



Modeling social factors of HIV risk in Mexico

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MODELING SOCIAL FACTORS OF HIV RISK IN MEXICO

by

Celina I. Valencia

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A dissertation submitted to the faculty of the
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SIGNED: Celina I. Valencia

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DEDICATION

For Alec, mi Sol para siempre

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ABSTRACT

Background

Human Immunodeficiency Virus (HIV) and Acquired Immunodeficiency Syndrome (AIDS) is an urgent public health issue in Mexico. Mexico has witnessed a 122% increase in reported prevalence of HIV since 2001 (Holtz et al., 2014). Country estimates suggest there are between 140,000-230,000 individuals living with HIV in Mexico (CENSIDA, 2014). While approximately 50% of individuals living with HIV in Mexico are unaware that they are living with the virus (CENSIDA, 2014).

Despite a federal universal HIV program implemented in 2011, HIV in Mexico has not reached chronic infectious disease classification as seen in other regions of the globe (Deeks, 2013). The mortality rate among individuals with HIV/AIDS in Mexico is 4.2 per 100,000 (CENSIDA, 2014). There is a paucity of findings regarding social and epidemiological data focused on populations outside traditional at HIV risk populations in Mexico (Martin-Onraët et al., 2016).

Analyzing aggregate country level data for Mexico provides necessary insights to better understanding previously unconsidered social factors that are driving sexual and reproductive health trends which by extension inform HIV health patterns.

Methods

Secondary data analyses were performed on Mexico's *Encuesta Nacional de Salud y Nutrición 2012* (ENSANUT). Mexico's ENSANUT is a probabilistic aggregate national dataset with a multistage stratified cluster sampling design (Janssen et al.,

2013). ENSANUT is Mexico's equivalent to the National Health and Nutrition Examination Survey (NHANES) conducted by the Centers for Disease Control and Prevention (CDC) in the United States.

Data is collected via self-report interviews conducted at the participant's home. A structured questionnaire was administered to individuals 20 years of age and older (≥ 20) where sexual and reproductive data was collected from participants. The ENSANUT adult study sub-sample ($n=46,227$) is comprised of 42.75% men and 57.25% women.

A general linear model (GLM), principal component analysis (PCA), chi-squares (χ^2), and logistic regressions were applied to the study adult subsample to disentangle social factors associated with sexually transmitted infections (STIs) in the population. Quantitative analyses were conducted on SAS 9.4.

Findings

Men were more likely to have a STI diagnosis (OR=3.60; 95% CI 3.00, 4.32, $p<0.001$). Previous HIV testing was found to be protective for STI diagnosis across both genders (OR=0.82, 95% CI 0.72, 0.94, $p<0.001$). Co-infections of HIV/gonorrhea and HIV/syphilis ($n=20$) were the highest in the study population.

The latent variable model indicates mental health and access to health care resources are critical for positive sexual and reproductive health outcomes in Mexico. Mental health was found to be non-protective for STI risk among the study population (OR=1.59, 95% CI 1.41, 1.81, $p<0.0001$).

Policy recommendations

1. Increased access and utilization of HIV resources and mental health services would benefit the study population. Further qualitative research is needed to better

understand the barriers to health care access and utilization in these two domains; 2. Increase in preventative programs and health initiatives that encourage established strategies for positive sexual and reproductive health outcomes. These strategies include: universal human papillomavirus (HPV) vaccines, wide availability of Pre-Exposure Prophylaxis (PrEP), and routine HIV/STI screenings; 3. Alternative data collection strategies for ENSANUT which are culturally appropriate for sexual and reproductive health constructs.

CHAPTER ONE

BACKGROUND AND SIGNIFICANCE

Background

Human Immunodeficiency Virus (HIV) and Acquired Immunodeficiency Syndrome (AIDS) are urgent public health issues in Mexico. Country estimates suggest there are between 140,000-230,000 individuals living with HIV in Mexico (CENSIDA, 2014). Approximately 50% of individuals living with HIV in Mexico are unaware of their disease status (CENSIDA, 2014). HIV in Mexico has reached a chronic infectious disease classification as seen in other regions of the globe (Deeks, 2013) despite a federal program that provides screening and free universal treatment for HIV. The mortality rate among individuals with HIV/AIDS in Mexico is currently at a rate of 4.2 per 100,000 (CENSIDA, 2014).

Mexico has witnessed a 122% increase in reported prevalence of HIV since 2001 (Holtz et al., 2014). New cases of HIV in Mexico continues to steadily increase. Heterosexual transmission of HIV is on the rise in Mexico (Martin-Ornaët et al., 2016). Findings have suggested an emerging sub-epidemic of HIV is taking place at the United States/Mexico border (Strathdee and Magis-Rodriguez, 2008; Strathdee and Magis-Rodriguez, 2012). States located along Mexico's Southern border are among the nation's highest HIV incidence rates in the country (CENSIDA, 2014). The cumulative incidence rate for the Southern border states are: 1. Campeche 271.7 per 100,000; 2. Quintana Roo 271.0 per 100,000; 3. Tabasco 247.4 per 100,000; and 4. Chiapas 200 per

100,000 (CENSIDA, 2014). Previous studies have asserted that the U.S./Mexico border may serve as a contextual risk factor for HIV (Zhang et al., 2017). Similar contextual factors may be influencing the HIV rates in Mexico's Southern border states. A lack of research regarding this geographic region complicates our understandings of the processes that contribute to the HIV disease burden in Mexico's Southern border region (Martin-Onraët et al., 2016). Mexico's HIV trends demonstrate a dire need for more research to identify culturally relevant strategies for effective and comprehensive HIV prevention and intervention.

The current body of scientific literature on HIV in Mexico has focused on populations traditional high risk populations as being disproportionately vulnerable for HIV acquisition and transmission. Globally, mobile populations, including migrant sex workers, remain disproportionately burdened by HIV incidence and prevalence (Ojeda et al., 2012). In Mexico and Central America, migrant subgroups most often engage in circular migratory pathways which expands the scope of HIV transmission vulnerability to include sedentary populations (Rangel et al., 2006). Sedentary populations embedded within a social network of migrant populations, who do not engage in traditional HIV risk behaviors, remain a highly understudied population.

The importance of prioritizing studies which focus on populations associated with traditional mechanisms for acute HIV risk is unquestionable. However, the current research approach needs to be extended to consider to the complexities of Latino populations. HIV vulnerability for Latinos must encompass the complex social networks that include individuals that fall outside the scope of traditional risk groups, especially for

Latino populations residing in Latin America. It is imperative that there is a move away from a research paradigm that evaluates HIV vulnerability as socially isolated.

Larger social networks and communities are inextricably linked to traditional high risk populations in ways which make it necessary to consider these individuals to better understand HIV vulnerability among Latinos (Piot et al., 2015). A scarcity of findings exist that consider social and epidemiological data focused on populations beyond traditional at risk populations of HIV in Mexico (Martin-Onraët et al., 2016). Analyzing aggregate country level data for Mexico provides the necessary insights towards a better understanding of previously understudied social causes that are driving sexual and reproductive health trends in Mexico.

Previous findings have indicated sexually transmitted infections (STIs) in Mexico have high prevalence and incidence rates (Marin-Navarrete et al., 2017). Similar to the body of literature on HIV in Mexico, studies on sexually transmitted infections for Mexico are composed fragmented analyses which evaluate populations with high vulnerability in isolation. Published quantitative studies on STIs in Mexico have focused on the following populations: sex workers (Bazzi et al., 2015), individuals who engage in substance use (Conners et al., 2017; Marin-Navarrete et al., 2017), and men who have sex with men (MSM) (Dennis et al., 2015).

Publications available which focus on STI trends among men in Mexico are unified by an underpinning of sex work. These studies have considered STIs among men and sex work in the following capacities: as clients (Patterson et al., 2009; Goldenberg et al., 2010; Goldenberg et al., 2011), as a worker in the sex work industry (Infante et al., 2009; Galárraga et al., 2014), as a male sex worker who engages in

injection drug use (Strathdee et al., 2008; Deis et al., 2008), and as individuals who can be categorized as someone who uses injection drugs and/or engages in sex work (Wagner et al., 2013). The consideration of STIs specific to these sex work affiliated populations is impactful towards an understanding of risk environments, drivers of behaviors, and structural vulnerabilities. Concentrating on sex work affiliated male populations generates a limited understanding of STI patterns among men as an aggregate in Mexico.

The body of existing scientific literature imposes a narrative which denies the social reality where men in Mexico have a more multi-faceted lived experience. Currently sex work is positioned as the central theme of HIV vulnerability in this population. The failure to consider pertinent social drivers associated with STI patterns across Mexico's general population signals the urgent need for a new approach for investigating sexual health in Mexico. Through the application of novel methodologies for investigating sexual and reproductive health, this study works to extend the prevailing research paradigm for health indicators in Mexico.

Structural factors of HIV prevention and intervention in Mexico

Empirical evidence demonstrates the efficacy of HIV prevention programs in both reducing HIV incidence and influencing change in sexual behaviors (UNAIDS, 2011; Padian et al., 2010). Despite the positive health impacts of HIV prevention programs, low and middle-income countries (LMICs) have not allocated resources in ways which maximize the effectiveness of these programs (Amico et al., 2012).

Mexico is categorized as a middle-income country per the World Bank 2017 rankings (World Bank, n.d.). A consequence of being a middle-income country is the

low resources available which heavily constrains health systems infrastructure and by extension limits the available health care services and provisions (Mills, 2014).

Difficulties of implementing prevention programs at the necessary scale and intensity have been identified as a primary challenge for HIV prevention in LMICs (Aral et al., 2012). Fundamentally HIV prevention interventions have been deemed to be difficult for country contexts that are navigating heavily constrained resources. Among these challenges is the limited resources available for the creation and implementation of effective, culturally relevant, context appropriate, and sustainable prevention education programs.

HIV prevention education and intervention specific to female sex workers (FSW) is complicated by additional layers of vulnerability from stigma and/or navigating a risk environment (Shannon et al., 201; Rhodes et al., 2012). The syndemic consequences of this intersection of structural vulnerability and FSW status are demonstrated by the disproportionate burden of HIV incidence and prevalence among FSW globally (WHO, 2012; Singer and Clair, 2013). HIV trends along the U.S./Mexico border are shaped heavily by the sex trade rendering HIV prevention intervention to be of critical importance in this geographic location (Goldenberg et al., 2012).

Syndemics theory literature (Singer et al., 2017) also points to understudied psychosocial barriers navigated by Latino populations such as fatalism, social stigma, social exclusion. These psychosocial factors have each been posited as serving as impediments for the uptake of HIV screenings among Latinos. (Solorio et al., 2013; Hoffman et al., 2016). These psychosocial challenges has been posited as playing a key role in the HIV reaching a chronic infectious disease classification among Latinos.

Surveillance of HIV in Mexico has proved to be onerous. A range of factors have emerged as deterrents for HIV screening in Mexico. The lack of widespread HIV screening complicates the compilation of robust epidemiological data on HIV vulnerability in Mexico. Accurate epidemiological surveillance is critical for understanding the demographic, social, and economic characteristics informing HIV trends. The identification of these social and epidemiological patterns allows for the identification of effective strategies and solutions to curtail the HIV sub-epidemics occurring in the Northern and Southern border regions.

Theoretical framework

Structural violence as defined for this project are the obstacles that hinder an individual from being able to obtain the necessary provisions to fulfill their fundamental human needs (Farmer, 2006; Gamlin, 2013). Specifically, the focus of this study is on the social, cultural, and institutional practices that deny an individual the ability to experience optimal health. Fundamental human needs here are defined by Maslow's Hierarchy of Needs which conceptualizes fundamental human need to be more than the need for food, shelter, and water (Maslow et al., 1987). Maslow (1987) points to human need includes drives to feel safe and to be loved. Structural factors are conceptualized by this study as entities created in the public sphere such as: public policies, economic factors, education, and socio-cultural practices. Structural factors thereby have a transactional relationship with structural violence as it shapes both the ability to access goods and services to fulfill an individual's human needs.

Acknowledging the systemic level at which structural violence operates allows for a biopolitical consideration of health pattern outcomes. Biopolitics posits that there is an

interplay of structural forces, such as gender expectations or public policies, and aggregate level disease outcome patterns (Carpenter and Casper, 2009). We can distill this to mean structural forces practically manifest as the socio-ecological forces that influences individual level health seeking behaviors. A derivative of the socio-ecological model specific to HIV vulnerability is the environments of risk and their corresponding structural vulnerabilities shaped by these contexts (Rhodes et al., 2012). Biopolitics asserts health disparities are firmly rooted in socially constructed processes. Biopolitics scholarship argues that structural violence is a human rights violation in that structural barriers to access are socially constructed and are not naturally occurring (Ho, 2007).

Syndemics theory moves biopolitics and structural violence towards a population based model to consider social and health problems (Singer et al., 2017). Syndemics theory instructs us to consider how the intersectionality of identities and their link to structural vulnerabilities increases the gravity of the afflictions, prognosis, and mortality rate experienced by populations. When considering social risk of HIV, syndemics theory underscores the need to move away from considering health behaviors in isolation and at the individual level (Ostrach and Singer, 2012). Syndemics theory challenges health sciences research to consider the structural forces and the ways which they constrain agency. The constraints imposed upon an individual's agency by structural forces influences health behaviors and health outcomes in structurally violent by influencing health outcomes. Empirical evidence has demonstrated the parallel of structural violence and disease cluster patterns indicating the need to integrate social considerations within our lines of health science inquiry (Singer et al., 2017).

Significance

This innovative study and the associated findings is a significant contribution to the existing body of scientific literature on HIV in Mexico. This study is the first to examine the aggregate national level data provided by Mexico's *Encuesta Nacional de Salud y Nutrición 2012* (ENSANUT) to consider issues of sexual and reproductive health across the population. This study speaks to the current gap in the scientific literature regarding HIV vulnerability across Mexico's general population.

Goals and objectives

The overarching goal of this study is to provide a robust synopsis of HIV trends and social factors of risk across Mexico's aggregate population. This dissertation focuses on the social and structural drivers of HIV vulnerability across Mexico through the analysis of national aggregate level data. The specific aims of this dissertation are:

1. Explore limited resources as a mechanism for HIV risk in low and middle income countries (LMICs);
2. Estimate HIV and sexually transmitted infection (STI) co-infection burden for Mexico;
3. Consider patterns of missing values for STI measures as a narrative of structural violence and structural vulnerability in Mexico;
4. Create a latent variable model to explore social and structural drivers of HIV risk and vulnerability;
5. Assess if the factors created in the latent variable model demonstrates a protective or non-protective factor for STI diagnoses via regression;

6. Provide evidence based policy recommendations derived from the findings of this study.

Chapter Two presents a scoping review to examine the scientific literature on HIV prevention in Mexico to explicate the goal of Aim One. The scoping review provides a review of the literature allowing for the assessment the link between limited resources and HIV prevention, risk, and vulnerability. Aims Two through Five corresponds to a unique quantitative analysis conducted by the author. Aims Two through Five of the corresponding articles contained in Appendices A-C. The author under the advisement of the doctoral committee wrote the three affiliated manuscripts found in Appendices A-C that were developed from the findings of proposed quantitative analyses. Aim Six is addressed in Chapter Four of this dissertation.

