 (9)	85 (25)	0.30 (0.11-0.86)	0.026
Currently undocumented+	16 (36)	183 (53)	0.49 (0.26-0.94)	0.033
Crossed the Mexico-Guatemala border at least 5 times, past year	5 (11)	75 (22)	0.45 (0.17-1.19)	0.108
<i>Social Support</i>				
Social Support Scale* (mean ± SD)	15 ± 11.43	14 ± 10.5	0.99 (0.96-1.02)	0.548
You have someone to:				
Talk about yourself or your problems	26 (58)	241 (70)	0.60 (0.32-1.13)	0.117
Give you advice about a crisis	32 (71)	282 (81)	0.57 (0.28-1.14)	0.112
Share your worries/fears	29 (64)	235 (67)	0.86 (0.45-1.66)	0.659
Help you (with daily chores or when you are sick)	24 (53)	245 (71)	0.48 (0.24-0.89)	0.021
Who can lend you money	23 (51)	226 (65)	0.56 (0.30-1.05)	0.069
Who shows you love and affection	22 (49)	179 (52)	0.89 (0.48-1.67)	0.734
To love and make you feel wanted	24 (53)	192 (55)	0.92 (0.49-1.72)	0.800
To get together for relaxation	19 (42)	156 (45)	0.89 (0.48-1.68)	0.729
To do things to help you get your mind off things	19 (42)	151 (44)	0.95 (0.51-1.78)	0.869
<i>Access to health care services</i>				
You thought you needed to see a doctor, for physical or emotional problems, but did not go ^b	13 (29)	77 (22)	1.43 (0.71-2.85)	0.317

Table 3.3 Factors independently associated with possible major depressive symptoms among substance using recent migrants at the Mexico-Guatemala border (N=392)*

Characteristic	AOR 95% CI	P Value
Recent International Migration (<5 years)	0.27 (0.12-0.61)	0.002
Short-term migration [^]	3.17 (1.48-6.55)	0.003
Recent Rural-Urban Migration (<5 years)	2.73 (1.33-5.60)	0.006
Females vs. Males	2.64 (1.17-5.96)	0.019
Income (<40 USD weekly)	2.23 (1.05-4.25)	0.035
Perceived homelessness, past 6 months	2.93 (1.39-6.19)	0.005

*Multicollinearity diagnoses were performed to avoid including highly correlated independent variables ($r > 0.4$).

[^] Three months to 1 year in the interview site.

Table 3.4 Sociodemographic characteristics of migration experiences that are significantly associated with possible major depressive symptoms status (N=392)

Characteristic	Recent International Migrants ^a (n=179) n (%)	Short-term migrants ^b (n=99) n (%)	Recent Rural-Urban Migrants ^a (n=146) n (%)
Age (median, IQR**)	31 (23-37)	30 (25-35)	32 (24-38)
Gender			
Female	42 (23)	23 (23)	34 (23)
Male	137 (77)	76 (77)	112 (77)
Sexual Orientation			
Gay or bisexual vs. Heterosexual	12 (7)	7 (7)	5 (3)
Member of an indigenous group	16 (9)	12 (12)	24 (16)
Marital Status			
Married/Common Law vs. Not married	51 (28)	21 (21)	40 (27)
Religion			
Maintains a religious affiliation vs. None	137 (77)	76 (77)	114 (78)
Education			
Elementary school or less vs. higher education	100 (56)	44 (44)	68 (47)
Has children	124 (69)	60 (61)	88 (60)
Currently employed	90 (50)	58 (59)	77 (53)
Informal job [^]	44 (25)	22 (22)	44 (30)
Taxi or bus driver, <i>triciclero</i>	19 (11)	12 (12)	8 (6)
Agriculture	29 (16)	9 (9)	7 (5)
Domestic work	14 (8)	5 (5)	7 (5)
Sex work	30 (17)	14 (14)	22 (15)
Selling drugs	3 (2)	4 (4)	2 (1)
Low income (<40 USD, weekly), n=380 ^{^^}	52 (30)	31 (33)	53 (38)
Perceived homelessness, past 6 months	72 (40)	28 (28)	58 (40)
Alcohol Use			
Hazardous and harmful alcohol use [’]	55 (31)	49 (50)	70 (48)

Table 3.4 Sociodemographic characteristics of migration experiences that are significantly associated with possible major depressive symptoms status (N=392)

Characteristic	Recent International Migrants ^a (n=179) n (%)	Short-term migrants ^b (n=99) n (%)	Recent Rural-Urban Migrants ^a (n=146) n (%)
Forced or coerced to move against your will	56 (31)	25 (25)	39 (27)
Forced or coerced to move by someone or due to violence in your community	113 (63)	44 (44)	74 (51)
Trying to move to the United States before arriving at the current city	45 (25)	12 (12)	15 (10)
Plans to move out from interview city	111 (62)	50 (50)	77 (53)
Crossed the Mexico-Guatemala border at least 5 times, past year~	33 (18)	16 (16)	26 (18)
Ever Deported from any country other than the U.S***	72 (40)	25 (25)	40 (28)
Ever deported from the U.S	51 (29)	16 (16)	26 (18)
Undocumented+	144 (80)	46 (46)	74 (51)
<i>Social Support</i>			
Social Support Scale* (mean, SD)	15 ± 11.4	14 ± 10.4	15 ± 10.7
You have someone to talk about yourself or your problems	112 (63)	63 (64)	90 (62)
You have someone to give you advice about a crisis	129 (72)	71 (72)	111 (76)
You have someone to share your worries/fears	116 (65)	66 (67)	99 (68)
You have someone to help you (with daily chores or when you are sick)	106 (59)	60 (60)	95 (65)

Table 3.4 Sociodemographic characteristics of migration experiences that are significantly associated with possible major depressive symptoms status (N=392)

Characteristic	Recent International Migrants ^a (n=179) n (%)	Short-term migrants ^b (n=99) n (%)	Recent Rural-Urban Migrants ^a (n=146) n (%)
You have someone who can lend you money	97 (54)	56 (57)	77 (53)
You have someone who shows you love/affection	78 (44)	40 (40)	67 (46)
You have someone to love and make you feel wanted	93 (52)	43 (43)	76 (52)
You have someone to get together for relaxation	82 (46)	39 (39)	65 (45)
You have someone to do things to help you get your mind off things	81 (45)	38 (38)	63 (43)
<i>Access to health care services</i>			
In the past year, have you thought you needed to see a doctor, but did not go	37 (21)	26 (26)	24 (16)
Main reason you did not go to the doctor, n=83			
Cost			
Time	19 (11)	13 (13)	14 (10)
Did not trust the health system or felt comfortable	9 (5) 7 (4)	6 (6) 4 (4)	5 (3) 2 (1)

^a Informal job entails not having a fixed salary or a boss. ^a Recent migration entails living less than 5 years in the interview city.

^b Short term migration entails between 3 months to a year in the interview site.

The total score is calculated by finding the sum of 10 items. Scores range from 0-30. A score equal to or above 10 indicates a person with depression symptoms.

Meets criteria for Major depressive episode:

Anhedonia or dysphoria 5-7 days in the past week, and in an additional 4 DSM symptom groups (i.e., appetite, sleep, concentration, fatigue, suicidality, or agitation) occurring 5-7 days in the past week;

Probable major depressive episode:

Anhedonia or dysphoria 5-7 days in the past week, and symptoms in an additional 3 DSM symptom groups occurring 5-7 days in the past week;

Possible major depressive episode:

Anhedonia or dysphoria 5-7 days in the past week, and symptoms in an additional 2 other DSM symptom groups reported as occurring either nearly every day for the past two weeks, or 5-7 days in the past week.