CHAPTER TWO

METHODS

This chapter provides the overview of the study methodology. Secondary analyses were performed on Mexico's ENSANUT 2012 data. Three manuscripts were developed from the five study aims (Appendices A-C). All quantitative analyses conducted for this study were performed using SAS 9.4.

Encuesta Nacional de Salud y Nutrición 2012

Mexico's *Encuesta Nacional de Salud y Nutrición* 2012 (ENSANUT) is a probabilistic aggregate national dataset with a multistage stratified cluster sampling design (Janssen et al., 2013). ENSANUT is Mexico's equivalent to the National Health and Nutrition Examination Survey (NHANES) in the United States. Data is collected via self-report interviews conducted at the participant's home.

ENSANUT Adult Survey Instrument

A structured questionnaire was administered to individuals 20 years of age and older (≥ 20). The ENSANUT adult study sub-sample ($n=46,227$) is comprised of 42.75% men and 57.25% women. The adult survey instrument has 20 sections with a total of 265 measures. The adult survey instrument includes a diverse range of health outcome measures including chronic disease, accidents, physiological conditions, and cognitive assessments. The adult survey instrument contains a total of 32 measures on the constructs of sexual and reproductive health. Women participants were asked an additional two questions on human papillomavirus (HPV) in the preventative screening section.

Study population

The five sexual health variables utilized for this study is participant self-report of their history of previous diagnosis or treatment in the last 12 months for the following health outcomes: genital warts, gonorrhea, syphilis, HIV, or a non-specific STI. The HPV measure was excluded from the study analyses as the measure had a missingness of 88.95% among the participants that were assessed. Women were the only participants that were asked about their history of HPV screening and diagnosis.

A high number of missing values were found for the sexual and reproductive health measures. Each of the sexual health measures were found to have the same number of missing values across the five variables (n=15,888) utilized for this study. The missing value analysis (MVA) was conducted to determine the pattern of missingness for the ENSANUT dataset. The MVA and its respective findings are discussed at length in Chapter Four.

As this is a novel line of inquiry for both the ENSANUT dataset and for investigating sexual health indicators across Mexico's general population no imputation was performed. Listwise deletion was employed for the study. Listwise deletion allows the findings from the analyses to highlight the narrative generated from the data collected in an unaltered fashion minimizing bias on measures that have been previously unexplored (Allison, 2000). Imputation could pose a challenge in that the degree of missingness found in the study variables could result in substitution produced inflation (Parent, 2013) or introduction of unnecessary bias as a result of imputing data (Allison, 2000). Following listwise deletion the sample size of 30,389 (n=30,389) was used for all of the proposed study aims.

ENSANUT measures capturing socioeconomic characteristics were collected in a separate questionnaire. The data from the socioeconomic questionnaire was merged with the adult survey data to allow for a comprehensive evaluation of associative relationships between sexual/reproductive health issues across socioeconomic characteristics. Gender and marital status variables collected in the socioeconomic questionnaire were included in the study analyses to provide demographic characteristics for health trends contained in the study population.

Statistical Analysis Plan

The initial analysis applied to the data was a general linear model (GLM) as the missing value analysis. Following the GLM, chi-squares (χ^2) were conducted to determine the country level prevalences of HIV and STI co-infections. Next, a latent variable model was created with a multivariate principal component analysis (PCA) as a method for developing an index of social risk for HIV specific to Mexico. The final quantitative element of this study was multivariate logistic regressions to triangulate the accuracy of the cluster variables created in the PCA.

A Kaiser-Meyer-Olkin (KMO) test was performed on the dataset ($n= 30,389$) to assess if the sampling adequacy for each of the variables of interest. The KMO value (0.50) indicated an acceptable sampling value (Kaiser and Rice, 1974; Hutcheson and Sofroniou, 1999). Bartlett's Test of Sphericity was performed following the KMO. Bartlett's Test of Sphericity was highly significant ($p=<0.0001$) indicating that proceeding with a factor analysis was appropriate.

Ethics Review

The University of Arizona Institutional Review Board (IRB) Human Subjects Determination form was submitted on behalf of this study. Based on the Human Subjects Determination form this study was deemed exempt from IRB human subjects review. The Human Subjects Determination form for this study is on file with the Mel and Enid Zuckerman College of Public Health Research Office.

CHAPTER THREE

LITERATURE SCOPING REVIEW

Introduction

To gain an understanding of the current state of HIV prevention in Mexico a scoping review was conducted to generate a comprehensive representation of published studies and their respective findings on this topic. The sparsity of studies considering HIV prevention and interventions in populations that are not traditionally high risk was prohibitive in conducting a scoping review focused on Mexico's general population.

As the overarching goal of the study is to identify the praxis of syndemics theory and HIV patterns, the author opted to focus the scoping review on studies where female sex workers (FSW) were the population of interest. FSWs were chosen as their social positionality places them at higher syndemic risk for HIV (Shannon et al., 2015; Rhodes et al., 2012). The syndemic consequences of this intersection of structural vulnerability and FSW status are demonstrated by the disproportionate burden of HIV incidence and prevalence among FSW globally (WHO, 2012; Singer and Clair, 2003).

Methods

A systematic search of the electronic databases PubMed, Scientific Electronic Library Online (SciELO), and Virtual Health Library (VHL) Regional Portal was conducted to identify the body of relevant peer reviewed literature to be included in this study. The search term strategy for these electronic databases was: "Central America," "Belize," "Honduras," "Nicaragua," "El Salvador," "Costa Rica," "Guatemala," "Panama,"

and “Mexico.” “HIV infections,” “VIH/SIDA,” “VIH infección,” “prevención,” and “educación,”. The searches were conducted with relevant search term strategies in both English and Spanish. The study including literature that had been published prior to June 30, 2016. Across the three electronic databases utilized to conduct the systematic review a total of 1,228 (N=1,228) articles were identified for study screening.

The following inclusion criteria were applied to the articles identified as relevant for the study: 1. The article must be a peer reviewed publication; 2. The study population must in located in Mexico, Belize, Guatemala, Honduras, Nicaragua, El Salvador, Costa Rica, or Panama; 3. The HIV prevention programs must have an emphasis on female sex worker (FSW) population. This included interventions that targeted clients of FSW as well as transgender sex worker populations. 4. The study must be primarily interested in outcomes related to a HIV prevention program; 5. Published after 2011. Publication date parameters were set by the authors to examine HIV prevention occurring in tandem with Mexico’s federal HIV program. Any article that had been included in the electronic database search but did not meet all of the inclusion criteria of the study were deemed ineligible for study. Articles categorized as ineligible were reviewed by two article screeners and a decision of ineligibility was determined by consensus. Following a consensus decision, the articles were excluded from further screening.

The scoping review used the procedures for systematic reviews as delineated by the Cochrane Handbook of Systematic (Higgins and Green, 2011). Two authors served as article screeners. The articles were screened independently for initial determinations regarding study eligibility. The article screeners met to discuss their respective results of

the independent article screening. The screening authors discussed disagreements regarding the independent determinations to either include or exclude an article for study eligibility. Disagreements regarding article categorization were resolved through a discussion of the two authors. In instances when a consensus could not be reached by the initial screeners a senior author would make the final determination.

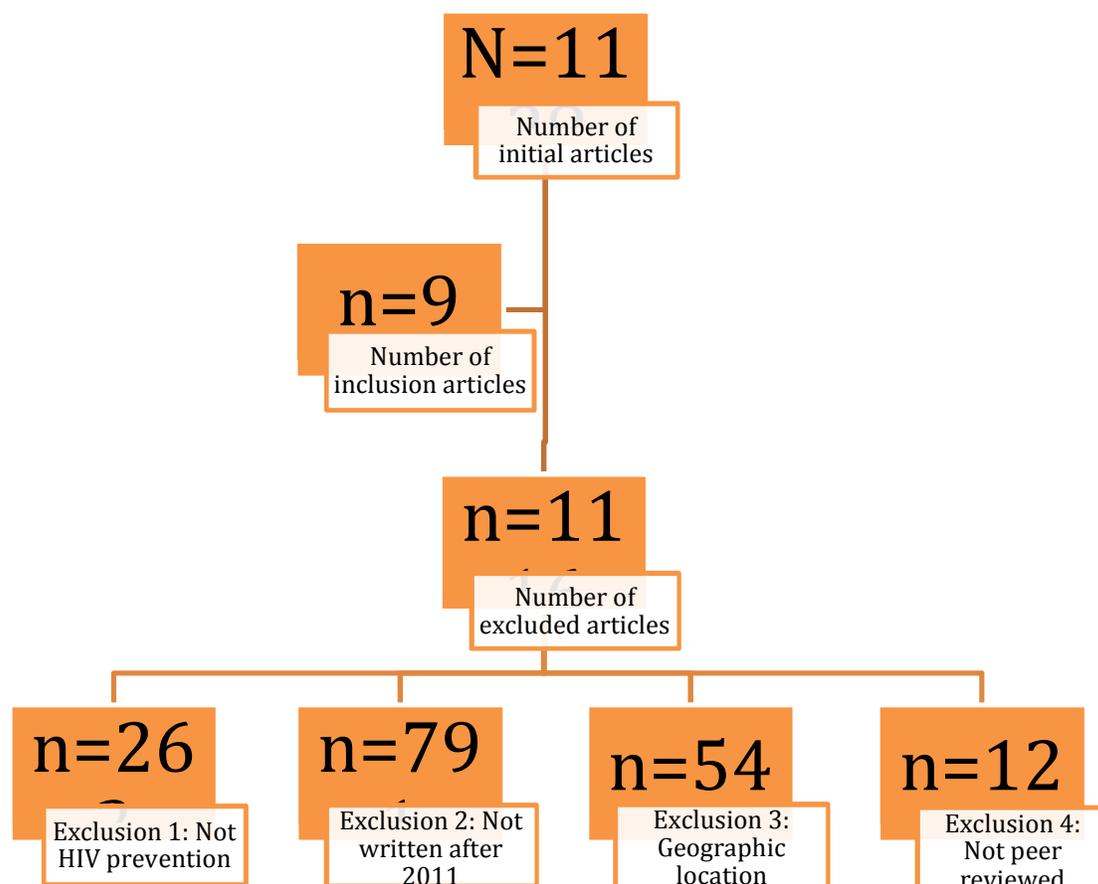


Figure 1: Process of article categorization for study exclusion and inclusion

Findings

A total of 9 (n=9) articles were deemed eligible for study inclusion (Figure 1). Full citations of articles determined to be eligible for inclusion in this scoping review is located in Appendix D.

The geographic distributions of these prevention programs were disproportionate. Six of the articles of the total study sample included an HIV prevention program that was operating in the city of Tijuana, Baja California, Mexico (Figure 2). Ciudad Juarez, Chihuahua, Mexico had the second highest number of HIV prevention interventions with three interventions. Patterson et al. discussed an HIV prevention program intervention that occurred across 12 cities in Mexico, however, an exact geographic locations of the intervention was not provided (Patterson et al., 2012). Tinajeros et al. also discussed an HIV prevention program intervention in Honduras across three non-specific cities (Tinajeros et al., 2012).

The majority of the included studies were behavioral interventions that used a qualitative methodological framework for HIV prevention. Two of the studies addressed individuals proximal to FSW for their intervention (Pitpitan et al., 2014; Palinkas et al., 2014). Pitpitan et al. (2014) conducted a behavioral intervention of FSW patrons. Palinkas et al. (2014) addressed the non-commercial intimate partners of FSWs.

Within HIV prevention programs that focus on FSWs, two subpopulations were identified in the eligible articles included in this review. The first subcategory is FSW who also engage in injection drug use were the population of interest for two of the studies included in this review (Strathdee et al., 2013; Vera et al., 2012). Transgender FSW was the second subpopulations that were addressed by HIV prevention program

studies by studies contained in the review articles (Rhodes et al., 2014).

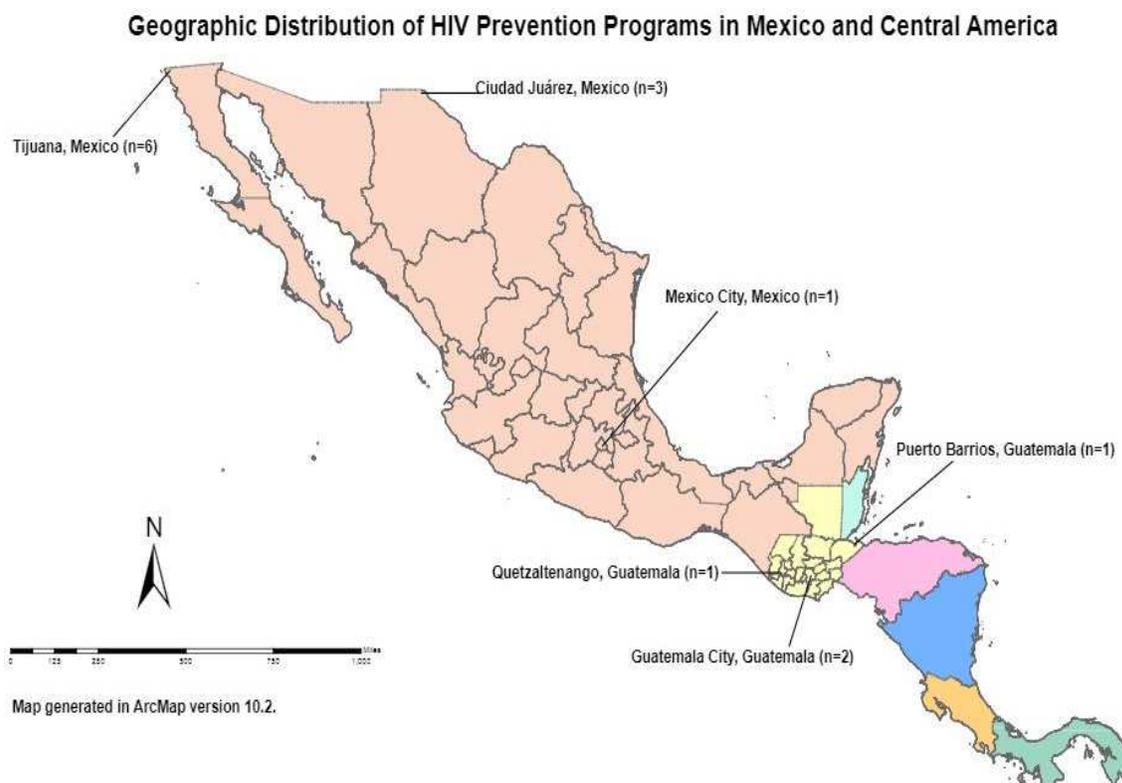


Figure 2: Cartographic representation of geographic distribution of HIV prevention programs in Mexico and Central America

Discussion

The geographic distribution of these HIV prevention programs demonstrates a significant disparity in HIV prevention programs for FSW across Mexico and Central America (Figure 2). The majority of the HIV prevention interventions for FSW occur in Tijuana, Mexico situated along the U.S./Mexico border. Tijuana is shaped by a high degree of mobility which increases the vulnerability to HIV transmission for the FSW population (Pitpitan, 2014; Strathdee et al., 2012). The social and structural forces that collectively create acute vulnerability across FSW populations in Tijuana, Mexico is not isolated to this specific location. Similar environment of risk contributes to the vulnerabilities experienced by FSW populations in other geographic contexts along borders shared by LMICs across Mexico and Central America as these regions are experiencing a HIV sub-epidemic (Rhodes et al., 2012; Strathdee et al., 2012).

The geographic disparity of HIV prevention programs is particularly striking in Central American countries. The Central American countries of Belize, Nicaragua, El Salvador, Costa Rica, and Panama did not have any HIV prevention programs interventions for FSW populations. Little is known about the situation faced by FSWs in these Central American countries that were not the subject of any of the articles included in this review.

The syndemic drivers informing HIV risk are most pronounced among transgender FSW populations (Operario et al., 1999). Syndemic theory considers the presence of social inequality as a distal consequence of structural violence which informs health patterns (Singer and Clair, 2003). These health patterns are particularly

prominent across vulnerable populations. High HIV prevalence data globally concretely demonstrates that transgender FSW are particularly vulnerable to the syndemic realities of HIV (Poteat et al., 1999). There was one HIV prevention program which addressed transgender FSW included in this review which was located in Guatemala (Rhodes et al., 2014).

Limitations

The major limitation of this scoping review would be the exclusion of any non-peer reviewed scientific literature. This could result in the limiting of other sources of literature that could contain a greater number of HIV prevention programs concerning FSW populations. Future studies should consider the inclusion of sources of grey literature or other non-peer reviewed sources of literature to generate a broader understanding of HIV prevention programs among FSW populations in Mexico and Central America.

Conclusion

The absence of HIV prevention programs in Mexico and Central America has been postulated as resulting from the LMIC status of these countries (Amico et al., 2012). The limited resources for health infrastructure complicates an LMICs' ability to sustain multi-strategy comprehensive HIV prevention to tackle co-occurring HIV transmission behaviors (Padian et al., 2010). The findings of this study concretely demonstrate the lack of HIV prevention programs for FSW across Mexico and Central America. Our findings demonstrate that across this geographical region only one program in Central America specifically focused on transgender FSW populations. The practical consequence of the constraints imposed by LMIC limited resources in Mexico

and Central America translates as an emerging HIV risk factor driven by a lack of comprehensive HIV prevention interventions in the region.

CHAPTER FOUR

CONCLUSIONS AND POLICY RECOMMENDATIONS

Overall Findings

This novel investigation illuminated various social factors of HIV vulnerability at the aggregate country level for Mexico that had not been previously considered. The newly generated empirical evidence regarding social factors of HIV vulnerability across Mexico's general population provides new directions for the development of effective interventions to curtail the current HIV disease trends for Mexico.

The general linear model (GLM) conducted by the study uncovered a pattern of missingness in the ENSANUT 2012 data that did not occur completely at random. Married women were the category with the highest rate of missing values in Mexico's ENSANUT 2012 data. The lack of comprehensive information on the reproductive and sexual health realities faced by married women in Mexico creates a distinct limitation on the intervention policies and programs that can be developed for married women. Additionally, the pattern of missing data detected by the GLM signals the possible presence of gender based structural violence that is an impediment to married women's health status in Mexico. This analysis points to the need for future research and the consideration of new strategies for the collection of sexual health self-report data for women in Mexico.

The social characteristics of sexually transmitted infections were assessed via multivariate logistic regression and chi-square analyses (χ^2). These analyses found co-infections of HIV/gonorrhea and HIV/syphilis (n=20) were the highest in the study population. The logistical regression also indicated men were more likely to have a STI

diagnosis (OR=3.60; 95% CI 3.00, 4.32, $p<0.001$). Previous HIV testing was found to be protective for STI diagnosis across both genders (OR=0.82, 95% CI 0.72, 0.94, $p<0.001$).

The multivariate latent variable model identified mental health and access to health care resources as cluster variables. Logistic regression was used to triangulate the findings from the latent variable model to assess if the cluster variables demonstrated either a protective or non-protective function for sexual and reproductive health across the study population. Mental health indicators were found to be non-protective for STI risk among the study population (OR=1.59, 95% CI 1.41, 1.81, $p<0.0001$). Access to HIV health care resources was found to be protective for sexual and reproductive health.

Evidence based policy recommendations

Evidence based practice and policy has demonstrated a high level of effectiveness for changing targeted health outcomes (Kitson et al., 1998; Damschroder et al., 2009). Previous studies indicate that evidence based intervention for HIV have been highly effective (Schackman, 1999). These studies have focused on various elements of HIV prevention such as: mother to child HIV transmission (Buchanan et al., 2014), male circumcision in Africa (Gray et al., 2007), and syringe needle distribution among injection drug using populations (Wodak and Cooney, 2006; Kaufman et al., 2014).

Translational studies in low and middle income country contexts are extremely limited (Ebrahim et al., 2013). Translational studies in LMICs provide the opportunity to develop evidence based policies and practices that are culturally relevant and context

specific. There is an urgent need for HIV translational studies to be conducted in LMICs (Narayan et al., 2014). This study seeks to provide generalizable findings regarding social process related to HIV vulnerability specific to Mexico. The study findings have been discussed in length in the previous chapters. This chapter will provide policy recommendations and future directions.

Policy recommendations: ENSANUT

The first set of policy recommendations will be directed to the agency of the Mexican government which is charged with overseeing the data collection for ENSANUT.

ENSANUT would benefit substantially from providing culturally relevant methods for women to provide information regarding their reproductive and sexual health information. Offering alternative options for disclosure of this information that does not include self-report while in the presence of other household members may increase data collection success for sexual and reproductive health measures.

ENSANUT should consider the addition of measures which gauge the participants' knowledge of reproductive and sexual health issues. This would allow for a robust understanding of the demographic and regional composition of participants with the highest degree of accurate health knowledge of these topics.

Data collection personnel should be assessed and trained to minimize their personal biases regarding discussing sexual health matters with a diverse participant population. Individuals serving as data collectors for ENSANUT would benefit from being trained on the existing scientific literature on misreporting of sexual health data that has been established previously in various studies. The data collector should be

trained to minimize their personal biases regarding sexual and reproductive health in order to avoid biasing the participant and their responses.

Anonymous surveys would augment the self-report data provided by study participants. This would also provide the opportunity for participants to provide unbiased responses to measures specific to sexual and reproductive health. An anonymous survey of these constructs would also allow triangulation of data collected between the self-report data from an interview versus an anonymous survey.

Policy recommendations: Mexico Ministry of Health

The cluster of social factors identified by the Principal Component Analysis (PCA) provides a mapping for future evidence based policies and interventions. The first cluster of social factors demonstrates that access to HIV resources at both the macro-level and at the individual level is protective for this study population. More research is necessary to better understand how the institutional and individual level intersect to successfully lower risk of contracting other sexually transmitted infections (STIs). Qualitative data to provide specifics as to how this protective mechanism operates among Mexican populations would be most useful.

The second cluster of social factors of mental health indicates a composite of risk which increases the individual's likelihood for having an STI. These findings align closely with previous studies of HIV risk in the syndemics literature.

Syphilis and gonorrhea co-infections in HIV positive individuals were the highest co-infection burden in this study sample. Syphilis co-infection with HIV has been found to be an issue in various country contexts (Pialox et al., 2008; Gállego-Lezáun et al., 2015; Shah et al., 2015). Gonorrhea co-infection with HIV has been extensively studied.

As these co-infection findings are novel for Mexico's populations, further research is needed to better understand the demographic and regional characteristics of this co-infection disease pattern.

Preventative initiatives for sexual and reproductive health such as universal HPV vaccine campaigns across both genders, widespread information dissemination regarding pre-exposure prophylaxis (PrEP), easily accessible routine screening procedures, and targeting matters of fatalism and/or stigma would encourage positive health outcomes for the population. These forms of preventative initiatives have the potential for shifting the prevailing discourse regarding sexual and reproductive health in productive ways that would culminate in positive public health outcomes.

Future directions

Further research is needed to disentangle the primary drivers of many of the findings in this study. Qualitative data would augment the current findings greatly. Qualitative data would provide a more complete portrayal of mechanisms that contribute to HIV not reaching an infectious chronic disease status in Mexico. Qualitative data also provides the opportunity to better understand individual level factors which dictate the health attitudes, knowledge, and behaviors of diverse populations in Mexico.

A follow up quantitative assessment of the next wave of ENSANUT data, anticipated to occur in 2018, would also provide insights into how the initiation and implementation of CAPASITS over the previous seven years has influenced sexual and reproductive health outcomes in Mexico.

Capacity building within research institutions as collaborative exchanges between partnerships of the Global North and Global South has been previously studied

(Atkins et al., 2016). Currently, there is a gap in the literature regarding the perspectives and positionality of individuals from low- and middle-income (LMICs) that participate in study coordination and data collection. Individuals of LMICs working as research staff contribute to a knowledge hybridity for study implementation (Wallerstein and Duran, 2010). Understanding the intersection of the LMIC research staff's biases and their role in scientific knowledge production highlights the complexities of health interventions in LMIC contexts. This assessment is particularly relevant for LMIC research staff involved in behavioral and health interventions focused on stigmatized and vulnerable populations

A major limitation for translating these policy and program recommendations into action is the middle income country status of Mexico. With limited resources for health services and specifically for HIV prevention and education, creative and innovative tactics must be employed to serve Mexico's population. Microfinance initiatives via local non-profits could be parlayed into successful strategies for funding high quality HIV prevention programs around Mexico.

REFERENCES

Ahn JY, Boettiger D, Kiertiburanakul S, Merati TP, Huy BV, Wong WW, Ditangco R, Lee MP, Oka S, Durier N, Choi JY. Incidence of syphilis seroconversion among HIV-infected persons in Asia: results from the TREAT Asia HIV Observational Database. *Journal of the International AIDS Society*. 2016;19(1).

Amico P, Gobet B, Avila-Figueroa C, Aran C, De Lay P. Pattern and levels of spending allocated to HIV prevention programs in low-and middle-income countries. *BMC Public Health*. 2012 Mar 21;12(1):1.

Aral SO, Blanchard JF. The Program Science initiative: improving the planning, implementation and evaluation of HIV/STI prevention programs. *Sexually transmitted infections*. 2012 Feb 22;sextrans-2011.

Barrington C, Knudston K, Bailey OA, Aguilar JM, Loya-Montiel MI, Morales-Miranda S. HIV Diagnosis, Linkage to Care, and Retention among Men Who Have Sex with Men and Transgender Women in Guatemala City. *Journal of Health Care for the Poor and Underserved*. 2016;27(4):1745-60.

Bazzi AR, Rangel G, Martinez G, Ulibarri MD, Syvertsen JL, Bazzi SA, Roesch S, Pines HA, Strathdee SA. Incidence and predictors of HIV and sexually transmitted infections among female sex workers and their intimate male partners in northern Mexico: a

longitudinal, multilevel study. *American journal of epidemiology*. 2015 May 1;181(9):723-31.

Biello KB, Oldenburg CE, Safren SA, Rosenberger JG, Novak DS, Mayer KH, Mimiaga MJ. Multiple syndemic psychosocial factors are associated with reduced engagement in HIV care among a multinational, online sample of HIV-infected MSM in Latin America. *AIDS care*. 2016 Mar 24;28(sup1):84-91.

Bourdieu, P. (1979). Symbolic power. *Critique of anthropology*, 4(13-14), 77-85.

Bourgois, P. (2002). The violence of moral binaries: response to Leigh Binford. *Ethnography*, 3(2), 221-231.

Buchanan AM, Dow DE, Massambu CG, Nyombi B, Shayo A, Musoke R, Feng S, Bartlett JA, Cunningham CK, Schimana W. Progress in the prevention of mother to child transmission of HIV in three regions of Tanzania: a retrospective analysis. *PloS one*. 2014 Feb 13;9(2):e88679.

Carpenter LM, Casper MJ. Global intimacies: Innovating the HPV vaccine for women's health. *WSQ: Women's Studies Quarterly*. 2009;37(1):80-100.

Carranza, M. E. (2013). Value transmission among salvadorian mothers and daughters: marianismo and sexual morality. *Child and Adolescent Social Work Journal*, 30(4), 311-327.

Centro Nacional prevencion y el control de el Control del VIH y el sida (CENSIDA). La epidemia del VIH y el sida en Mexico. Accessed from:

http://www.censida.salud.gob.mx/descargas/epidemiologia/L_E_V_S.pdf. 2014.

Chopel, A. M. (2014). Reproductive health in indigenous Chihuahua: giving birth 'alone like the goat'. *Ethnicity & health*, 19(3), 270-296.

Daley AE, MacDonnell JA. Gender, sexuality and the discursive representation of access and equity in health services literature: implications for LGBT communities. *International journal for equity in health*. 2011 Sep 29;10(1):40.

Damschroder LJ, Aron DC, Keith RE, Kirsh SR, Alexander JA, Lowery JC. Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science. *Implementation science*. 2009 Aug 7;4(1):50.

Das P, Horton R. The cultural challenge of HIV/AIDS. *The Lancet*. 2012 Jul 28;380(9839):309.

De Cock KM, Fowler MG, Mercier E, de Vincenzi I, Saba J, Hoff E, Alnwick DJ, Rogers M, Shaffer N. Prevention of mother-to-child HIV transmission in resource-poor countries: translating research into policy and practice. *Jama*. 2000 Mar 1;283(9):1175-82.