Figure 3.2. Center for Epidemiologic Studies Depression Scale Revised (CESD-R-10) (Haroz et al., 2014)

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Chapter 4. HIV/STI and other health risk factors and their association with intra-urban mobility among a cohort of female sex workers in Tijuana, Mexico

Abstract

Intra-urban mobility has been associated with positive (e.g., commuting to safer environments) as well as negative outcomes for people's health (e.g., sharing needles among more mobile PWID). Clustering of sex work venues near Tijuana, Mexico's red light district has been associated with female sex workers' risk of HIV/STI acquisition, but less is understood about how the living conditions and their geography of FSWs may impact such risks. Thus, the main goal of this study is to determine the correlates of low intra-urban mobility (i.e., short or no commute distance from residence to work) of female sex workers with HIV/STI acquisition and other relevant structural risks (e.g., substance use). Bivariate and multivariable multinomial generalized estimating equations regression models were conducted to identify individual, structural, work environment, and spatial variables associated with less intra-urban mobility. Low intra-urban mobility was significantly associated with decreased odds of having health insurance and higher odds of having active syphilis, living in a place related with sex work (e.g., hotel), injection drug use, working in the street or any other public space, and eviction from housing. Public health interventions should consider the living conditions, social segregation, and marginalized environment in which female sex workers may be situated.

Introduction

Migration and intra-urban mobility have been associated with positive factors such as commuting to safer environments, enhanced access to healthcare, increased agency, and improved socioeconomic status (Brouwer, Lozada, et al., 2012; Jose R. Bucheli, 2019; Cresswell, 2006b; Lassetter & Callister, 2009). Mobility was central to the early twentieth century's urbanization process and enabled the creation of cities as spaces of development and modernity (Burgess, 2008). However, mobility has also been related to increased anonymity and risk-taking (e.g., substance use and needle sharing) (Brouwer et al., 2009; X. Chen, Stanton, Li, Fang, & Lin, 2008; Haviland de León et al., 2016), and as a consequence, negative outcomes for people's health, such as transmission of certain diseases (e.g., HIV) (Lurie et al., 2003; Olawore et al., 2018; Sanchez et al., 2012).

The association between mobility and adverse outcomes, has led to a historical pattern of surveillance, and displacement of specific types of mobile/transient groups of people, such as nomads, occupational migrants, homeless, and sex workers (Cresswell, 2006a, 2006b; Foucault, 2012; Guerrero, 2018; Hubbard, 1998; Malkki, 1992; Scott, 1998; Shannon, Rusch, et al., 2008). Furthermore, it has created geographical spaces of segregation where groups who are perceived as strangers or 'others' are concentrated (Burgess, 2008; Casillas, 2011a; Goodyear, Lowman, Fischer, & Green, 2005; Harris, 2018; Rea, 2006; Viruell-Fuentes, 2007).

Understanding the relationship between extent of intra-urban mobility within social and work environments and HIV/STI risk is especially relevant in border settings where there is a significant overlap of substance use and sex work in a context of structural factors conducive to risks, such as migration, policing, and poverty (Brouwer, Rusch, et al., 2012; Case et al., 2008; Connors et al., 2018). Sex work in Tijuana, Mexico is mainly concentrated and socially tolerated

in the red light district (*Zona Norte*), a clustering of commercial sex establishments covering approximately 2.9 km² around the city's main tourist area, and located near the border with the United States (Curtis & Arreola, 1991; T. L. Gaines et al., 2013) (See Map I). The *Zona Norte* is also adjacent to the Tijuana River Canal, an open-air water artery where PWID and other vulnerable population (e.g., homeless) live, congregate, and use drugs (Brouwer, Rusch, et al., 2012; Gaines et al., 2015; Guerrero, 2018; Morales et al., 2019).

Previous studies analyzing the effect of geography on sexual risks and HIV/STI in Tijuana have found that proximity to the geographic center of the *Zona Norte*, where sex work is more visible, is associated with higher access to certain services (e.g., condoms, STI prevention services) (T. L. Gaines et al., 2013), but also with higher concentration of HIV/STI infections (Brouwer, Rusch, et al., 2012; Rusch et al., 2010) as well as police activity, (Werb et al., 2016) drug dealing (Willoughby, 2003), and drug use (Strathdee et al., 2005).

While the impact of concentrating sex work in Tijuana's red light district has been associated with effects on female sex worker's risk of HIV/STI acquisition, less is understood about how FSW living conditions and their geography may impact HIV/STI risk and other relevant risks in this setting (van Blerk, 2016). We built on the concept of "live-in" (i.e., living and working in the same place) (Ozegin & Hondagneu-Sotelo, 2008) to investigate the impact of extent of intra-urban mobility of female sex workers in Tijuana (van Blerk, 2016). Studies conducted among domestic workers, who live and work in the same location, have found that long shifts, employer restriction on when and how you can leave the premises, and stigma and discrimination have detrimental outcomes for workers; mental health as well as limit access to health care services, among other risks (Ahonen et al., 2010; Artázcoz et al., 2001; Sales & Santana, 2003; Smith, 2011). Meanwhile, a study in Tijuana of PWID found that while more

mobile PWID lived in more stable environments, they had less knowledge of health risks of injection and were more likely share needles and get arrested for carrying syringes (Brouwer, Lozada, et al., 2012; Brown, 2007).

Thus, the goal of this paper is to determine the extent and correlates of intra-urban mobility of FSW with HIV/STI acquisition and relevant structural risks, such as negative interaction with law enforcement, work environment related risks (e.g., high volume of clients), and access to health care services among a cohort of female sex workers in Tijuana, Mexico. Based on previous research, we hypothesize that less mobile women will have higher odds of acquiring HIV/STI. Given common patterns of displacement and segregation (i.e., the extent to which individuals of different groups occupy or experience different social or geographical environments) (Reardon & Sullivan, 2004) in Tijuana, we also hypothesize that the female sex workers who live close to their main sex work venue will be spatially situated in the red light district of Tijuana, the Zona Norte (Brouwer, Lozada, et al., 2012; Cresswell, 2006b; Malkki, 1992; Morales et al., 2019), as opposed to other neighborhoods with sex work venues in the city. Findings from this study may inform public health interventions to consider the spatial and structural environment in which sex workers interact, including living conditions and their geography, when addressing health risks faced by this population (Kerrigan et al., 2006; Shannon, Rusch, et al., 2008).

Methods

In designing this study, we drew on Rhodes' 'risk environment' framework developed to conceptualize the physical and social space in which factors external to the individual interact to produce risks to an individual's health (e.g., drug use) (Rhodes, 2002). We also considered Galea and colleagues contextual determinants of drug risk, which considers the physical environment

as a key factor that may affect risk behaviors (Galea et al., 2003). Lastly, we incorporated the HIV structural determinants framework previously conceptualized by Shannon and colleagues that considers the sex work environment as key to understanding HIV acquisition (Shannon et al., 2014). A key focus of our analysis was the spatial component, as geography impacts distribution of diseases, work environments, as well as access to health services (T. L. Gaines et al., 2013; Neutens, 2015; Shannon, Rusch, et al., 2008).