De Los Monteros KE, Gallo LC. The relevance of fatalism in the study of Latinas' cancer screening behavior: A systematic review of the literature. *International journal of behavioral medicine*. 2011 Dec 1;18(4):310-8.

Ebrahim S, Pearce N, Smeeth L, Casas JP, Jaffar S, Piot P. Tackling non-communicable diseases in low-and middle-income countries: is the evidence from high-income countries all we need?. *PLoS Med*. 2013 Jan 29;10(1):e1001377.

Espinoza, R., Martínez, I., Levin, M., Rodriguez, A., Chan, T., Goldenberg, S., & Zúñiga, M. L. (2014). Cultural perceptions and negotiations surrounding sexual and reproductive health among migrant and non-migrant indigenous Mexican women from Yucatan, Mexico. *Journal of Immigrant and Minority Health*, 16(3), 356-364.

Farmer PE, Nizeye B, Stulac S, Keshavjee S. Structural violence and clinical medicine. *PLoS Med*. 2006 Oct 24;3(10):e449.

Galárraga O, Sosa-Rubi SG, González A, Badial-Hernández F, Conde-Glez CJ, Juárez-Figueroa L, Bautista-Arredondo S, Kuo C, Operario D, Mayer KH. The disproportionate burden of HIV and STIs among male sex workers in Mexico City and the rationale for economic incentives to reduce risks. *Journal of the International AIDS Society*. 2014 Nov 14;17(1).

Gállego-Lezáun C, Asenjo MA, González-Moreno J, Ferullo I, Teslev A, Fernández-Vaca V, Cifre AP. Syphilis in men who have sex with men: a warning sign for HIV infection. *Actas Dermo-Sifiliográficas (English Edition)*. 2015 Nov 30;106(9):740-5.

Gray RH, Kigozi G, Serwadda D, Makumbi F, Watya S, Nalugoda F. Male circumcision for HIV prevention in men in Rakai, Uganda: a randomised trial. *Lancet [Internet]*. 2007 Feb 24; 369 (9562): 657–66.

Gamlin, J. B. (2013). Shame as a barrier to health seeking among indigenous Huichol migrant labourers: An interpretive approach of the “violence continuum” and “authoritative knowledge”. *Social science & medicine*, 97, 75-81.

Gil, R. M., & Vazquez, C. I. (2014). *The Maria paradox: How Latinas can merge old world traditions with new world self-esteem*. Open Road Media.

Goldenberg SM, Silverman JG, Engstrom D, Bojorquez-Chapela I, Strathdee SA. “Right Here is the Gateway”: mobility, sex work entry and HIV risk along the Mexico–US Border. *International Migration*. 2014 Aug 1;52(4):26-40.

Goldenberg SM, Cruz MG, Strathdee SA, Nguyen L, Semple SJ, Patterson TL. Correlates of unprotected sex with female sex workers among male clients in Tijuana, Mexico. *Sexually transmitted diseases*. 2010 May;37(5):319.

Goldenberg SM, Strathdee SA, Gallardo M, Nguyen L, Lozada R, Semple SJ, Patterson TL. How important are venue-based HIV risks among male clients of female sex workers? A mixed methods analysis of the risk environment in nightlife venues in Tijuana, Mexico. *Health & place*. 2011 May 31;17(3):748-56.

González-Guarda RM, McCabe BE, Leblanc N, De Santis JP, Provencio-Vasquez E. The contribution of stress, cultural factors, and sexual identity on the substance abuse, violence, HIV, and depression syndemic among Hispanic men. *Cultural diversity and ethnic minority psychology*. 2016 Oct;22(4):563.

Gray RH, Kigozi G, Serwadda D, Makumbi F, Watya S, Nalugoda F. Male circumcision for HIV prevention in men in Rakai, Uganda: a randomised trial. *Lancet* [Internet]. 2007 Feb 24; 369 (9562): 657–66.

Hatzenbuehler ML, Phelan JC, Link BG. Stigma as a fundamental cause of population health inequalities. *American journal of public health*. 2013 May;103(5):813-21.

Link BG, Phelan JC. Stigma and its public health implications. *The Lancet*. 2006 Feb 11;367(9509):528.

Hernandez I, Johnson A, Reina-Ortiz M, Rosas C, Sharma V, Teran S, Naik E, Saliu HM, Teran E, Izurieta R. Syphilis and HIV/Syphilis Co-infection Among Men Who Have Sex With Men (MSM) in Ecuador. *American Journal of Men's Health*. 2016 Dec 5:1557988316680928.

Hietanen, A. E., & Pick, S. (2015). Gender stereotypes, sexuality, and culture in Mexico. In *Psychology of gender through the lens of culture* (pp. 285-305). Springer International Publishing.

Higgins JP, Green S, editors. *Cochrane handbook for systematic reviews of interventions*. John Wiley & Sons; 2011 Aug 24.

Hirsch JS. Desire across borders: markets, migration, and marital HIV risk in rural Mexico. *Culture, health & sexuality*. 2015 May 29;17(sup1):20-33.

Hirsch, J. S., Meneses, S., Thompson, B., Negroni, M., Pelcastre, B., & Del Rio, C. (2007). The inevitability of infidelity: sexual reputation, social geographies, and marital HIV risk in rural Mexico. *American Journal of Public Health*, 97(6), 986-996.

Hirsch, J. S., Higgins, J., Bentley, M. E., & Nathanson, C. A. (2002). The social constructions of sexuality: marital infidelity and sexually transmitted disease—HIV risk in a Mexican migrant community. *American Journal of Public Health*, 92(8), 1227-1237.

Holtz C, Sowell R, VanBrackle L, Velasquez G, Hernandez-Alonso V. A quantitative study of factors influencing quality of life in rural Mexican women diagnosed with HIV. *Journal of the Association of Nurses in AIDS Care*. 2014 Dec 31;25(6):555-67.

Ho, K., 2007. Structural violence as a human rights violation.

Hook EW, Shafer W, Deal C, Kirkcaldy RD, Iskander J. CDC Grand Rounds: the growing threat of multidrug-resistant gonorrhea. *Morbidity and Mortality Weekly Report*. 2013 Feb 15;62(06):103-6.

Hoffmann M, MacCarthy S, Batson A, Crawford-Roberts A, Rasanathan J, Nunn A, Silva LA, Dourado I. Barriers along the care cascade of HIV-infected men in a large urban center of Brazil. *AIDS care*. 2016 Jan 2;28(1):57-62.

Hutcheson GD, Sofroniou N. *The multivariate social scientist: Introductory statistics using generalized linear models*. Sage; 1999 May 28.

Index, G. I. (2014). UNDP.

Infante C, Sosa-Rubi SG, Cuadra SM. Sex work in Mexico: vulnerability of male, travesti, transgender and transsexual sex workers. *Culture, health & sexuality*. 2009 Feb 1;11(2):125-37.

Joint United Nations Programme on HIV/AIDS. AIDS at 30: nations at the crossroads. UNAIDS; 2011.

Kaiser HF, Rice J. Little jiffy, mark IV. Educational and psychological measurement. 1974 Apr;34(1):111-7.

Kalichman SC, Pellowski J, Turner C. Prevalence of sexually transmitted co-infections in people living with HIV/AIDS: systematic review with implications for using HIV treatments for prevention. *Sexually transmitted infections*. 2011 Apr 1;87(3):183-90.

Karp G, Schlaeffer F, Jotkowitz A, Riesenber K. Syphilis and HIV co-infection. *European journal of internal medicine*. 2009 Jan 31;20(1):9-13.

Katz, A. (2002). Where I Come From, We Don't Talk About That. *Nursing for Women's Health*, 6(6), 533-536.

Kaufman MR, Cornish F, Zimmerman RS, Johnson BT. Health behavior change models for HIV prevention and AIDS care: practical recommendations for a multi-level approach. *JAIDS Journal of Acquired Immune Deficiency Syndromes*. 2014 Aug 15;66:S250-8.

Kendall, T., & Pelcastre, B. E. (2010). HIV vulnerability and condom use among migrant women factory workers in Puebla, Mexico. *Health care for women international*, 31(6), 515-532.

Kissinger P, Kovacs S, Anderson-Smits C, Schmidt N, Salinas O, Hembling J, Beaulieu A, Longfellow L, Liddon N, Rice J, Shedlin M. Patterns and predictors of HIV/STI risk among Latino migrant men in a new receiving community. *AIDS and Behavior*. 2012 Jan 1;16(1):199-213.

Moreno CL. The relationship between culture, gender, structural factors, abuse, trauma, and HIV/AIDS for Latinas. *Qualitative health research*. 2007 Mar;17(3):340-52.

Kitson A, Harvey G, McCormack B. Enabling the implementation of evidence based practice: a conceptual framework. *Quality in Health care*. 1998 Sep 1;7(3):149-58.

Knight RE, Shoveller JA, Carson AM, Contreras-Whitney JG. Examining clinicians' experiences providing sexual health services for LGBTQ youth: considering social and structural determinants of health in clinical practice. *Health education research*. 2014 Aug 1;29(4):662-70.

Lawi JD, Mirambo MM, Magoma M, Mushi MF, Jaka HM, Gumodoka B, Mshana SE. Sero-conversion rate of Syphilis and HIV among pregnant women attending antenatal

clinic in Tanzania: a need for re-screening at delivery. *BMC pregnancy and childbirth*. 2015 Jan 22;15(1):3.

Leblanc NM, Flores DD, Barroso J. Facilitators and barriers to HIV screening: A qualitative meta-synthesis. *Qualitative health research*. 2016 Feb;26(3):294-306.

Magis-Rodriguez C, Lemp G, Hernandez MT, Sanchez MA, Estrada F, Bravo-Garcia E. Going North: Mexican migrants and their vulnerability to HIV. *JAIDS Journal of Acquired Immune Deficiency Syndromes*. 2009 May 1;51:S21-5.

Marín-Navarrete R, Magis-Rodríguez C, Strathdee SA. Sexually transmitted infections and substance use disorders: evidence and challenges in Mexico. *Salud Mental*. 2017 Jan 31;40(1):1-4.

Marmot M, Commission on Social Determinants of Health. Achieving health equity: from root causes to fair outcomes. *The Lancet*. 2007 Oct 5;370(9593):1153-63.

Martin-Onraët A, Volkow-Fernández P, Alvarez-Wyssmann V, González-Rodríguez A, Casillas-Rodríguez J, Rivera-Abarca L, Sierra-Madero J. Late Diagnosis Due to Missed Opportunities and Inadequate Screening Strategies in HIV Infected Mexican Women. *AIDS and Behavior*. 2016 Sep 20:1-0.

Martinez-Donate AP, Hovell MF, Rangel MG, Zhang X, Sipan CL, Magis-Rodriguez C, Gonzalez-Fagoaga JE. Migrants in transit: the importance of monitoring HIV risk among migrant flows at the Mexico–US border. *American journal of public health*. 2015 Mar;105(3):497-509.

McAuliffe, T. L., DiFranceisco, W., & Reed, B. R. (2007). Effects of question format and collection mode on the accuracy of retrospective surveys of health risk behavior: a comparison with daily sexual activity diaries. *Health Psychology, 26*(1), 60.

Mills A. Health care systems in low-and middle-income countries. *New England Journal of Medicine*. 2014 Feb 6;370(6):552-7.

Mir BA, Sirwar SB, Vijayaraghavan R. Prevalence and antibiotic susceptibility of neisseria gonorrhoeae in HIV positive and hiv negative cases at a tertiary care hospital. *Indian Journal of Microbiology Research*. 2016;3(2):213-8.

Narayan, K. V., Miotti, P. G., Anand, N. P., Kline, L. M., Harmston, C., Gulakowski III, R., & Vermund, S. H. (2014). HIV and noncommunicable disease comorbidities in the era of antiretroviral therapy: a vital agenda for research in low-and middle-income country settings.

Ojeda VD, Burgos JL, Hiller SP, Lozada R, Rangel G, Vera A, Artamonova I, Magis-Rodriguez C. Circular migration by Mexican female sex workers who are injection drug

users: implications for HIV in Mexican sending communities. *Journal of Immigrant and Minority Health*. 2012 Feb 1;14(1):107-15.

Omisakin CT, Esan AJ, Fasakin KA, Owoseni MF, Ojo-Bola O, Aina OO, Omoniyi DP. Syphilis and human immunodeficiency virus co-infection among pregnant women in Nigeria: prevalence and trend. 2014.

Operario D, Nemoto T. HIV in transgender communities: syndemic dynamics and a need for multicomponent interventions. *Journal of acquired immune deficiency syndromes (1999)*. 2010 Dec 15;55(Suppl 2):S91.

Ostrach B, Singer M. At special risk: Biopolitical vulnerability and HIV/STI syndemics among women. *Health Sociology Review*. 2012 Sep 1;21(3):258-71.

Padian NS, McLOY SI, Balkus JE, Wasserheit JN. Weighing the gold in the gold standard: challenges in HIV prevention research. *AIDS (London, England)*. 2010 Mar 13;24(5):621.

Palinkas, L. A., Robertson, A. M., Syvertsen, J. L., Hernandez, D. O., Ulibarri, M. D., Rangel, M. G., ... & Strathdee, S. A. (2014). Client perspectives on design and implementation of a couples-based intervention to reduce sexual and drug risk behaviors among female sex workers and their noncommercial partners in Tijuana and Ciudad Juarez, Mexico. *AIDS and Behavior*, 18(3), 583-594.

Patterson TL, Goldenberg S, Gallardo M, Lozada R, Semple SJ, Orozovich P, Abramovitz D, Strathdee SA. Correlates of HIV, STIs and associated high risk behaviors among male clients of female sex workers in Tijuana, Mexico. *AIDS (London, England)*. 2009 Aug 24;23(13):1765.

Patterson, T. L., Semple, S. J., Chavarin, C. V., Mendoza, D. V., Santos, L. E., Chaffin, M., ... & Aarons, G. A. (2012). Implementation of an efficacious intervention for high risk women in Mexico: protocol for a multi-site randomized trial with a parallel study of organizational factors. *Implementation Science*, 7(1).

Pialoux G, Vimont S, Moulignier A, Buteux M, Abraham B, Bonnard P. Effect of HIV infection on the course of syphilis. *AIDS Rev*. 2008 Apr 1;10(2):85-92.

Pitpitan, E. V., Chavarin, C. V., Semple, S. J., Magis-Rodriguez, C., Strathdee, S. A., & Patterson, T. L. (2014). Hombre Seguro (Safe Men): a sexual risk reduction intervention for male clients of female sex workers. *BMC public health*, 14(1), 1.

Poteat T, Scheim A, Xavier J, Reisner S, Baral S. Global epidemiology of HIV infection and related syndemics affecting transgender people. *Journal of Acquired Immune Deficiency Syndromes (1999)*. 2016 Aug 15;72(Suppl 3):S210.

Preda A, Voigt K. The social determinants of health: Why should we care?. *The American Journal of Bioethics*. 2015 Mar 4;15(3):25-36.

Priego-Hernández, J. (2015). Sexual health in transition: A social representations study with indigenous Mexican young women. *Journal of health psychology*, 1359105315611954.

Pialoux G, Vimont S, Moulignier A, Buteux M, Abraham B, Bonnard P. Effect of HIV infection on the course of syphilis. *AIDS Rev*. 2008 Apr 1;10(2):85-92.

Quesada J, Hart LK, Bourgois P. Structural vulnerability and health: Latino migrant laborers in the United States. *Medical anthropology*. 2011 Jul 1;30(4):339-62.

Ramírez AS. Fatalism and cancer risk knowledge among a sample of highly acculturated Latinas. *Journal of Cancer Education*. 2014 Mar 1;29(1):50-5.

De Los Monteros KE, Gallo LC. Fatalism and cardio-metabolic dysfunction in Mexican-American women. *International journal of behavioral medicine*. 2013 Dec 1;20(4):487-94.

Rangel M, Martínez-Donate AP, Hovell MF, Santibáñez J, Sipan CL, Izazola-Licea JA. Prevalence of risk factors for HIV infection among Mexican migrants and immigrants: probability survey in the North border of Mexico. *salud pública de méxico*. 2006 Feb;48(1):3-12.

Rhodes T, Wagner K, Strathdee SA, Shannon K, Davidson P, Bourgois P. Structural violence and structural vulnerability within the risk environment: theoretical and methodological perspectives for a social epidemiology of HIV risk among injection drug users and sex workers. In *Rethinking social epidemiology 2012* (pp. 205-230). Springer Netherlands.

Robinson KL, Ernst KC, Johnson BL, Rosales C. Health status of southern Arizona border counties: A Healthy Border 2010 midterm review. *Revista panamericana de salud publica*. 2010 Nov;28(5):344-52.

Safren SA, Biello KB, Smeaton L, Mimiaga MJ, Walawander A, Lama JR, Rana A, Nyirenda M, Kayoyo VM, Samaneka W, Joglekar A. Psychosocial predictors of non-adherence and treatment failure in a large scale multi-national trial of antiretroviral therapy for HIV: data from the ACTG A5175/PEARLS trial. *PloS one*. 2014 Aug 25;9(8):e104178.

Safren SA, Hughes JP, Mimiaga MJ, Moore AT, Friedman RK, Srithanaviboonchai K, Limbada M, Williamson BD, Elharrar V, Cummings V, Magidson JF. Frequency and predictors of estimated HIV transmissions and bacterial STI acquisition among HIV-positive patients in HIV care across three continents. *Journal of the International AIDS Society*. 2016;19(1).

Schackman BR. Implementation science for the prevention and treatment of HIV/AIDS. *Journal of acquired immune deficiency syndromes (1999)*. 2010 Dec 1;55(Suppl 1):S27.

Shannon K, Strathdee SA, Goldenberg SM, Duff P, Mwangi P, Rusakova M, Reza-Paul S, Lau J, Deering K, Pickles MR, Boily MC. Global epidemiology of HIV among female sex workers: influence of structural determinants. *The Lancet*. 2015 Jan 9;385(9962):55-7

Shah BJ, Karia DR, Pawara CL. Syphilis: Is it making resurgence?. *Indian Journal of Sexually Transmitted Diseases and AIDS*. 2015 Jul 1;36(2):178.

Simon V, Ho DD, Karim QA. HIV/AIDS epidemiology, pathogenesis, prevention, and treatment. *The Lancet*. 2006 Aug 11;368(9534):489-504.

Singer M, Clair S. Syndemics and public health: Reconceptualizing disease in bio-social context. *Medical anthropology quarterly*. 2003 Dec 1;17(4):423-41.

Singer M, Bulled N, Ostrach B, Mendenhall E. Syndemics and the biosocial conception of health. *The Lancet*. 2017 Mar 10;389(10072):941-50.

Strathdee SA, Magis-Rodriguez C. Mexico's evolving HIV epidemic. *JAMA*. 2008 Aug 6;300(5):571-3.

Solorio R, Forehand M, Simoni J. Attitudes towards and beliefs about HIV testing among Latino immigrant MSM: a comparison of testers and nontesters. *AIDS research and treatment*. 2013 Dec 23;2013.

Strathdee SA, Magis-Rodriguez C, Mays VM, Jimenez R, Patterson TL. The emerging HIV epidemic on the Mexico-US border: an international case study characterizing the role of epidemiology in surveillance and response. *Annals of epidemiology*. 2012 Jun 30;22(6):426-38.

Strathdee, S. A., Abramovitz, D., Lozada, R., Martinez, G., Rangel, M. G., Vera, A., ... & Patterson, T. L. (2013). Reductions in HIV/STI incidence and sharing of injection equipment among female sex workers who inject drugs: results from a randomized controlled trial. *PLoS One*, 8(6), e65812.

Sullivan PS, Carballo-Diéguez A, Coates T, Goodreau SM, McGowan I, Sanders EJ, Smith A, Goswami P, Sanchez J. Successes and challenges of HIV prevention in men who have sex with men. *The Lancet*. 2012 Aug 3;380(9839):388-99.

Swendeman, D., Comulada, W. S., Ramanathan, N., Lazar, M., & Estrin, D. (2015). Reliability and validity of daily self-monitoring by smartphone application for health-related quality-of-life, antiretroviral adherence, substance use, and sexual behaviors among people living with HIV. *AIDS and Behavior*, 19(2), 330-340.

Tinajeros, F., Miller, W. M., Castro, L., Artiles, N., Flores, F., Evans, J. L., ... & Paz-Bailey, G. (2012). Declining sexually transmitted infections among female sex workers: the results of an HIV and sexually transmitted infection prevention strategy in Honduras, 2006–08. *International journal of STD & AIDS*, 23(2), 88-93.

Vyas S, Kumaranayake L. Constructing socio-economic status indices: how to use principal components analysis. *Health policy and planning*. 2006 Nov 1;21(6):459-68.

Wagner KD, Pitpitan EV, Chavarin CV, Magis-Rodriguez C, Patterson TL. Drug-using male clients of female sex workers who report being paid for sex: HIV/STI, demographic and drug use correlates. *Sexually transmitted diseases*. 2013 Aug;40(8).

World Health Organization (WHO). Prevention and treatment of HIV and other sexually transmitted infections for sex workers in low-and middle-income countries: recommendations for a public health approach. World Health Organization; 2012.

World Bank. World Bank country and lending groups. Accessed from:

<https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups>. No date.

Wodak A, Cooney A. Do needle syringe programs reduce HIV infection among injecting drug users: a comprehensive review of the international evidence. *Substance use & misuse*. 2006 Jan 1;41(6-7):777-813.

Zhang X, Martinez-Donate AP, Simon NJ, Hovell MF, Rangel MG, Magis-Rodriguez C, Sipan CL. Risk behaviours for HIV infection among travelling Mexican migrants: The Mexico–US border as a contextual risk factor. *Global public health*. 2017 Jan 2;12(1):65-83.

APPENDIX A

Does missing sexual health data signal structural violence for women?: Assessing missing data in Mexico's Encuesta Nacional de Salud y Nutrición (ENSANUT) 2012

Abstract

Word Count: 250

Background: Evaluation of Mexico's Encuesta Nacional de Salud y Nutrición (ENSANUT) 2012 variables on sexually transmitted infections (STIs) (n= 46,277) indicated a high degree of missing values in the data collected.

Methods: General linear model (GLM) using SAS 9.4 was conducted on the 2012 ENSANUT as a missing value analysis. The variables for HIV, HPV, gonorrhea, genital warts, syphilis, non-specific STIs, gender, and relationship status were assessed in the GLM.

Findings: The STI variables had a 50.37% missing value among women versus a 36.22% missing value among men in the study sample. Across all relationship categories, married women had the highest percentage of missing values (30.71%) for the STI variables. The F-value (1.19) indicates that the relationship of missingness of married women for STI measures did not occur completely at random.

Discussion: Qualitative studies have indicated married women in Mexico are the most vulnerable for novel STI diagnoses. This category of women was found to be largely absent in the country's aggregate national data. Empirical evidence is crucial for the development of interventions and policies to curtail STI risk and promote sexual health. Cultural and social factors may be the primary influence upon this data trend. An absence of data on women, specifically married women, points to a degree of structural violence which impedes the collection of this data. The lack of comprehensive data permutates into new forms of structural violence by disallowing the development of accurate evidence based interventions for women in Mexico.

Keywords: Structural violence; Sexual health; Global health; Mexico

Background

Human Immunodeficiency Virus (HIV) and Acquired Immunodeficiency Syndrome (AIDS) are of urgent public health concern in Mexico. The country has witnessed a 122% increase in reported prevalence of HIV since 2001 (Holtz et al., 2014), and the mortality rate among individuals with HIV/AIDS is 4.2 per 100,000 (CENSIDA, 2014). The number of new cases of HIV is steadily rising, including through heterosexual transmission (Martin-Ornaët et al., 2016). Country estimates suggest between 140,000-230,000 individuals are living with HIV in Mexico, and approximately 50% of those individuals are unaware of their HIV status (CENSIDA, 2014). HIV in Mexico has not been classified as a chronic infectious disease as seen in other regions of the globe (Deeks, 2013), despite a federal program that provides screening and universal treatment for HIV.

Despite the rise of heterosexual transmission of HIV in Mexico (Martin-Ornaët et al., 2016), there is a disparity in the available data regarding women in the general population. The current body of scientific literature regarding HIV in Mexico has focused upon groups that have been historically identified to possess a high HIV vulnerability. There is a scarcity of findings regarding social and epidemiological data focused on populations outside traditional at-risk HIV populations in Mexico (Martin-Ornaët et al., 2016). Accurate surveillance and epidemiological data could provide the necessary social and demographic information pertaining to HIV disease patterns. These social and demographic factors serve as the cornerstone for the development of effective HIV prevention interventions to curtail the current HIV disease trends.

Mexico national survey the Encuesta Nacional de Salud y Nutrición (ENSANUT) was last collected in 2012. ENSANUT is similar to National Health and Nutrition Examination Survey (NHANES), which is conducted in the United States. Seeking to better understand population level patterns of sexual and reproductive health among women, a previous study by the researchers analyzed the ENSANUT dataset to develop a deeper understanding of these health indicators. In assessing the dataset, an absence of data on women in the study sample was discovered and an examination of the missing data commenced.

This project considers the patterns of missing data in ENSANUT's aggregate data as a performance of structural violence and structural vulnerability experienced by women in Mexico. In 2013, Mexico ranked 72 out of 148 countries on the United Nations rankings based on the Gender Inequality Index (GII) (UNDP, 2014; Hietanen and Pick, 2015). The GII uses a country's reproductive health as a measure for assessing gender inequality (Hietanen and Pick, 2015). Structural violence points to the need to consider the ways in which social forces and institutional practices which engender inequality hinders categories of individuals from being able to access the necessary provisions for health (Farmer et al., 2006; Gamlin, 2013). The continuum of violence as posited by Bourgois (2002) is instructive to considering the ways which every day and structural violence produced by social processes have an interplay. This is useful for understanding the ways which imprecise aggregate data of health indicators can translate as new forms of symbolic violence for women (Bourdieu, 1979). Moreover, the absence of accurate data of sexual and reproductive health indicators

disallows implementation of relevant interventions tailored for individuals that could benefit most from these programs and policies.

Methods

ENSANUT is a probabilistic dataset which stratifies for urban and rural to provide a comprehensive representation of Mexico's population despite drastic regional differences. ENSANUT was last collected in 2012, with data collection scheduled to occur every six years. ENSANUT 2012 has a total sample size of 194,923 (N=194,923) which includes children, adolescents, and adults.

Individuals aged 20 and older (≥ 20) were defined as adult participants. Adults were administered an adult-structured, self-report questionnaire during the data collection interview (n=46,277). The adult instrument touches on various health topics, including sexual and reproductive health matters. Robust epidemiological surveillance covering sexual health is imperative for Mexico as the country continues to experience a steady increase in the number of new cases each year. The ENSANUT adult study sub-sample (n=46,227) is comprised of 42.75% men and 57.25% women. The adult survey instrument has 20 sections with a total of 265 measures. The adult survey instrument includes a diverse range of health outcome measures including chronic disease, accidents, physiological conditions, and cognitive assessments. The adult survey instrument contains a total of 32 measures for the constructs of sexual and reproductive health.

A missing value analysis (MVA) was conducted on ENSANUT's measurements of sexually transmitted infections (STIs). The STI variables evaluated by this MVA from ENSANUT's adult survey questionnaire were: HIV, human papillomavirus (HPV),

gonorrhoea, genital warts, syphilis, and non-specific STIs. The measures assess if the participant has received a diagnosis or treatment for each of these STI disease outcomes. All of the quantitative analyses were conducted on SAS 9.4.

The initial analysis generated a frequency of missing values for each variable assessed. A high number of missing values were found for the sexual and reproductive health measures. Each of the sexual health measures were found to have the same number of missing values across the five variables ($n=15,888$) being examined for the study. The missing data discovered during the review of the frequencies prompted the researchers to further evaluate the pattern of missing values via an additional analysis.

A general linear model (GLM) was then performed on the variables to evaluate the type of pattern suggested by the missing values in the dataset. Based on the outcomes of the initial frequencies performed gender and relationship status were included in the GLM. The relationship status measure was originally a continuous variable that transformed into a binary variable for the purposes of this study.

Findings

The STI variables had a 50.37% missing value among women versus a 36.22% missing value among men in the study sample. Across all relationship categories, married women had the highest percentage of missing values (30.71%) for the STI variables. The GLM F-value (1.19) indicates that the relationship of missingness of married women for STI measures did not occur completely at random. The missing not completely at random (MNCAR) status of the sexual health variables from the ENSANUT dataset indicates that there are additional forces influencing the ways in which the missing values exist.

Discussion

The absence of data from women regarding sexual and reproductive health indicators in the ENSANUT dataset presents a public health challenge. The absence of data from women regarding their sexual health history complicates identifying patterns that could be the drivers of these epidemiological disease patterns. Further, it impedes the development of generalizable conclusions about women's sexual and reproductive health in Mexico. Empirical evidence is crucial for the development of interventions and policies to curtail STI risk and promote sexual health. Cultural and social factors may be the primary influence upon this data trend.