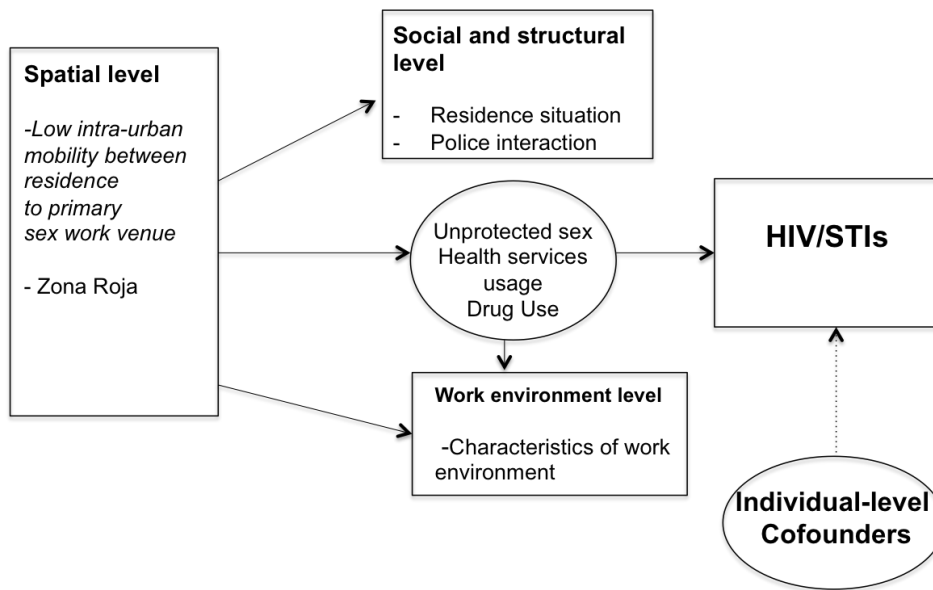


Figure 4.1 Adapted Conceptual Framework of Risk, Contextual, and Spatial Components (Galea et al., 2003; Rhodes, 2002; Shannon et al., 2014)

Design considerations

From March 2013 to April 2014, female sex workers in Tijuana, Mexico (N=301) were enrolled into a National Institutes of Health supported longitudinal study assessing how changes in social, spatial and physical factors affect HIV and STI acquisition, risk behaviors, and access to healthcare (*Mapa de Salud*, R01DA028692). In order to identify sex work venues (e.g., hotels, bars, night clubs) located both in and outside of the Zona Norte, we used venue maps developed by previous research (Brouwer, Lozada, et al., 2012; Rusch et al., 2010) and then updated and

added new venues through fieldwork and as identified by staff, participants, and community stakeholders. Participants were recruited from all identified venues using modified time-location sampling. In order to obtain a diverse sample, we limited recruitment to no more than 15 women per venue. Recruiters were trained local field staff with prior experience working with FSWs and other vulnerable populations. Local staff would approach potential participants, invite them to participate, then use a brief screening tool to assess eligibility and if interested, eligible women were invited to come to the study office.

Eligibility criteria for this longitudinal study included: (a) being 18 years or older; (b) biologically female; (c) exchanging sex for money or goods in the past month; (d) willing to undergo STI testing and treatment; and (e) residing in Tijuana with no plans to move out of the city in the next 18 months. All participants provided written informed consent and were reimbursed \$20 USD at baseline, with escalating reimbursements (additional \$5) at each subsequent follow-up visit. In addition to the survey, HIV (SURE CHECK HIV ½ Assay, Chembio) and syphilis (SD BIOLINE Syphilis 3.0, Standard Diagnostics, Inc.) rapid tests were performed by a study nurse during the visit and vaginal swabs for gonorrhea and chlamydia were obtained and sent to the San Diego County laboratory for testing (Aptima Combo 2, Gen-probe). HIV preliminary positive or inconclusive samples were sent to the county laboratory for a confirmatory BioRad Multispot HIV-1/HIV-2 assay and syphilis positivity was assessed with a rapid plasma reagin (RPR) and *Treponema pallidum hemagglutinin* assay (TPHA) to confirm the diagnosis and determine titer indicative of an active versus past infection (Connors, Silverman, et al., 2016).

Counseling pre-testing and post sharing of results was provided to all participants by trained field staff. Those with active syphilis, chlamydia, or gonorrhea were given free treatment

on-site by study nurses. Those testing positive for HIV were actively referred to local public health care providers (e.g., Center for the Prevention and Treatment of HIV and Sexually Transmitted Infections, CAPASITS).

The survey included questions on sociodemographics, exposure to violence, living and working conditions, sexual and substance using behaviors, HIV knowledge and interactions with law enforcement. The current analysis considers data from all four-study visits (i.e., baseline, 6, 12, and 18-month follow-ups). At each study visit, participants were asked to provide the location where they live, work, and use drugs (if applicable). Using Google Maps, interviewers asked participants to identify each location. Geographical coordinates were recorded and imported into ArcGis 10.2.2 (ESRI, Redlands, CA, USA) (Conners, West, et al., 2016). This study was approved by the Institutional Review Boards of the University of California, San Diego, and the Comisión de Salud Fronteriza, México-Estados Unidos.

Measures

Our dependent variable was ‘low intra-urban mobility’ defined as a distance of <1 km between the residence and the primary sex work venue location of female sex workers, which is a short or no commute distance from residence to work. The rationale for using the cutoff of 1km was based on the distance between the geographic center of the Zona Norte to the periphery of the Zona Norte, to the canal, and to some services such as the Sanitary Control Clinic. Additionally, 1 km is a short distance to walk (i.e., between 5-10 minutes) and may reflect the concept of live-in sex work (i.e., living and working in the same location) (Gaines et al., 2015; T. L. Gaines et al., 2013; Werb et al., 2016).

Independent variables

Individual sociodemographic variables included age (in years), civil status (steady partner vs. other), education (dichotomized by middle school or less, which is the cut-off of compulsory education in Mexico) and children living at home (yes vs. no). Perceived financial situation was coded from a 5-point Likert scale into a binary measure (very good/good/neutral vs. bad/extremely bad). Perceived financial situation was considered a more accurate measure than income because income in the sex trade may vary considerably from week to week and perceived financial situation takes into account a wider range of financial difficulty (e.g. debt).

We asked participants to list all the places where they have slept in the past 6 months and then to choose their current main residence situation. We classified participants who reported living in the street, shooting gallery, canal, abandoned building, migrant camp, and medical center in one category (i.e., unstable housing). A variable for eviction from living space was created if participants reported having in the past 6 months moved at least once from a place they have slept 7 days or more in a month due to eviction.

Participants were asked about the frequency (lifetime or past 6 months) of use of a variety of illicit drugs and the route of administration. Injection drug use was a dichotomous variable of ever use versus no use in the past 6 months. Any non-injection hard drug use was created considering the use of heroin, methamphetamine, crack, or cocaine by any mode of administration in the past 6 months. Drinking and using drugs with clients before or during sex with a client was coded from a 5-point Likert scale into a binary measure (always/often vs. about half of the time/sometimes/never) in the past month.

Police sexual harassment and abuse includes reporting if police forced sex on you, or coerced you for sexual favors in the past 6 months. The volume of different new clients in the

past month (>10) was built considering the median of the number of new clients reported. We dichotomized indoor venues into formal (i.e., bar, brothels) and informal (i.e., hotel, massage parlors) venues and created a third category that encompassed reporting as the main sex work venue the street, a client's car, or other public space (e.g., shooting gallery).

Spatial variables

We chose relevant locations such as the Sanitary Control Clinic (health card required of sex workers) (L. T. Gaines et al., 2013), the CAPASITS (HIV treatment), the Public Drug Treatment Center (CIJ), and the Tijuana General Hospital to calculate the distance from the participants' residence and main sex work venue location to those services. Distances to the Zona Norte were calculated considering the mean geographical center of the red light district as a point (T. L. Gaines et al., 2013; Sirotin, Strathdee, Lozada, Abramovitz, et al., 2010; Sirotin, Strathdee, Lozada, Nguyen, et al., 2010). Distances were calculated using the ArcGIS 10.6 measuring tool (ESRI, Redlands, CA, USA), which uses the trigonometric function to find the proportion of a sphere between points, and then multiplies it to the earth radius (i.e., great-circle distance between two points). The geodetic lines connecting participant's residence to their main sex work venue location at baseline (Map II) were calculated using ArcGis 10.6.1 (ESRI, Redlands, CA, USA) by using the 'XY to line' measuring tool (ArcGIS Pro, 2018).