An absence of data on women, specifically married women, constructs a representation of social norms and cultural expectations regarding sexual health and women in Mexico. Previous studies have shown that self-report data regarding sexual health is often skewed. Sexual behavior self-report assessments have been found to encourage reporting biases, such as underreporting of sexual activities in studies among populations in the United States (McAuliffe et al., 2007; Swendeman et al., 2014). Cultural expectations may dictate it inappropriate for married women to be asked by a stranger about their sexual history (Chopel et al., 2014). Additionally, interviewers may also have a reluctance to broach the subject of sexual health with a married woman as it could be deemed taboo as dictated by prevailing social norms regarding discussing female sexuality and sexual activity (Espinosa-Hernandez et al., 2015; Gil and Vazquez, 2014; Katz, 2002).

Previous qualitative studies have posited married women in Mexico are the most vulnerable population category for new STI diagnoses including HIV (Hirsch et al., 2007;

Hirsch et al., 2002). Social norms that deem the discussion of women's sexuality and sexual activities to be taboo position women in Mexico to be more vulnerable to contracting an STI (Gil and Vazquez, 2014). Other evidence indicates that women in Mexico may also have limited knowledge around modes of STI and HIV transmission and acquisition (Ruiz et al., 2014; Kendall and Pelcastre, 2010). This evidence demonstrates the high need for sexual and reproductive health interventions for women in Mexico.

The recommendation of this study echoes previous findings regarding collection sexual and reproductive health data (McAuliffe et al., 2007; Swendeman et al., 2014). Further research is necessary to better understand the rationale for misreporting sexual and reproductive health data. Future ENSANUT data collections should consider alternate methods of data collection for sexual and reproductive health measures that do not require self-report in an interview format. Allowing participants to return their completed survey on these measures to a physical dropbox or via mail could ease participants' unease on disclosing this health information. The ultimate goal would be to further normalize discussions of sexual health as a public health strategy for accurate reporting by the participant.

Table 1: Missing values by participant for STI variables

	Total Missing Value	Single and missing value	Married and missing value
Male	70,599 (36.22%)		
Female	98,179 (50.37%)	52,460 (26.91%)	59,869 (30.71%)

Table 2: General Linear Model

Degrees of Freedom (DF)	Sum of Squares	Mean Square	F Value
5	6.70	1.33	1.19

References

Bourdieu, P. (1979). Symbolic power. *Critique of anthropology*, 4(13-14), 77-85.

Bourgois, P. (2002). The violence of moral binaries: response to Leigh Binford.

Ethnography, 3(2), 221-231.

Carranza, M. E. (2013). Value transmission among salvadorian mothers and daughters: marianismo and sexual morality. *Child and Adolescent Social Work Journal*, 30(4), 311-327.

Chopel, A. M. (2014). Reproductive health in indigenous Chihuahua: giving birth 'alone like the goat'. *Ethnicity & health*, 19(3), 270-296.

Espinoza, R., Martínez, I., Levin, M., Rodriguez, A., Chan, T., Goldenberg, S., & Zúñiga, M. L. (2014). Cultural perceptions and negotiations surrounding sexual and reproductive health among migrant and non-migrant indigenous Mexican women from Yucatan, Mexico. *Journal of Immigrant and Minority Health*, 16(3), 356-364.

Gamlin, J. B. (2013). Shame as a barrier to health seeking among indigenous Huichol migrant labourers: An interpretive approach of the "violence continuum" and "authoritative knowledge". *Social science & medicine*, 97, 75-81.

Gil, R. M., & Vazquez, C. I. (2014). *The Maria paradox: How Latinas can merge old world traditions with new world self-esteem*. Open Road Media.

Hietanen, A. E., & Pick, S. (2015). Gender stereotypes, sexuality, and culture in Mexico. In *Psychology of gender through the lens of culture* (pp. 285-305). Springer International Publishing.

Hirsch, J. S., Meneses, S., Thompson, B., Negroni, M., Pelcastre, B., & Del Rio, C. (2007). The inevitability of infidelity: sexual reputation, social geographies, and marital HIV risk in rural Mexico. *American Journal of Public Health, 97*(6), 986-996.

Hirsch, J. S., Higgins, J., Bentley, M. E., & Nathanson, C. A. (2002). The social constructions of sexuality: marital infidelity and sexually transmitted disease—HIV risk in a Mexican migrant community. *American Journal of Public Health, 92*(8), 1227-1237.

Index, G. I. (2014). UNDP.

Katz, A. (2002). Where I Come From, We Don't Talk About That. *Nursing for Women's Health, 6*(6), 533-536.

Kendall, T., & Pelcastre, B. E. (2010). HIV vulnerability and condom use among migrant women factory workers in Puebla, Mexico. *Health care for women international*, 31(6), 515-532.

McAuliffe, T. L., DiFranceisco, W., & Reed, B. R. (2007). Effects of question format and collection mode on the accuracy of retrospective surveys of health risk behavior: a comparison with daily sexual activity diaries. *Health Psychology*, 26(1), 60.

Priego-Hernández, J. (2015). Sexual health in transition: A social representations study with indigenous Mexican young women. *Journal of health psychology*, 1359105315611954.

Swendeman, D., Comulada, W. S., Ramanathan, N., Lazar, M., & Estrin, D. (2015). Reliability and validity of daily self-monitoring by smartphone application for health-related quality-of-life, antiretroviral adherence, substance use, and sexual behaviors among people living with HIV. *AIDS and Behavior*, 19(2), 330-340.

APPENDIX B

Social characteristics of sexually transmitted infections and HIV co-infections in Mexico

Abstract

Word count: 301

Background: Individuals living with human immunodeficiency virus (HIV) are more vulnerable to co-infection with other infectious diseases. Social factors have been previously identified as playing a role in sexually transmitted infections (STIs). HIV and STI co-infection prevalence at the aggregate country level for Mexico has not previously been compiled. Identification of social factors that increase or decrease an individual's risk for STIs for Mexico has not previously been evaluated.

Methods: Mexico's Encuesta Nacional de Salud y Nutrición 2012 (ENSANUT) data were analyzed for HIV and STI co-infection and corresponding descriptive characteristics. Logistic regression and chi-squares were conducted on the ENSANUT 2012 adult study sample (n=46,277). All quantitative analyses were performed using SAS 9.4. The variables utilized were self-report diagnoses for sexually transmitted infections (STIs), previous HIV testing, gender, and marital status. Chi-square analyses were conducted to identify HIV and STI co-infection prevalence in the study sample.

Findings: Men were found to be more likely to be diagnosed with an STI (OR= 3.60; CI= 3.00, 4.32; $p < 0.001$). Women who reported being tested for HIV during pregnancy were less likely to be diagnosed for an STI (OR= 0.54; CI=0.41, 0.74; $p < 0.001$). Both men and women that reported being previously tested for HIV were less likely to have been diagnosed with an STI (OR=0.82; CI=0.72,0.94; $p < 0.001$). The individual's marital status was not statistically significant associated with an STI diagnosis. The chi-square analyses demonstrated co-infection of HIV/gonorrhea (n=20) and HIV/syphilis (n=20) had the highest co-infection rate in the study sample.

Discussion: HIV testing may serve as a proxy for access to health care in the study sample. The access to health care could contribute to health decisions and degree of health knowledge among study participants. Health knowledge and access to health care could be the most salient factors for preventing STIs in Mexico.

Background

Previous findings in published literature have indicated high prevalence and incidence rates of sexually transmitted infections (STIs) in Mexico (Marin-Navarrette et al., 2017), and human immunodeficiency virus (HIV) rates have steadily increased along the U.S./Mexico border since 2000 (Strathdee & Magis-Rodriguez, 2008; Robinson et al., 2010). The exact rates of STIs, including rates of HIV, have often been fragmentally focused on specific populations in Mexico, such as sex workers (Bazzi et al., 2015), individuals who engage in substance use (Connors et al., 2017), and men who have sex with men (MSM) (Dennis et al., 2015). These findings have provided useful insights for better understanding of STI disease trends in Mexico, but provides a segmented representation. These analyses need to be extended to consider how these special populations tie to the larger macro-level trends of STIs in the country.

Northern Mexico has been of particular interest in the body of literature that focuses on the prevalence of STIs in Mexico (Bazzi et al., 2015; Magis-Rodriguez et al., 2009; Strathdee and Magis-Rodriguez, 2008; Strathdee et al., 2012). Expanding this line of investigation to consider the STI disease trends is imperative because Mexico has a high rate of mobility (Goldenberg et al., 2014), which extends beyond sex workers and has been the focus of published studies.

Co-infection among individuals living with HIV is of particular public health importance. Some co-infections facilitate HIV proliferation (Karp et al., 2009) and can encourage pathogenesis to AIDS (Simon et al., 2008; Kalichman et al., 2011). Further, because HIV has not yet reached the chronic infectious disease category, cases are

grossly underreported. Co-infection rates of STIs in Mexico have not been previously analyzed.

Methods

National aggregate level data from Mexico's Encuesta Nacional de Salud y Nutrición 2012 (ENSANUT) was utilized for this study. ENSANUT is Mexico's equivalent of the National Health and Nutrition Examination Survey (NHANES) in the United States. ENSANUT is a probabilistic survey that stratifies for rural and urban contexts. Data collection methods for ENSANUT includes the administration of an adult questionnaire to participants 20 years and older. ENSANUT's adult study population (n=46,277) was analyzed by the research team. All quantitative analyses were performed on SAS 9.4. Institutional Review Board approval was not required for this secondary data analysis as no human subjects were involved in this study.

Chi-square analysis was conducted to identify HIV and STI co-infections in the sample. Chi-squares were conducted individually. STI measures were: gonorrhea, syphilis, human papillomavirus (HPV), genital warts, and non-specific STI. These were the only explicit STI measures included in the ENSANUT data collection instrument. Each of the variables in this study were collected via participant self-report. Chi-square analyses were applied to the data to provide an HIV/STI co-infection prevalence rate in the study sample.

A composite STI variable was created for the multivariate logistic regression conducted in this study. The composite STI variable consisted of HIV and each of the STI measures previously assessed in the Chi-square analyses. The purpose of the

composite variable was to succinctly capture all participants who had a previous or current STI diagnosis to compare across social categories of interest.

Findings

The Chi square analyses demonstrated the presence HIV and STI co-infections across every category. HIV/STI co-infections were found to be most prevalent for HIV and gonorrhea (n=20) and HIV and syphilis (n=20).

The odds ratio of the multivariate logistic regression indicated that men are 3.6 times more likely to be diagnosed with an STI (OR=3.60; 95% CI=3.00, 4.32; $p<0.001$) than women in the sample. Marital status was not statistically significant for an STI diagnosis across either gender category.

Women who reported being tested for HIV during pregnancy were less likely to be diagnosed with an STI (OR= 0.54; 95% CI=0.41, 0.74; $p<0.001$). Men and women that reported a previous HIV test were found to be less likely to have been diagnosed with an STI (OR=0.82; 95% CI=0.72,0.94; $p<0.001$).

Limitations

A key limitation of the study is that the data is self-reported regarding a topic that continues to be taboo according to cultural norms in Mexico (that of HIV and STIs). This cultural taboo is particularly salient for women in the population sample (Hietanen and Pick, 2015). Additionally, there was a high percentage of missing values for the study variables, with married women to have the highest percentage of missingness. The missing values across these variables demonstrates the high degree of stigma associated with STIs among women or regarding women for the data collector in Mexico. This presents a challenge for STI surveillance in this population.

Discussion

STI co-infections for Mexico have not previously been reported. However, studies that have considered syphilis/HIV co-infection rates in low and middle income countries (LMICs) have been published (Lawi et al., 2015; Omisakin et al., 2014; Ahn et al., 2016; Hernandez et al., 2016). These studies demonstrate the public health need for more inquiry into syphilis/HIV co-infection as a re-emergence in syphilis is currently taking place (Hernandez et al., 2016). Our findings align with the body of literature regarding syphilis/HIV co-infection as being one of the highest co-infection rates among HIV populations for Mexico.

HIV/gonorrhea co-infections in this study were found at a similar rate for the population in Mexico as seen with the HIV/syphilis co-infection rate. Gonorrhea has been deemed as one of the most common STIs in LMICs (Ahmad et al., 2016) yet limited research has been conducted considering HIV/gonorrhea co-infection. Multidrug resistant gonorrhea (Hook et al., 2013) poses an acute danger to HIV positive populations in LMICs. Further research is necessary to better understand gonorrhea co-infection patterns in Mexico for HIV positive populations in order to tailor necessary secondary prevention interventions for these individuals.

Recent research findings have pointed to married women as being the highest risk category for STIs, particularly HIV in Mexico (Hirsch et al., 2007; Espinoza et al., 2014; Hirsch, 2015). The current study's findings are contrary to these prior findings. Men, regardless of relationship status, were found to be more likely to report a prior STI diagnosis. As aforementioned in the limitations of the study, it is unclear if the women

are constrained by cultural norms dictating a reluctance to report previous STI diagnoses to the interviewer. Or, a reluctance to report could be contributing to the contradictory finding to the prior published findings. Moreover, the prior research findings have drawn their conclusions from qualitative data, while this study focused solely on quantitative data. Further research is necessary to identify the reason for contradictory findings of this study.

Additionally, individuals that reported having an HIV test were found to be less likely to report a previous STI diagnosis. It is unclear if this finding is a proxy for access to health care and, by extension, accurate sexual health information. STI testing frequency outside of Latin America has been linked to social conditions, social exclusion, and stigma (Knight et al., 2014; Link and Phelan, 2006; Daley et al., 2011). Among Latin American populations, fatalism has served as an impediment for HIV testing (Kissinger et al., 2012; Rhodes et al., 2014; Barrington et al., 2016). The discourse regarding the role of fatalism in STI testing has largely focused on sexual minorities, however, and the salience of fatalism for health related behaviors for Latinos has been identified as playing a role in cancer screening (De Los Monteros and Gallo, 2011; Ramirez, 2014), cardio-metabolic dysfunction (De Los Monteros and Gallos, 2013), and engagement in risk behaviors (Moreno, 2007) across multiple country contexts.

Structural and cultural factors identified in the literature as being barriers for STI/HIV screening provides a basis for why Latinos would be less likely to engage in these health behaviors. There is a paucity in the literature as to why engaging in HIV screening would reduce the likelihood of other STI diagnoses in this population. Further

research is needed to better understand the relationship of HIV screening and STI diagnoses among Latinos. This is a positive finding as it provides a preliminary insight for STI prevention in Mexico for both men and women.