Data Analysis

Baseline descriptive statistics and Chi-square tests were run to compare differences in variables by mobility between their residence and primary sex work venue location (Table 4.1). We ran bivariate and multivariable multinomial logistic regression to identify individual, structural, work environment, associated with extent of intra-urban mobility using generalized

estimating equations. Generalized estimating equations are used for repeated measures and account for correlated data within participants using a variance–covariance matrix (Ballinger, 2004). We used the autoregressive AR(1) working correlation matrix as it considers correlation diminishing exponentially over-time (Twisk, 2013).

Bivariate and multivariate models controlled for time, measured by follow-up visit. Potential collinearity was assessed with Pearson correlation coefficients. The model was built using a hierarchical block method to see the impact of four levels of risk (individual, structural, work environment, and spatial) on the outcome. Individual-level variables significant at $P \leq 0.05$ in the bivariate model were added to the multivariate model. The same procedure was followed for structural, and work environment. The spatial variables were not included in the final model as several of them were highly correlated with the dependent variable. Variables significant at $P \leq 0.05$ were retained in the final model. To ensure the integrity of the model, interactions between the predictors were also assessed and ruled out. All analyses were conducted using SPSS Statistics 21 Software (IBM, 2012).

Results

A total of 301 women in Tijuana were enrolled at baseline. Between baseline and the 6-month follow-up visit, one woman withdrew and three women died. Subsequent follow-up rates were 77% ($n = 228$) at the 6 months follow-up, 79% ($n = 231$) at the 12-month follow-up, and 65% ($n=195$) at the 18-month follow-up visit. At baseline, nine participants did not provide the location of their residence or main sex work venue. Therefore, we excluded them from the baseline analyses ($n=292$). At the 6-month follow-up visit, 188 participants provided complete location information (83%), 183 at the 12-month follow-up (79%) and 135 at the 18-month

follow-up (69%). At each study visit, participants were asked if they exchanged sex for money or something else in the past month; if they reported not engaging in sex work, they were censored for the analysis of that visit. At 6 months, 31 women temporarily exited sex work, 36 at 12 months, and 45 at the 18-month follow-up.

Diagnosis of HIV, any STI ($P < 0.01$), syphilis ($P < 0.01$), chlamydia ($P < 0.01$), having more than 10 new clients in the past month ($P = 0.02$), any physical or sexual abuse by clients in the past month ($P < 0.01$), indoor formal main sex work venue (e.g., bar) ($P < 0.01$), and indoor informal main sex work venue (e.g., hotel) decreased over time ($P < 0.01$). Working on the streets, in a car, or any other public space significantly increased over time ($P < 0.01$). Women who reported their primary venue was the street or other public space were significantly more likely to return for follow-up visits, as well as women with more years in sex work. No other baseline characteristics were significantly associated with returning for at least one follow-up visit.

Baseline characteristics

Forty percent of the total sample lived 1 km away or closer to their main sex work venue and of those, 22 reported living and working in the same place. Participants had a median age of 32 years, and a majority lived at home with their children (57%) (Table 4.1). Almost half of the total sample reported renting a house or an apartment as their main residence situation, and the same percentage reported not having health insurance (e.g., Seguro Popular [free health care for Mexican citizens], Mexican Social Security Institute IMSS [free health care for Mexican citizens who have a formal job]). Only 8% of the total sample had a current health card (i.e., entails periodical HIV/STI testing at the Sanitary Control Clinic). Almost 40% of the participants reported any non-injection hard drug use (i.e., heroin, methamphetamine, crack, or cocaine) and

20% reported injection drug use in the past 6 months. Regarding structural and community violence, 6% of the total sample reported sexual harassment and abuse by police, 23% reported being arrested, and 6% reported being evicted at least once from their living space in the past 6 months.

In terms of client characteristics and the work environment, 44% of the participants reported having 10 or more new clients in the past month and also 10% reported consistent condom use with their clients in the past month. Almost 40% reported working on the street or in another public space (e.g., canal). Nearly half of the entire sample reported witnessing a fight or violence at their main sex work location in the past month.

Longitudinal bivariate associations with intra-urban mobility

Table 4.2 provides results from the bivariate generalized estimating equations regression. Individual-level cofounders were examined first. Compared to more mobile sex workers, FSWs who lived close to their work location were significantly more likely to be older, less likely to have kids living with them as well as to have health insurance. Less mobile women were more likely to have syphilis (titer \geq 1:8) than their more mobile counterparts. Regarding participants' residence situation, women with limited mobility from their residence to their work location were more likely to live in a space related to sex work, such as a hotel, in contrast to more mobile participants.

In terms of substance use and sexual risk behaviors, less mobile participants were less likely to drink alcohol before or after having sex with their clients, but more likely to use drugs with their clients in the past month in contrast with the more mobile participants. Less mobile sex workers were also more likely to inject drugs and to use any non-injection drug than their

more mobile counterparts in the past 6 months. Women living less than 1km away from their main sex work venue were more likely to be arrested in the past 6 months and to be evicted from a living space than their more mobile counterparts. Lastly, women who lived near their main sex work venue were more likely to work on the street or other public space, and less likely to work in a formal venue such as a bar or a nightclub in contrast with their more mobile counterparts.

Longitudinal multivariable associations with low intra-urban mobility

Results of the multivariable multinomial generalized estimating equation model are shown in Table 4.3. After adjusting for visit and years in sex work, less intra-urban mobility was significantly associated with almost four times greater odds of having syphilis (titer \geq 1:8) (adjusted odds ratio [aOR] = 3.64, 95% confidence interval [CI] = 3.64 (1.68-7.87)) and with injection use in the past six months (aOR=4.05, 95% CI= 2.52-6.51). Low mobility was significantly associated with decreased odds of having health insurance (aOR=0.67, 95% CI=0.51-0.89). Less intra-urban mobility was significantly associated with living in a place related to sex work (e.g., hotel) (aOR= 1.90, 95% CI=1.35 -2.67) and with working in the street, client's car, or in any other public space (aOR=1.60, 95% CI=1.22-2.06). Finally, regarding structural and community violence, women with less intra-urban mobility had higher odds of being evicted from a living space in the past 6 months (aOR=2.88, 95% CI=1.42-5.84).

Discussion

Female sex workers with low intra-urban mobility between work and residence faced lower odds of having health insurance but increased STI (i.e., syphilis) risk, increased injection drug use, and higher odds of living in a space related to sex work (e.g., hotel), being recently evicted, or working in the street or in any other public space. As hypothesized, the descriptive

spatial data shows that women with less intra-urban mobility are mainly situated in the red light district of the Zona Norte or in the adjacent neighborhoods such as the Zona Centro and the canal area (See Map I).

An analysis conducted in Tijuana exploring the effect of the geography on HIV/STI risk found that proximity of the main sex work venue location to the red light district's geographical center (i.e., the center point of a one-block street where sex work is most concentrated in the Zona Roja) was protective of HIV/STI prevalence (T. L. Gaines et al., 2013). The center of the red light district is near STI prevention services, such as the Sanitary Control Health Clinic (<500m), as well as near the canal and heavily policed areas of the city. It has been found that increased distance from the center of the Zona Roja reduced the likelihood of being registered as a sex worker (L. T. Gaines et al., 2013). Being registered has been found to be associated with lower HIV/STI prevalence among certain female sex workers in Tijuana (L. T. Gaines et al., 2013; Sirotin, Strathdee, Lozada, Abramovitz, et al., 2010; Sirotin, Strathdee, Lozada, Nguyen, et al., 2010). However, our analysis did not find that proximity of a sex worker's residence and the main sex work venue location to the center of the red light district was protective of recent STI diagnosis, specifically syphilis incidence, and that it was associated with other risks.