Publications which focus on STI rates and trends among men in Mexico primarily speak to sex work, as either a client (Patterson et al., 2009; Goldenberg et al., 2010; Goldenberg et al., 2011) or as a worker in the industry (Infante et al., 2009; Galárraga et al., 2014); the presence of injection drug use (Strathdee et al., 2008; Deis et al., 2008); and the overlap of these populations (Wagner et al., 2013). The consideration of these populations is incredibly important and impactful towards understanding risk environments, drivers of behaviors, and structural vulnerabilities. However, concentrating solely on these populations creates a fragmented understanding of STI patterns among men in Mexico. This study provides the first quantitative evidence of STIs addressing men at the aggregate national level in Mexico and their increased likelihood of reporting an STI diagnosis.

Table 1: Chi-square of HIV and STI co-infections

	Gonorrhoea	Syphilis	Non-specific STI
HIV	20	20	10

Table 2: Logistic regression

	N	DF	Odds Ratio	95% CI	p value
Sex	4430	1	3.60	3.00, 4.32	<0.001
Marital Status	4430	1	1.14	0.99, 1.29	0.051
Women who received an HIV test while pregnant	4430	1	0.54	0.41, 0.74	<0.001
Individuals who received HIV screening	4430	1	0.82	0.72, 0.94	<0.001

References

1. Marín-Navarrete R, Magis-Rodríguez C, Strathdee SA. Sexually transmitted infections and substance use disorders: evidence and challenges in Mexico. *Salud Mental*. 2017 Jan 31;40(1):1-4.
2. Bazzi AR, Rangel G, Martinez G, Ulibarri MD, Syvertsen JL, Bazzi SA, Roesch S, Pines HA, Strathdee SA. Incidence and predictors of HIV and sexually transmitted infections among female sex workers and their intimate male partners in northern Mexico: a longitudinal, multilevel study. *American journal of epidemiology*. 2015 May 1;181(9):723-31.
3. Goldenberg SM, Silverman JG, Engstrom D, Bojorquez-Chapela I, Strathdee SA. “Right Here is the Gateway”: mobility, sex work entry and HIV risk along the Mexico–US Border. *International Migration*. 2014 Aug 1;52(4):26-40.
4. Magis-Rodríguez C, Lemp G, Hernandez MT, Sanchez MA, Estrada F, Bravo-Garcia E. Going North: Mexican migrants and their vulnerability to HIV. *JAIDS Journal of Acquired Immune Deficiency Syndromes*. 2009 May 1;51:S21-5.
5. Hirsch JS, Meneses S, Thompson B, Negroni M, Pelcastre B, Del Rio C. The inevitability of infidelity: sexual reputation, social geographies, and marital HIV risk in rural Mexico. *American Journal of Public Health*. 2007 Jun;97(6):986-96.
6. Strathdee SA, Magis-Rodríguez C. Mexico's evolving HIV epidemic. *JAMA*. 2008 Aug 6;300(5):571-3.
7. Strathdee SA, Magis-Rodríguez C, Mays VM, Jimenez R, Patterson TL. The emerging HIV epidemic on the Mexico-US border: an international case study

- characterizing the role of epidemiology in surveillance and response. *Annals of epidemiology*. 2012 Jun 30;22(6):426-38.
8. Karp G, Schlaefter F, Jotkowitz A, Riesenberk K. Syphilis and HIV co-infection. *European journal of internal medicine*. 2009 Jan 31;20(1):9-13.
 9. Simon V, Ho DD, Karim QA. HIV/AIDS epidemiology, pathogenesis, prevention, and treatment. *The Lancet*. 2006 Aug 11;368(9534):489-504.
 10. Kalichman SC, Pellowski J, Turner C. Prevalence of sexually transmitted co-infections in people living with HIV/AIDS: systematic review with implications for using HIV treatments for prevention. *Sexually transmitted infections*. 2011 Apr 1;87(3):183-90.
 11. Hernandez I, Johnson A, Reina-Ortiz M, Rosas C, Sharma V, Teran S, Naik E, Salihi HM, Teran E, Izurieta R. Syphilis and HIV/Syphilis Co-infection Among Men Who Have Sex With Men (MSM) in Ecuador. *American Journal of Men's Health*. 2016 Dec 5:1557988316680928.
 12. Lawi JD, Mirambo MM, Magoma M, Mushi MF, Jaka HM, Gumodoka B, Mshana SE. Sero-conversion rate of Syphilis and HIV among pregnant women attending antenatal clinic in Tanzania: a need for re-screening at delivery. *BMC pregnancy and childbirth*. 2015 Jan 22;15(1):3.
 13. Omisakin CT, Esan AJ, Fasakin KA, Owoseni MF, Ojo-Bola O, Aina OO, Omoniyi DP. Syphilis and human immunodeficiency virus co-infection among pregnant women in Nigeria: prevalence and trend. 2014.
 14. Ahn JY, Boettiger D, Kiertiburanakul S, Merati TP, Huy BV, Wong WW, Ditangco R, Lee MP, Oka S, Durier N, Choi JY. Incidence of syphilis seroconversion

- among HIV-infected persons in Asia: results from the TREAT Asia HIV Observational Database. *Journal of the International AIDS Society*. 2016;19(1).
15. Mir BA, Sirwar SB, Vijayaraghavan R. Prevalence and antibiotic susceptibility of neisseria gonorrhoeae in HIV positive and hiv negative cases at a tertiary care hospital. *Indian Journal of Microbiology Research*. 2016;3(2):213-8.
16. Hook EW, Shafer W, Deal C, Kirkcaldy RD, Iskander J. CDC Grand Rounds: the growing threat of multidrug-resistant gonorrhea. *Morbidity and Mortality Weekly Report*. 2013 Feb 15;62(06):103-6.
17. Hietanen AE, Pick S. Gender stereotypes, sexuality, and culture in Mexico. In *Psychology of gender through the lens of culture 2015* (pp. 285-305). Springer International Publishing.
18. Espinoza R, Martínez I, Levin M, Rodriguez A, Chan T, Goldenberg S, Zúñiga ML. Cultural perceptions and negotiations surrounding sexual and reproductive health among migrant and non-migrant indigenous Mexican women from Yucatan, Mexico. *Journal of Immigrant and Minority Health*. 2014 Jun 1;16(3):356-64.
19. Hirsch JS. Desire across borders: markets, migration, and marital HIV risk in rural Mexico. *Culture, health & sexuality*. 2015 May 29;17(sup1):20-33.
20. Patterson TL, Goldenberg S, Gallardo M, Lozada R, Semple SJ, Orozovich P, Abramovitz D, Strathdee SA. Correlates of HIV, STIs and associated high risk behaviors among male clients of female sex workers in Tijuana, Mexico. *AIDS (London, England)*. 2009 Aug 24;23(13):1765.

21. Goldenberg SM, Cruz MG, Strathdee SA, Nguyen L, Semple SJ, Patterson TL. Correlates of unprotected sex with female sex workers among male clients in Tijuana, Mexico. *Sexually transmitted diseases*. 2010 May;37(5):319.
22. Goldenberg SM, Strathdee SA, Gallardo M, Nguyen L, Lozada R, Semple SJ, Patterson TL. How important are venue-based HIV risks among male clients of female sex workers? A mixed methods analysis of the risk environment in nightlife venues in Tijuana, Mexico. *Health & place*. 2011 May 31;17(3):748-56.
23. Infante C, Sosa-Rubi SG, Cuadra SM. Sex work in Mexico: vulnerability of male, travesti, transgender and transsexual sex workers. *Culture, health & sexuality*. 2009 Feb 1;11(2):125-37.
24. Wagner KD, Pitpitan EV, Chavarin CV, Magis-Rodriguez C, Patterson TL. Drug-using male clients of female sex workers who report being paid for sex: HIV/STI, demographic and drug use correlates. *Sexually transmitted diseases*. 2013 Aug;40(8).
25. Galárraga O, Sosa-Rubi SG, González A, Badial-Hernández F, Conde-Glez CJ, Juárez-Figueroa L, Bautista-Arredondo S, Kuo C, Operario D, Mayer KH. The disproportionate burden of HIV and STIs among male sex workers in Mexico City and the rationale for economic incentives to reduce risks. *Journal of the International AIDS Society*. 2014 Nov 14;17(1).
26. Martinez-Donate AP, Hovell MF, Rangel MG, Zhang X, Sipan CL, Magis-Rodriguez C, Gonzalez-Fagoaga JE. Migrants in transit: the importance of monitoring HIV risk among migrant flows at the Mexico–US border. *American journal of public health*. 2015 Mar;105(3):497-509.

27. Zhang X, Martinez-Donate AP, Simon NJ, Hovell MF, Rangel MG, Magis-Rodriguez C, Sipan CL. Risk behaviours for HIV infection among travelling Mexican migrants: The Mexico–US border as a contextual risk factor. *Global public health*. 2017 Jan 2;12(1):65-83.
28. Knight RE, Shoveller JA, Carson AM, Contreras-Whitney JG. Examining clinicians' experiences providing sexual health services for LGBTQ youth: considering social and structural determinants of health in clinical practice. *Health education research*. 2014 Aug 1;29(4):662-70.
29. Hatzenbuehler ML, Phelan JC, Link BG. Stigma as a fundamental cause of population health inequalities. *American journal of public health*. 2013 May;103(5):813-21.
30. Link BG, Phelan JC. Stigma and its public health implications. *The Lancet*. 2006 Feb 11;367(9509):528.
31. Daley AE, MacDonnell JA. Gender, sexuality and the discursive representation of access and equity in health services literature: implications for LGBT communities. *International journal for equity in health*. 2011 Sep 29;10(1):40.
32. Rhodes SD, Alonzo J, Mann L, Downs M, Simán FM, Andrade M, Martinez O, Abraham C, Villatoro GR, Bachmann LH. Novel approaches to HIV prevention and sexual health promotion among Guatemalan gay and bisexual men, MSM, and transgender persons. *AIDS Education and Prevention*. 2014 Aug;26(4):345-61.
33. Barrington C, Knudston K, Bailey OA, Aguilar JM, Loya-Montiel MI, Morales-Miranda S. HIV Diagnosis, Linkage to Care, and Retention among Men Who

- Have Sex with Men and Transgender Women in Guatemala City. *Journal of Health Care for the Poor and Underserved*. 2016;27(4):1745-60.
34. De Los Monteros KE, Gallo LC. The relevance of fatalism in the study of Latinas' cancer screening behavior: A systematic review of the literature. *International journal of behavioral medicine*. 2011 Dec 1;18(4):310-8.
35. Ramírez AS. Fatalism and cancer risk knowledge among a sample of highly acculturated Latinas. *Journal of Cancer Education*. 2014 Mar 1;29(1):50-5.
36. De Los Monteros KE, Gallo LC. Fatalism and cardio-metabolic dysfunction in Mexican–American women. *International journal of behavioral medicine*. 2013 Dec 1;20(4):487-94.
37. Kissinger P, Kovacs S, Anderson-Smits C, Schmidt N, Salinas O, Hembly J, Beaulieu A, Longfellow L, Liddon N, Rice J, Shedlin M. Patterns and predictors of HIV/STI risk among Latino migrant men in a new receiving community. *AIDS and Behavior*. 2012 Jan 1;16(1):199-213.
38. Moreno CL. The relationship between culture, gender, structural factors, abuse, trauma, and HIV/AIDS for Latinas. *Qualitative health research*. 2007 Mar;17(3):340-52.

APPENDIX C

Modeling social factors of HIV risk in Mexico: Applying a Principal Component Analysis to Mexico's Encuesta Nacional de Salud y Nutrición 2012 data

Abstract

Word count: 327

Background: Principal Component Analysis (PCA) has been validated as an appropriate methodological tool for evaluating the intersection of health outcomes and social factors. Social factors have been previously established as playing a key role in disease burden pattern distributions of human immunodeficiency virus (HIV). Mexico's aggregate country level data has not been previously evaluated with a PCA. This study provides an innovative approach for identifying salient social factors which potentially contribute to HIV disease burden trends in Mexico.

Methods: Principal Component Analysis (PCA) was applied to Mexico's Encuesta Nacional de Salud y Nutrición 2012 (ENSANUT) aggregate country level data. ENSANUT is Mexico's equivalent to NHANES in the United States. The PCA was conducted using SAS 9.4. Items loaded into the PCA were chosen based on their association with human immunodeficiency virus (HIV) risk. A total of seven items were loaded into the PCA.

Findings: A total of six items were found to contribute to a simple factor structure. Items with a factor loading of more than 0.3 (>0.3) were included as they suggested a reasonable factorability. Gender was eliminated because it did not load with any of the other factors at 0.3 or above. Two items loaded to create factor one. These items are: has previously been tested for HIV and received an HIV test during pregnancy. Four items loaded to create factor two. These items are: received information for tobacco, alcohol, or drug cessation; received a diagnosis for depression; has received free condoms in the past 12 months; health has suffered from some form of violence or abuse including suicide attempt in the past 12 months loaded to create Factor Two.

Discussion: The two factors created by the PCA point to the latent constructs of access to health care and mental health status as possibly playing a role in HIV risk in Mexico. These findings provide a useful framework for developing evidence based programs and policies to minimize HIV risk in Mexico.

Key words: Principal Component Analysis; Latent variable model; social risk; HIV vulnerability; Mexico

Background

Mexico has had a 122% increase in Human Immunodeficiency Virus (HIV) prevalence since 2001 (Holtz et al., 2014). HIV increases in prevalence is of particular importance to the U.S./Mexico border region as predictions based on epidemiological data suggests a rising sub-epidemic in this region (Strathdee and Magis-Rodriguez, 2008; Strathdee et al., 2012). The U.S./Mexico Border Health Commission Healthy Border 2010 report echoes this finding regarding the increase of HIV incidence and prevalence across the Arizona border counties (Robinson et al., 2010).

Mexico initiated the *Centro Nacional Para la Prevención y el Control de VIH/SIDA* (CAPASITS) in 2011, a federal program offering universal HIV testing and treatment. Mexico remains a limited resource middle-income country per the World Bank 2017 rankings. A consequence of being a limited resource middle-income country is the difference in health care services and provisions available regionally (Marmont, 2007; Preda and Voigt, 2015).

Social factors have been identified as playing a salient role in disease patterns of HIV (Rhodes et al., 2012; Singer et al., 2017). Principal component analysis (PCA) has been identified as an appropriate statistical tool for evaluating psychosocial factors which influence health outcomes (Vyas et al., 2006). PCA has previously been applied to large multi-country data as a tool for identifying psychosocial factors for ART adherence among HIV positive populations (Safren et al., 2014).