One explanation for this differing result may be because our sample was more diverse than previous studies, which in the past had largely recruited from within the red light district. As we recruited throughout Tijuana, the microgeographical protective effect seen within the red light district diminished when compared to a sample drawn from throughout the city. Another explanation may be in relation to health card registration. The overall registration of the entire sample was considerably low (8%) in comparison to other studies conducted with female sex workers in Tijuana that found registration levels of 40-50% (L. T. Gaines et al., 2013; Sirotin,

Strathdee, Lozada, Nguyen, et al., 2010). The low percentage of registration may be reflecting a particularly vulnerable sample of sex workers that overall is not accessing HIV/STI prevention services. Low income and other individual-level variables (e.g., substance use) have also been found to be associated with decreased odds of registration (L. T. Gaines et al., 2013).

The low registration percentage also may suggest that for some particularly vulnerable subgroups of sex workers, geographical proximity of residence or sex work venue is not enough when it comes to accessing health services. Women who were less mobile were more likely to work in the street, a client's car, or any other public space; to live in a space related to sex work, and to have been evicted in the past six months. Such findings suggest that living conditions are profoundly intertwined with the sex work environment. Less mobile participants may have been experiencing a manifestation of social segregation which occurs when a group of people is not only located in a defined geographical space (i.e., Zona Norte) but also socially excluded from specific social environments (Reardon & Sullivan, 2004; White & Borrell, 2011).

Geographical and social segregation or marginalization has shown to affect people's lives as a result of the differential exposure to disadvantaged neighborhood, concentration of poverty, violence, law enforcement, and limited access to health care services (Kramer & Hogue, 2009; Shihadeh & Flynn, 1996; White & Borrell, 2011). Such conditions intersect in the 'red light district' and adjacent neighborhoods in Tijuana (Curtis & Arreola, 1991; Gaines et al., 2015; Werb et al., 2016).

In addition, participants who reported living close to their main sex work location were also more likely to inject drugs, which has been shown to be associated with numerous negative health outcomes, such as HIV acquisition (Strathdee & Sherman, 2003; Sypsa et al., 2015). Spatial and qualitative studies in Tijuana have found that women who inject drugs prefer to buy

and use drugs within their homes or residential neighborhood (Brouwer, Rusch, et al., 2012; Cruz et al., 2007; Ojeda et al., 2011). As some of the main drug selling points are located in the Zona Norte and adjacent areas, including the canal, (Kori, Roth, Lozada, Vera, & Brouwer, 2014; Willoughby, 2003), drug use may be pushing women to remain segregated in a confined or ‘entrenchment’ context (Shira M Goldenberg et al., 2011; Shannon, Rusch, et al., 2008; Van Blerk, 2008; Werb et al., 2010). Furthermore, historically, Tijuana’s government has followed a displacement policy for specific groups (e.g., people who inject drugs, homeless), without providing any housing alternatives (Conners et al., 2018; Morales et al., 2019) (T. Alegría & Ordoñez, 2007).

Besides safer sex work venues, the development of safe and affordable housing located outside of the Zona Roja and adjacent areas could be a first step to reduce the risks faced by geographical and social segregation (e.g., eviction) and it could be followed by provision of other necessary services (e.g., drug treatment) (Aidala, Cross, Stall, Harre, & Sumartojo, 2005; Conners et al., 2018; Reed, Gupta, Biradavolu, Devireddy, & Blankenship, 2011). Finally, the distances calculated to certain services, such as the Tijuana General Hospital, and the CIJ (public rehabilitation center) (See Map II), show that public services, that ideally would be available for all the population, are not geographically accessible especially for women who are segregated or with limited mobility. Women with low intra-urban mobility were less likely to have health insurance, thus efforts to affiliate this specific group of sex workers to the Seguro Popular or other affordable health service access should be prioritized.

This study has several limitations; first, we were not able to determine causality between the covariates and low intra-urban mobility between residence and main sex work location. However, these analyses may contribute to increased understanding of health risks of female sex

workers' with limited mobility, including HIV/STI acquisition, and inform future studies, in Tijuana and in similar settings that are aiming to address social segregation among vulnerable populations. Second, this cohort may not be representative of all FSWs working in Tijuana, as it may be reflecting a particularly vulnerable subgroup of sex workers (e.g., limited access to HIV/STI prevention services). Additionally, we limited the recruitment to participants who did not have plans or moving of the city in the next months. Thus, this analysis may have not captured more mobile or transient female sex workers in Tijuana. Third, distances calculated for this analysis did not take in consideration exact roads and bus routes in Tijuana. Therefore, some of the distances may be overestimating or underestimating the needed distance from one location to another. However, this analysis illustrates the concept of 'live-in sex work' and geographical segregation of this subgroup of sex workers and incorporates the living condition of female sex workers. It is important to highlight, that women who are traveling from other neighborhood in Tijuana to work in the Zona Norte may be facing other risks that we did not analyze. Future analysis should consider this more mobile group and assess their specific barriers.

Conclusions

Low intra-urban mobility between residence and main sex work location is associated with important health risks for female sex workers in Tijuana. Findings from this study highlight the need not only to consider the geographical component but also the social segregation or entrenchment environment in which female sex workers are situated. Public health interventions and programs that aim to increase access to health services for female sex workers should consider the living condition and expanding their services to neighborhoods beyond the Zona Norte and the adjacent neighborhoods.

Acknowledgments

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Table 4.1 Characteristics of female sex workers in Tijuana by extent of intra-urban mobility, at baseline (N=292)

	Total (N=292) N (%)	Less intra-urban mobility <1km (n=117) n (%)	More intra-urban mobility ≥1km (n=175) n (%)	P-value ¹
Any HIV/STI	108 (37%)	52 (48%)	65 (35%)	0.03
HIV	8 (3%)	5 (4%)	3 (2%)	0.17 [^]
Chlamydia	81 (28%)	33 (28%)	48 (28%)	0.90
Syphilis (titer ≥1:8)	20 (7%)	18 (15%)	2 (1%)	<0.01
Gonorrhea	19 (7%)	12 (10%)	7 (4%)	0.04
Individual Level Cofounders				
Median age in years [IQR]	32 [25-40]	35 [30-44]	30 [23-37]	0.01
Median years in sex work [IQR]	16 [9-24]	22 [14-29]	14 [8-21]	<0.01
Middle school or less	121 (41%)	45 (38%)	76 (43%)	0.39
Has steady partner	100 (34%)	49 (42%)	51 (29%)	0.02
Has kids living at home*	167 (57%)	37 (32%)	130 (74%)	<0.01
Current financial situation bad or extremely bad	109 (38%)	51 (44%)	58 (33%)	0.07
Health service access				
Has health insurance	138 (47%)	36 (31%)	102 (58%)	<0.01
Current health card	23 (8%)	4 (3%)	19 (11%)	0.02[^]
Main Residence situation				
Unstable housing ⁺	15 (5%)	11 (9%)	4 (2%)	<0.01[^]
Own home	73 (25%)	16 (14%)	57 (33%)	<0.01
Rents a house or an apartment	142 (49%)	49 (42%)	93 (53%)	0.05
Someone they know rents or owns a place	19 (7%)	5 (4%)	14 (8%)	0.15 [^]
Work related place (e.g., hotel)	42 (14%)	35 (30%)	7 (4%)	<0.01
Substance use & sexual risk behaviors				
FSW often/always drink alcohol before or after having sex ^a	58 (20%)	13 (11%)	45 (26%)	<0.01
FSW often/always use drugs before or after having sex ^a	68 (23%)	52 (44%)	16 (9%)	<0.01
Any injection drug use ^b	67 (23%)	51 (44%)	16 (9%)	<0.01
Any non-injection hard drug use ^b	108 (37%)	69 (59%)	39 (22%)	<0.01
Characteristics of work environment				
Primary sex work venue: street, car, or other public space	108 (37%)	68 (58%)	40 (23%)	<0.01
Primary sex work venue: indoor informal (e.g., hotel)	94 (32%)	34 (29%)	60 (34%)	0.35
Primary sex work venue: indoor formal (e.g., bar)	90 (31%)	15 (13%)	75 (43%)	<0.01
Witnessed a fight or violence in your main work location ^b	136 (47%)	62 (53%)	74 (42%)	0.06
Client characteristics ^a				
>10 different new clients	127 (44%)	61 (53%)	66 (38%)	<0.01
Any physical or sexual abuse by clients	33 (11%)	16 (14%)	17 (10%)	0.29
Consistent condom use with new and regular clients	129 (44%)	42 (36%)	86 (49%)	0.02
Structural disruption and community violence ^b				
Arrested	67 (23%)	48 (41%)	19 (11%)	<0.01

Table 4.1 Characteristics of female sex workers in Tijuana by extent of intra-urban mobility, at baseline (N=292)

	Total (N=292) N (%)	Less intra-urban mobility <1km (n=117) n (%)	More intra-urban mobility >=1km (n=175) n (%)	P-value¹
Police sexual harassment and abuse	17 (6%)	9 (8%)	8 (5%)	0.26
Evicted from living space	18 (6%)	16 (14%)	2 (1%)	<0.01
Spatial level variables (in Km)	Median [IQR]	Median [IQR]	Median [IQR]	
Distance from residence to geographic center of Zona Norte	7.3 [0.6-14.6]	0.5 [0.2-3.8]	12 [6.2-16.2]	<0.01
Distance from main work location to geographic center of Zona Norte	0.6 [0.08-8.87]	0.1 [0.07-3.7]	1.07 [0.1-10.8]	<0.01

IQR: Interquartile Range, ^ Fisher exact test, + Includes people living on the streets living in the street, shooting gallery, canal, abandoned building, migrant's camp, or medical center.
^a Past month, ^b Past 6 months. *n=268 have at least one kid, n=106 (<1km from residence to work) and n=162 (>=1km from residence to work)

Table 4.2 Bivariate generalized estimating equations logistic regression analysis of factors associated with low intra-urban mobility in the past 6 months among female sex workers

	Low intra-urban mobility	
	Distance between residence to primary sex work venue location <1km	
	uOR ^a (95% CI)	P Value
Any HIV/STI	0.95 (0.74-1.22)	0.67
HIV	1.62 (0.76-3.45)	0.22
Chlamydia	0.91 (0.77-1.22)	0.53
Syphilis (titer >=1:8)	1.99 (1.17-3.38)	0.01
Gonorrhea	1.11 (0.82-1.51)	0.51
Individual level covariates		
Age	2.27 (1.40-3.68)	< 0.01
Years in sex work	1.31 (0.95-1.80)	0.09
Middle school or less	0.95 (0.69-1.29)	0.73
Steady partner vs. other	1.22 (0.92-1.62)	0.16
Has kids living at home	0.16 (0.10-0.27)	< 0.01
Current financial situation bad or extremely bad	1.03 (0.84-1.25)	0.78
Health service access		
Health insurance	0.63 (0.48-0.82)	< 0.01
Has health card	0.85 (0.66-1.09)	0.29
Main Residence situation		
Unstable housing [†]	1.06 (0.49-2.28)	0.87
Own home	0.98 (0.79-1.22)	0.13
Rents a house or an apartment	0.84 (0.67-1.05)	0.12
Someone they know rents or owns a place	0.77 (0.57-1.04)	0.09
Work related place (e.g., hotel)	1.47 (1.09-1.98)	0.01
Substance use & sexual risk behaviors		
FSW often/always drink alcohol before or after having sex ^a	0.76 (0.62-0.95)	0.02
FSW often/always use drugs before or after having sex ^a	1.35 (1.09-1.69)	< 0.01
Any injection drug use ^b	4.61 (2.85-7.44)	< 0.01
Any non injection hard drug use ^b	1.64 (1.23-2.17)	< 0.01
Characteristics of work environment		
Primary sex work venue: street, car, or other public space	1.44 (1.17-1.77)	< 0.01
Primary sex work venue: indoor informal (e.g., hotel)	0.84 (0.68-1.02)	0.07
Primary sex work venue: indoor formal (e.g., bar)	0.62 (0.44-0.85)	< 0.01
Witnessed a fight or violence in your main work location ^b	0.98 (0.78-1.21)	0.82
Client characteristics^a		
>10 different new clients	1.13 (0.87-1.47)	0.34
Any physical or sexual abuse by clients	0.97 (0.74-1.27)	0.83
Consistent condom use with new and regular clients	0.68 (0.79-1.17)	0.96

Table 4.2 Bivariate generalized estimating equations logistic regression analysis of factors associated with low intra-urban mobility in the past 6 months among female sex workers

Arrested	1.28 (1.02-1.63)	0.03
	uOR^a (95% CI)	P Value
Police sexual harassment and abuse	0.76 (0.34-1.68)	0.50
Evicted from living space	2.84 (1.51-5.31)	<0.01

All models were adjusted for visit. [†] Includes people living on the streets living in the street, shooting gallery, canal, abandoned building, migrant's camp, or medical center

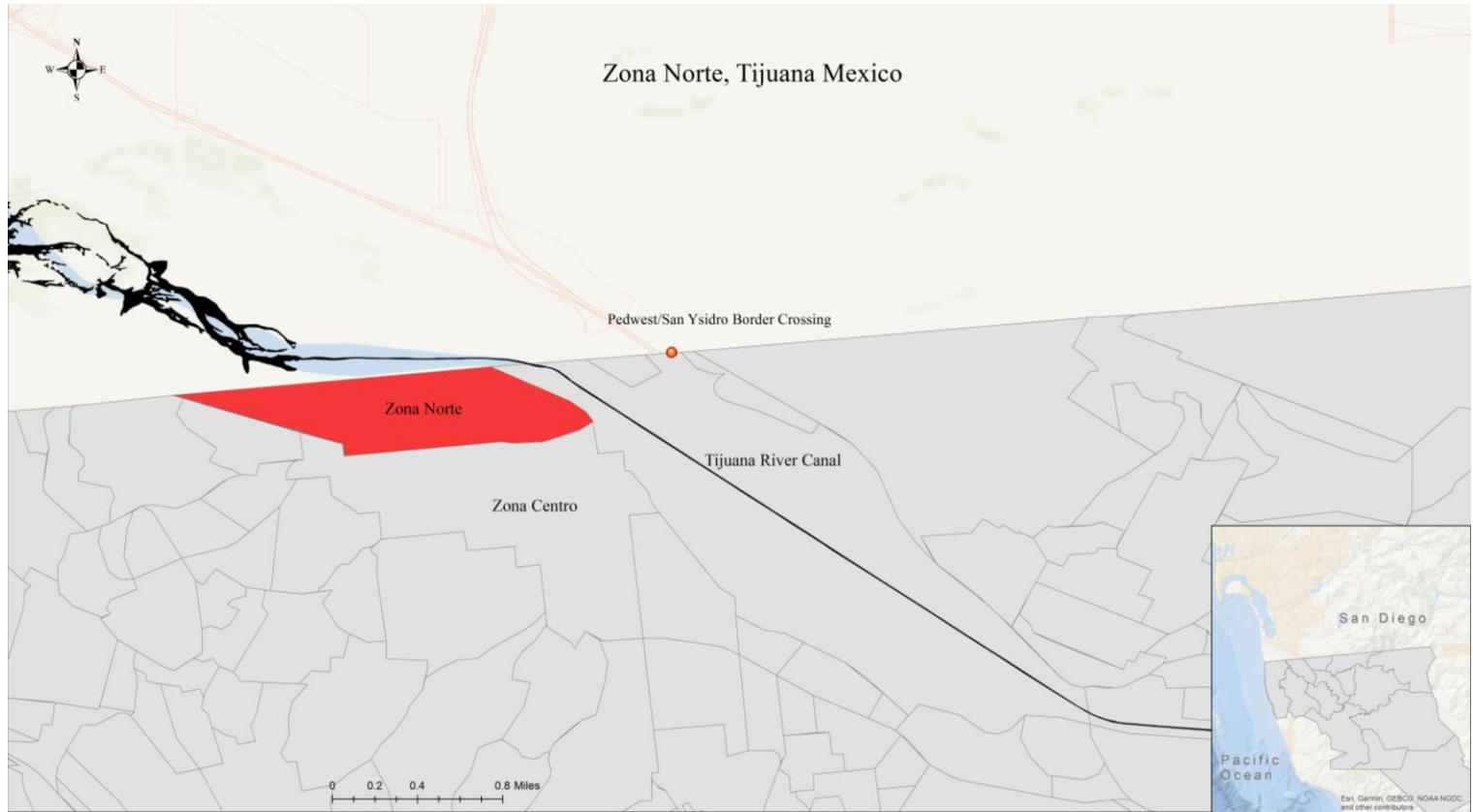
^a Past month. ^b Past 6 months.