A PCA has not previously been applied to Mexico's aggregate national level data. This is the first study to work towards creating a social risk index for HIV for Mexico. This PCA has been performed on aggregate data from 2012 which provides the

unique opportunity to capture health seeking behaviors associated with HIV one year following the implementation of the CAPASITS federal program.

Methods

Mexico's *Encuesta Nacional de Salud y Nutrición* 2012 (ENSANUT) is a probabilistic aggregate national dataset. ENSANUT is Mexico's equivalent to the National Health and Nutrition Examination Survey (NHANES) in the United States. ENSANUT collects self report data via participant interviews. An adult questionnaire is given to individuals 20 years of age and older. The ENSANUT adult study sub-sample (n=46,227) was the focus for this study as this is the segment of the study population who were asked questions about sexual and reproductive health. All quantitative analyses were performed using SAS 9.4. Institutional Review Board approval for this study was determined to be unnecessary as it is a secondary data analysis there were no human subjects involved in this project.

Missing values were excluded from the analysis reducing the sample (n=11,169). A Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy was performed to assess if there was adequate sampling of the population. The KMO value was 0.5 which suggests an acceptable value (Kaiser and Rice, 1974; Hutcheson and Sofroniou, 1999). A Bartlett's Test of Sphericity was performed following the KMO. Bartlett's Test of Sphericity was highly significant ($p < 0.0001$) indicating that proceeding with a PCA was appropriate.

Items loaded into the PCA were chosen based on their association with HIV risk in previous studies focused on disentangling the syndemics of HIV (Safren et al., 2016, Singer et al., 2017). A total of seven items were loaded into the PCA. The seven items

are: gender; previous HIV testing; HIV testing while pregnant; male condom use; received free condoms in the last 12 months; referral to alcohol, tobacco, and/or drug cessation resources; experienced of violence or attempted suicide in the last 12 months; and diagnosis of depression by a health care provider.

A logistic regression was performed to identify if the factors created in the PCA were protective for other sexual health outcomes in the population. STI measures used in the logistic regression were: gonorrhea, syphilis, human papillomavirus (HPV), genital warts, and non-specific STI. The STI measures were also found in the ENSANUT adult questionnaire data collection.

Results

Six of the seven items loaded at a value of more than 3.0 (>3.0) which suggested a reasonable factorability. The six items loaded to create a total of two factors. Gender was the only factor that was eliminated as it did not load with any other factor at a value of greater than 3.0.

The first factor consists of two items. These items are with their respective eigenvalues are: HIV testing while pregnant (0.635) and previous HIV test (0.678) (Table 1). The second factor consists of four items. The second factor items with their respective eigenvalues are: diagnosis of depression by a health care provider (0.544); have been received free condoms in the last 12 months (0.489); received tobacco, alcohol, or and/or drug cessation resources in the last year (0.412); and experienced violence or attempted suicide in the past 12 months (0.404) (Table 1).

Discussion

The unifying latent variable for factor one is attributed to access to HIV health care resources. This factor demonstrates two separate social forces about Mexico and HIV. The first social force is the availability of high quality comprehensive HIV resources. Thirty-five percent (35%) of women that reported being pregnant in the ENSANUT sample indicated that they did not receive an HIV test while pregnant. HIV screening during prenatal care has been identified as an effective strategy to minimize HIV mother-to-child transmission risk (DeCock et al., 2000). It is unclear whether these HIV resources are both available and easily accessible in all regions of Mexico or to what degree HIV screening is embedded within routine care practices. The second social reason, assuming HIV resources are easily accessible across the country, could be characteristics of the individual that would inform the health seeking behavior of the person that would influence the decision to engage in preventative HIV behaviors. The rationale could be accurate health education, reduced feelings of stigma, and/or reduced degree of fatalistic logic, which motivate access of HIV health care resources (Leblanc et al., 2016; Sullivan et al., 2012; Das and Horton, 2012; Kendall and Pelcastre, 2010). Utilization and adherence to treatment provided by Mexico's program would provide a promising solution for HIV transmission as it would identify HIV positive individuals and provide ART therapy (Biello et al., 2016). The HIV health care resource factor is useful when considering HIV intervention policies and programs specific to Mexico's population.

The unifying latent variable attributed for factor two is mental health. The items which loaded together are a cluster of issues related to mental health outcomes and

mental health services. While free condoms may not initially seem to align with the proposed unifying latent variable, spaces which provide mental health services may also provide free condoms. Free condoms would be a more generalized reproductive health service while HIV testing would be specialized. Receiving free condoms should not be conflated with male condom use. A previous PCA conducted included male condom use that did not load into the factor with the item for free condoms. The mental health factor could be a salient consideration in the construction of HIV intervention in Mexico as it demonstrates an increased likelihood for the individual to report other STI diagnoses. Future directions for this research should consider how addressing the mental health factor could increase positive sexual and reproductive health factors among Mexican populations.

There are several future directions for tied to the findings of this study. The first would be exploring how HIV prevention interventions could utilize the factors generated by this PCA to create population tailored approaches. Assessing whether the HIV resource factor reflects structural level barriers to access, such as a lack of available screening and testing facilities, or if is indicative of individual level drivers of health seeking behaviors. Since the mental health factor has been found to be predictive of poor sexual health outcomes, future interventions should consider the ways which these items influence sexual and reproductive health practices of the individual. Addressing drivers of mental health may prove to be useful for better understanding social factors of HIV transmission factors in Mexico. ENSANUT is scheduled to be collected every six years. The next wave of ENSANUT data should be available in 2018. Mexico's government may be faced with constraints of financial resources which may preclude

the next wave of data from being collected in 2018. Assessing the next wave of ENSANUT data will provide insights as to how a federal HIV program has influenced outcomes of the items used in this PCA. Future directions of this research will be to apply a PCA to the next wave of ENSANUT data to investigate if the same items will hang together and load in the same factors.

Table 1: Principal Component Analysis Eigenvectors

Item	Factor 1	Factor 2
Have you received a test to detect HIV?	0.678	
During your last pregnancy, did you receive a test to detect HIV?	0.635	
In the last year have you been given cessation information for tobacco/alcohol/drug use?		0.412
Has a physician or health professional told you that you suffer or have suffered from depression?		0.544
In the past 12 months, have you received free		0.486

condoms?		
Have you suffered from any damage to your health from aggression or violence including suicide attempts in the last 12 months?		0.404

References

De Cock KM, Fowler MG, Mercier E, de Vincenzi I, Saba J, Hoff E, Alnwick DJ, Rogers M, Shaffer N. Prevention of mother-to-child HIV transmission in resource-poor countries: translating research into policy and practice. *Jama*. 2000 Mar 1;283(9):1175-82.

Safren SA, Biello KB, Smeaton L, Mimiaga MJ, Walawander A, Lama JR, Rana A, Nyirenda M, Kayoyo VM, Samaneka W, Joglekar A. Psychosocial predictors of non-adherence and treatment failure in a large scale multi-national trial of antiretroviral therapy for HIV: data from the ACTG A5175/PEARLS trial. *PloS one*. 2014 Aug 25;9(8):e104178.

Biello KB, Oldenburg CE, Safren SA, Rosenberger JG, Novak DS, Mayer KH, Mimiaga MJ. Multiple syndemic psychosocial factors are associated with reduced engagement in HIV care among a multinational, online sample of HIV-infected MSM in Latin America. *AIDS care*. 2016 Mar 24;28(sup1):84-91.

Vyas S, Kumaranayake L. Constructing socio-economic status indices: how to use principal components analysis. *Health policy and planning*. 2006 Nov 1;21(6):459-68.

Hutcheson GD, Sofroniou N. The multivariate social scientist: Introductory statistics using generalized linear models. Sage; 1999 May 28.

Kaiser HF, Rice J. Little jiffy, mark IV. Educational and psychological measurement. 1974 Apr;34(1):111-7.

Sullivan PS, Carballo-Diéguez A, Coates T, Goodreau SM, McGowan I, Sanders EJ, Smith A, Goswami P, Sanchez J. Successes and challenges of HIV prevention in men who have sex with men. The Lancet. 2012 Aug 3;380(9839):388-99.

Das P, Horton R. The cultural challenge of HIV/AIDS. The Lancet. 2012 Jul 28;380(9839):309.

Leblanc NM, Flores DD, Barroso J. Facilitators and barriers to HIV screening: A qualitative meta-synthesis. Qualitative health research. 2016 Feb;26(3):294-306.

Kendall T, Pelcastre BE. HIV vulnerability and condom use among migrant women factory workers in Puebla, Mexico. Health care for women international. 2010 May 14;31(6):515-32.

Marmot M, Commission on Social Determinants of Health. Achieving health equity: from root causes to fair outcomes. The Lancet. 2007 Oct 5;370(9593):1153-63.

Preda A, Voigt K. The social determinants of health: Why should we care?. *The American Journal of Bioethics*. 2015 Mar 4;15(3):25-36.

Robinson KL, Ernst KC, Johnson BL, Rosales C. Health status of southern Arizona border counties: a Healthy Border 2010 midterm review. *Revista panamericana de salud publica*. 2010 Nov;28(5):344-52.

Strathdee SA, Magis-Rodriguez C. Mexico's evolving HIV epidemic. *JAMA*. 2008 Aug 6;300(5):571-3.

Strathdee SA, Magis-Rodriguez C, Mays VM, Jimenez R, Patterson TL. The emerging HIV epidemic on the Mexico-US border: an international case study characterizing the role of epidemiology in surveillance and response. *Annals of epidemiology*. 2012 Jun 30;22(6):426-38.

Singer M, Bulled N, Ostrach B, Mendenhall E. Syndemics and the biosocial conception of health. *The Lancet*. 2017 Mar 10;389(10072):941-50.

Rhodes T, Wagner K, Strathdee SA, Shannon K, Davidson P, Bourgois P. Structural violence and structural vulnerability within the risk environment: theoretical and methodological perspectives for a social epidemiology of HIV risk among injection drug users and sex workers. In *Rethinking social epidemiology 2012* (pp. 205-230). Springer Netherlands.

Safren SA, Hughes JP, Mimiaga MJ, Moore AT, Friedman RK, Srithanaviboonchai K, Limbada M, Williamson BD, Elharrar V, Cummings V, Magidson JF. Frequency and predictors of estimated HIV transmissions and bacterial STI acquisition among HIV-positive patients in HIV care across three continents. *Journal of the International AIDS Society*. 2016;19(1).

APPENDIX D
Scoping Review Articles

CITATION	YEAR OF PUBLICATION	LOCATION OF PROGRAM	TARGET POPULATION	TYPE OF INTERVENTION	RESULT
<p>Palinkas, L. A., Chavarin, C. V., Rafful, C. M., Um, M. Y., Mendoza, D. V., Staines, H., ... & Patterson, T. L. (2015). Sustainability of Evidence-Based Practices for HIV Prevention among Female Sex Workers in Mexico. <i>PloS one</i>, 10(10), e0141508.</p>	2015	13 randomly chosen MexFam clinics throughout Mexico participated	Female sex workers in Mexico	Mujer Segura, the clinical intervention is a brief (35 to 40 minutes), single-session, intervention that combines principles of motivational interviewing (MI), social cognitive theory (SCT), and the theory of reasoned action	These outcomes included a reduction of risk through education and increased outreach through referrals from FSWs who received the intervention.
Morales-Miranda,	2014	Guatemala-	Female Sex	Demographic,	During

<p>S., Jacobson, J. O., Loya-Montiel, I., Mendizabal-Burastero, R., Galindo-Arandi, C., Flores, C., & Chen, S. Y. (2014). Scale-up, retention and HIV/STI prevalence trends among female sex workers attending VICITS clinics in Guatemala. <i>PloS one</i>, 9(8), e103455.</p>		<p>VICITS Clinics</p>	<p>Workers</p>	<p>behavioral and clinical data collected using a standardized form. Data analyzed by year and health center. HIV and STI prevalence estimated from routine visits. Retention estimated as % of new users attending VICITS clinics who returned for at least one follow-up visit to any clinic within 12 months.</p>	<p>2007–2011 5,682 FSW visited a VICITS clinic for the first-time. Factors negatively impacting retention included current HIV diagnosis, having practiced sex work in another country</p>
<p>Rhodes, S. D., Alonzo, J., Mann,</p>	<p>2014</p>	<p>Guatemala</p>	<p>Bisexual men, MSM,</p>	<p>Conducted Spanish-language</p>	<p>Characteristics of</p>

<p>L., Downs, M., Simán, F. M., Andrade, M., ... & Bachmann, L. H. (2014). Novel Approaches to HIV Prevention and Sexual Health Promotion Among Guatemalan Gay and Bisexual Men, MSM, and Transgender Persons. <i>AIDS Education and Prevention</i>, 26(4), 345.</p>			<p>and transgender persons</p>	<p>focus groups with 87 participants who self-identified as male (n=64) or transgender (n=23) and individual in-depth interviews with ten formal and informal gay community leaders.</p>	<p>successful programs: including providing guidance on accessing limited resources; offering supportive dialogue around issues of masculinity, socio-cultural expectations, love, and intimacy; using Mayan values and images; harnessing</p>
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					technology; increasing leadership and advocacy skills; and mobilizing social networks.
Pitpitan, E. V., Chavarin, C. V., Semple, S. J., Magis-Rodriguez, C., Strathdee, S. A., & Patterson, T. L. (2014). Hombre Seguro (Safe Men): a sexual risk reduction intervention for male clients of female sex workers. BMC	2014	Tijuana, Mexico	Male clients of female sex workers	Hombre Seguro sexual risk reduction intervention: Participants underwent interviewer-administered surveys and testing for HIV and other STIs at baseline, and at 4, 8, and 12 month follow-ups.	Analyses indicated that randomization was successful; there were no significant differences between the participants in the two conditions at

public health, 14(1), 1.					baseline. Average follow-up was 84%
Palinkas, L. A., Robertson, A. M., Syvertsen, J. L., Hernandez, D. O., Ulibarri, M. D., Rangel, M. G., ... & Strathdee, S. A. (2014). Client perspectives on design and implementation of a couples-based intervention to reduce sexual and drug risk behaviors among female sex workers and their noncommercial partners in Tijuana	2014	Tijuana and Ciudad Juarez, Mexico	Female sex workers and their intimate (non- commercial) male partners	mixed-methods study examined the acceptability of a hypothetical couples-based HIV prevention program: study draws on data collected as part of Proyecto Parejas (Couples Project), a prospective study of the social epidemiology of HIV/STIs among 214 FSWs and their non- commercial male	Among 320 participants, 67% preferred couples- based over individual programs, particularly among men.

and Ciudad Juarez, Mexico. AIDS and Behavior, 18(3), 583-594.				partners	
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