Table 4.3 Multivariate generalized estimating equations logistic regression analysis of factors associated with low intra-urban mobility in the past 6 months among female sex workers

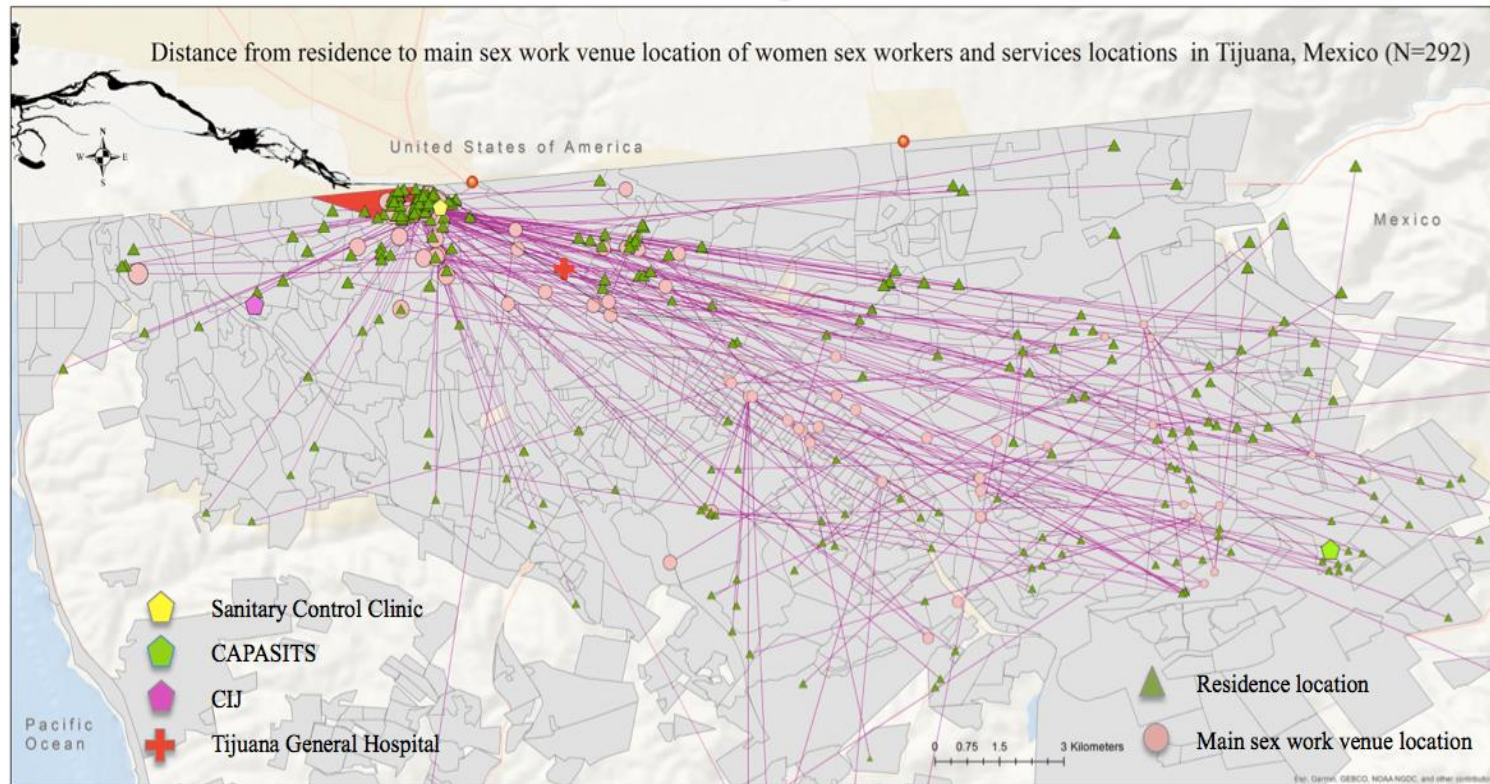
	Low intra-urban mobility	
	Distance between residence to primary sex work venue location <1km	
	aOR* (95% CI)	P Value
Syphilis (titer \geq 1:8)	3.64 (1.68-7.87)	<0.01
Health service access		
Health insurance	0.67 (0.51-0.89)	<0.01
Substance use		
Any injection use ^a	4.05 (2.52-6.51)	<0.01
Main Residence situation		
Work related place (e.g., hotel)	1.90 (1.35-2.67)	<0.01
Characteristics of work environment		
Primary sex work venue: street, car, or other public space	1.60 (1.23-2.07)	<0.01
Structural disruption and community violence		
Eviction from living space ^a	2.88 (1.42-5.84)	<0.01

* The model was adjusted for visit and years in sex work. ^a Past 6 months.

Map I. Zona Norte, Tijuana Mexico



Map II. Distance from residence to main sex work venue location of women sex workers and services locations in Tijuana, Mexico



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Chapter 5. Discussion

Diverse migration and mobility experiences were found to be associated with female sex workers sexual health and with recent migrants' mental health status.

HIV testing and HIV/STI acquisition

In Chapter 2, we found a prevalence of HIV testing in the past year among FSW of 41%, a considerably low percentage considering that WHO recommends voluntarily tests for HIV every 3-6 months (World Health Organization, 2012). However, we found that female sex workers who engaged in short-term travel to another country for sex work had independently higher odds of being tested for HIV in the past year. This finding suggests that perhaps mobile women among this sample are being better reached by public health services than women who do not travel or are working in less visible sex work environments (Leyva-Flores et al., 2013). We hypothesized that recent migration (i.e., past 5 years or less in the interview city) was going to be associated with lower odds of HIV testing, but, after adjusting for other covariates, it did not remain statistically significant. Covariates such as having a current health card, HIV education, and prior STI diagnosis were stronger predictors of HIV testing. This may also suggest that time spent in the interview city may not be as relevant as other variables for HIV/STI prevention services among sex workers in this setting.

When analyzing a different variation of mobility (i.e., extent of intra-urban mobility) among a cohort of female sex workers in Tijuana, Mexico we found that low intra-urban mobility was associated with risks in comparison with more mobile female sex workers (Chapter 4). Low intra-urban mobility was associated with active syphilis (titer $\geq 1:8$) and with structural risks, such as not having health insurance, living in a space related to sex work, eviction, working in the street, and injection drug use. Geographical and social marginalization and

displacement have been shown to affect people's lives as a result of the differential exposure to poverty, violence, law enforcement, and limited access to health care services (Kramer & Hogue, 2009; Shihadeh & Flynn, 1996; White & Borrell, 2011). Such conditions have been shown to intersect in the Zona Norte and adjacent neighborhoods in Tijuana (Curtis & Arreola, 1991; Gaines et al., 2015; Werb et al., 2016). Although we cannot establish causality, some of the main drug selling points are located in the Zona Norte and adjacent areas, including the canal, (Kori et al., 2014; Willoughby, 2003), drug use may be pushing women to remain in a confined or 'entrenchment' context (Shira M Goldenberg et al., 2011; Shannon, Rusch, et al., 2008; Van Blerk, 2008; Werb et al., 2010).

Mental Health

In Chapter 3, we found that the prevalence of symptoms of depression among substance-using recent migrants at the Mexico-Guatemala border was 47% and the prevalence of possible major depressive symptoms among this population was 11.5%. This is substantially higher than the general population (Ma Elena Medina-Mora et al., 2003). After adjusting for gender, homelessness, and financial status, short-term migration and rural to urban migration were associated with possible major depressive symptoms. However, recent international migration had significantly adjusted lower odds of having possible major depressive symptom. It is important to consider the healthy migration effect (Aguila et al., 2013; R. D. Alarcón et al., 2016; Lewin Fischer, 2012; Salgado de Snyder, 2014; Zúñiga et al., 2014) among international migrants. This group may have increased resilience to negative experiences given that they have a major goal that they're looking forward to in comparison to the other two groups of migrants (i.e., rural-urban, recent migrants) (Temores-Alcántara et al., 2015).

Contrary to what we hypothesized and what other studies have found (Fortuna et al., 2008; Lusk et al., 2013), being forced or coerced by someone against their will or forced to move due to violence in your community was not significantly associated with possible major depressive symptoms. However, it is important to highlight that almost 43% of our sample reported being forced to move due to violence and 20% were forced or coerced to move against their will. These data show that an important percentage of migrants in the Mexico-Guatemala border are fleeing from their communities, and that future research studies, health, and policy interventions must consider such reality (Dominguez-Villegas, 2019).

Strengths and Limitations

Generalizability

All three Chapters used data from studies that used time location sampling to capture high-risk populations. Time-location sampling is considered a valid method of recruiting hard to reach and marginalized populations in research (Gayet & Fernández-Cerdeño, 2009). The *Mapa de Salud* study (Chapter 4), recruited no more than 15 women per venue and invited participants from different neighborhoods in Tijuana (i.e., Zona Norte vs. others). This effort resulted in a sample capturing a diverse sex work context (e.g., different types of sex work venues) in Tijuana. The *Cruzando Fronteras* study (Chapters 2 and 3) recruited participants using a combination of modified time-location sampling and peer referrals. As none of these studies' populations were randomly recruited, we are cautious in the generalizability of our results to other populations.

Self-reported measures and scales

Behaviors and demographics were collected through self-reported measures. Therefore, social desirability or recall bias may have influenced results. In order to address this potential bias, trained local staff conducted all the interviews in safe and private spaces (e.g., study's office) after conducting extensive outreach to establish trust and explaining with detail the purpose of the surveys. A strength was that the studies directly tested for diseases (HIV/STI) rather than relying on self-reported measures.

For Chapter 3, symptoms of depression were defined based a self-reported measures, and thus potentially subject to bias. Participants may have underreported symptoms fearing the stigma associated with mental health conditions. Nevertheless, our categories are based on a previously validated and widely used clinical scale for depression (CESDR-10 scale). Also, our field team included a trained psychologist who has previously worked with vulnerable populations at the border (e.g., female sex workers and migrants).

Implications and recommendations

Migration, mobility, and HIV/STI

Female sex workers at the Mexico-Guatemala border who reported mobility had higher odds of receiving an HIV test. This might warrant further study to learn from the educational campaigns that could be influencing decisions to be tested as well as efforts that are reaching mobile female sex workers (L. T. Gaines et al., 2013; Saggurti et al., 2009; Taylor et al., 2015; van Blerk, 2016). However, overall access to HIV testing among female sex workers in border settings needs to increase. Efforts especially need to be concentrated in reaching out to less

mobile women as well as those who work in less visible venues (Quintino et al., 2011; Rocha-Jiménez et al., 2019).

Low intra-urban mobility between residence and main sex work location at the United States-Mexico border was associated with important health risks for female sex workers in Tijuana. Findings from this study highlight the need not only to consider the geographical component but possibly also the social segregation environment in which female sex workers, or other vulnerable populations, may be situated (Shihadeh & Flynn, 1996; White & Borrell, 2011). Public health interventions and programs that aim to increase access to health services for female sex workers should also consider the living condition and expand their services to sex workers that currently being missed by key health services (Connors et al., 2018; Moyer et al., 2008; Reed et al., 2011).

Migration, mobility, and mental health

Recent migrants at the Mexico-Guatemala border reported high levels of symptoms of depression (50%) and the prevalence of possible major depressive symptoms among this population was 11.5%. Findings from this study highlight that symptoms of depression are a common health problem among migrants. Limited access to health care services has been found to be higher among migrants in specific settings, and this may be related to poor mental health (Derose et al., 2007; Derose et al., 2011; Temores-Alcántara et al., 2015; Zúñiga et al., 2014). It is important to consider structural barriers and time spent in the interview site when analyzing mental health status among migrants (Cislo et al., 2010). Furthermore, the analysis featured in this chapter shows the diversity of experiences among migrants at Mexico's Southern border and how their impact on health goes beyond the traditional migration paradigm (Correal & Specia, 2018; Cuero Montenegro, 2018; Sánchez, 2018).

Conclusions

Migration and mobility experiences were found to be associated with female sex workers sexual health and with recent migrants' mental health status. This dissertation highlights the need to consider comprehensive and complex migration and mobility experiences and to unpack their impact on the health of vulnerable populations. Furthermore, the nuances of each migration and mobility or low mobile experiences need to be considered when designing public health programs or interventions that aim to improve vulnerable population's health.

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GLOSSARY

Chapter 2	
Term	Definition
Recent migration	According to demography studies and the United Nations Development Program, people who have spent 5 years or less in their current city are considered recent migrants (H. Chen, 2017; International Organization for Migration, 2004). Both international migrants and internal migrants may fall into this definition.
Short-term travel to engage in sex work in another country	Participants who reported engaging in sex work in another country, for a short period, besides where they were interviewed in the past year.
Chapter 3	
Forced migration	Forced or coerced to move against their will by someone or due to violence in their community. We specified that this did not include moving for economic reasons. Unfortunately, we do not know if this involved trafficking, as we did not ask this directly. Based on the few responses (n=24) of who forced our participants to move (e.g., gangs, n=15) we believe that most of the cases are displaced persons.
Recent international migration	Considering participants who were born in a different country from where they were interviewed and had been in the current country less than 5 years.
Recent rural-urban migration	Recent rural-urban migration was defined by participants reporting ever having lived in a rural area for more than 6 months and if the participant have recently moved (within the past 5 years) from a rural area/small town (e.g., Coatepeque, Malacatán, Tecún Umán, Huixtla, Arriaga, Cacahoatán, Ciudad Hidalgo) to a city (e.g., Tapachula, Quetzaltenango). Classification of sites as rural or urban was based on population density and economic activity.
Short-term migration	Short-term migration is defined by spending between 3 months to a year in the interview city (International Organization for Migration, 2004).
Chapter 4	
Less intra-urban mobility	Defined as a distance of <1 km between the residence and the primary sex work venue location of female sex workers. The rationale for using the cutoff of 1km was based on the distance between the geographic center of the Zona Norte to the periphery of the Zona Norte, to the canal, and to some services such as the Sanitary Control Clinic. Additionally, 1 km is a considerably short distance to walk (i.e., between 5-10 minutes) and it may reflect the concept of live-in sex work (i.e., living and working in the same location or in a restrictive space) (Gaines et al., 2015; T. L. Gaines et al., 2013; Werb et al., 2016).